Primary Productivity Measurements

in

St. Margaret's Bay, 1967

by

Trevor Platt and Brian Irwin

FISHERIES RESEARCH BOARD OF CANADA

TECHNICAL REPORT NO. 77

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Primary Productivity Measurements in St. Margaret's Bay, 1967

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Marine Ecology Laboratory

Bedford Institute

Dartmouth, Nova Scotia

July 1968

ACKNOWLEDGEMENTS

We wish to thank Dr. L. M. Dickie, Director, Marine Ecology Laboratory for the opportunity to do this work and for continued interest in its progress. We are grateful to Dr. C. S. Yentsch and Mr. N. Corwin, Woods Hole Oceanographic Institution, and to Dr. T. R. Parsons, Pacific Oceanographic Group, who made available their advice and experience when the work was in the planning stage. We are indebted to Dr. V. M. Brawn for making the calorific value determinations and to Dr. D. Faber, Head, Canadian Oceanographic Identification Centre for sorting the zooplankton samples. Collection of samples during the autumn bloom was made possible by the cooperation of Dr. R. W. Trites, Head, Applied Oceanography Group. Dr. K. H. Mann and Dr. E. Kott read the manuscript and made useful suggestions for its improvement. Finally, we thank the many people who have helped at difficult times in the collection and treatment of samples, at sea and in the laboratory.

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INTRODUCTION

The purpose of this study was to measure the seasonal changes in the biomass and rate of production of the phytoplankton community in St. Margaret's Bay, and to make simultaneous measurement of a wide variety of physical and chemical parameters which might affect the rate of primary production: it was hoped that the more significant parameters could then be selected for further study and incorporated into a predictive model of primary production in St. Margaret's Bay. No attempt was made to measure the contribution of the attached algae and macrophytes to the total primary production of the bay.

At the outset we were faced with the problem of how to divide the total effort between cursory examination of a large number of different stations, and frequent, comprehensive measurements at a few selected stations. In the absence of any prior knowledge of the physical oceanography of St. Margaret's Bay and of the nature of the physical and biological heterogeneities within the bay, we decided to put the main part of our effort into making frequent measurements of a large number of parameters at a single station (Station A). The rest of the effort went into making a series of statistical surveys designed to study the biological variability within the bay, and to make occasional measurements at different stations, both inside the bay and in the approaches on the continental shelf, such that we could estimate to what extent our measurements at one station could be considered as representative of conditions in the bay. The measurements on the spatial variability of phytoplankton will be described in a separate report.

The data collected in this report may be grouped into three classes:

(i) Regular sampling at station A.

(ii) Irregular sampling at other stations.

(iii) Weekly sampling at nine stations during the autumn bloom.

Station A

Station A is located one mile from the western shore of St. Margaret's Bay at 64°02'W 44°35'N in 58 m of water (Fig. 1). Preliminary observations were made on this station in July and August 1966. Between January and December 1967 station A was occupied fifty-one times. Seven depths were sampled on each occasion, giving a total of 357 samples. The interval between sampling was not fixed, but was adjusted according to the activity in the plankton.

Sampling was done from the FRB research vessel *SIGMA-t*. The station was occupied at 0900 hours local time. First, a cast was made of 7-litre PVC Van Dorn bottles at 1m, 5m, 10m, 15m, 25m, 40m, 55m. From this cast samples for dissolved oxygen analysis were drawn and pickled. Next, from each depth (except bottom), two light and one dark 125 ml stoppered glass bottles were filled with raw sea-water. These bottles were brought into a darkened laboratory where they were inoculated with 1 ml $NaHC^{14}O_3$, for photosynthetic rate measurement. The bottles were clamped into clear plexiglass frames which were lowered to the depths from which the samples were taken and incubated for 4 hours, from 1000 to 1400 hours local time. The remainders of the samples in the Van Dorn bottles were treated as follows. From each depth, two litres were filtered and the residues used for chlorophyll and particulate

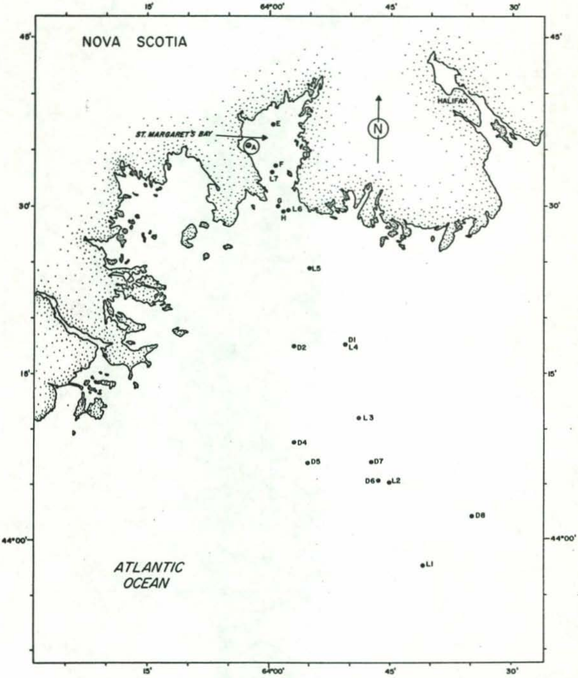


Fig. 1. Location of sampling stations in St. Margaret's Bay and approaches.

carbon analysis. A third litre was filtered, the residue retained for particulate phosphorus analysis and the filtrate poured into six 130 ml screw-top polyethylene bottles. One of these was used for salinity analysis. The rest were stored at -20°C until required for inorganic phosphate, total phosphate, nitrate, ammonia and silicate analyses. Finally, 150 ml was preserved in formalin and passed to S. M. Saifullah, McGill University, for species enumeration of phytoplankton. Metered vertical plankton tows were made with a 0.5 m 366μ (#2) net for study of zooplankton biomass and chemistry and for species enumeration. The species counts were made by the Canadian Oceanographic Identification Centre, National Museum, Ottawa through the couresy of Dr. Daniel Faber. Measurements of water transparency were made down to 30 m using a two cell photometer and a green filter. The peak sensitivity of the system was at 530 mμ, width (full width at half weight) was 70 mμ. Incident radiation was measured continuously with two Eppley 50-junction pyranometers; one mounted on a barge moored 1 mile east of station A (see chart), the other on the roof of a trailer parked close to the Mill Cove Government Wharf.

Other Stations

(i) CNAV *SACKVILLE* May 2 - 17 1967 (CODC # 01-67-003)

(ii) R/V *E. E. PRINCE* Sept. 7 - 8 1967 (CODC # 01-67-005)

The station positions relevant to these cruises are shown on the chart, Fig. 1.

Autumn Bloom Survey

Collection of data in this group was made possible by the cooperation of Dr. R. W. Trites and the Applied Oceanography Group, Bedford Institute. Nine stations were occupied at weekly intervals between Oct. 3 and Nov. 8, 1967. The locationsof the stations are shown on the chart in Fig. 12. On each station samples were collected for chlorophyll, inorganic phosphate and nitrate analyses, in addition to standard hydrographic measurements. Sampling depths were 1, 5, 10, 15, 25, 40 and 55 metres. With these samples it was hoped that some insight could be gained into the station-to-station variation within the bay and into the progress of the bloom throughout the bay.

METHODS

1. Nutrients

All measurements of concentration of inorganic nutrients were made on filtered samples.

Nitrate

Nitrate was measured as the sum of nitrate plus nitrite by reducing the nitrate to nitrite using the Grasshoff modification of the Cadmium amalgam column method, as described in Strickland and Parsons (1965). No separate determination of the nitrite fraction was made.

Silicate

Silicate was measured by the method of Grasshoff (1964).

Phosphate

(a) Inorganic: Inorganic phosphate was measured by the method of Murphy and Riley (1962).

(b) Total dissolved: Total dissolved phosphate was measured by the method of Menzel and Corwin (1965).

Ammonia

Ammonia was measured by an unpublished method of Grasshoff. The ammonia reacts with hypobromide to form a bromamine complex. Excess hypobromide is destroyed by sodium nitrite. The complex forms a blue solution with starch-iodide reagent. The extinction of this solution is measured at 610 mμ.

Oxygen

Dissolved oxygen was measured by the modified Winkler method as described in Strickland and Parsons (1965).

2. Phytoplankton Biomass

Particulate Carbon

Samples for particulate carbon analysis were obtained by filtering one liter of sea-water through a 5.5 cm Whatman GF/C glass-fibre filter. Before use the filter was heated to 500°C for 30 minutes to remove organic carbon. Particulate carbon was determined by the wet ashing technique, essentially as described by Strickland and Parsons (1965). The method was standardized against dextrose.

Chlorophyll a

One liter of sea-water was filtered through a 5.5 cm Whatman GF/C filter. Chlorophyll a was measured on the filters by the fluorometric method of Yentsch and Menzel (1963), as modified by Holm-Hansen et al (1965). The fluorometer was calibrated against pure chlorophyll a extracted from spinach. Using this method of chlorophyll measurement one can also make an estimate of the concentration of the degradation product phaeophytin.

Particulate Phosphorus

Samples for particulate phosphorus analysis were collected by filtering one liter of sea-water through a 47 mm 0.45μ(HA) Millipore filter. The samples were placed individually in shell vials and stored in a dessicator at -20°C until required for analysis. At this time, the filters were placed in 125 ml Erlenmeyer Vycor (96% Silica) flasks. The flasks were heated in a muffle furnance at 500°C for 30 minutes to ash the filters. The residue was dissolved in 15 ml distilled water and the phosphorus measured by the method of Menzel and Corwin (1965).

3. Primary Production

Primary production was measured by the C^{14} method, essentially as outlined in Strickland and Parsons (1965). The samples were incubated *in situ*. Two light bottles and one dark bottle (125 ml) were used at each depth. Five microcuries of C^{14} ($NaHC^{14}O_3$) were added to each bottle. Incubation lasted four hours, covering the period 1000-1400 hours, local time. The samples were filtered immediately; formalin was not used to arrest phytosynthesis. The filters (HA millipore filters, 2.5 cm diam., pore size 0.45µ) were dried in a dessicator and counted in a Baird-Atomic model 727 automatic β-counting system using a model FC-1 thin-window gas flow counter. The efficiency of the counting system was determined by repeating selected counts by liquid scintillation counting in the gas phase.

In the course of our carbon-14 experiments, we noticed from time to time erratic and improbable results; the activity on the filter seemed too high for the conditions, apparent high fixation rates in dark bottles, or one light bottle giving a higher reading than its duplicate. When results of this kind are encountered it is usual to suspect carbon fixation by bacteria and to take suitable steps to remove the bacterial contamination. However, experiments made in collaboration with Dr. W. H. Sutcliffe showed that the erratic results were caused by particulate detritus in the $NaHC^{14}O_3$ ampoules, which become trapped on the filter and gave spurious high counts of radioactivity. This radioactivity cannot be removed by washing with distilled water, sea-water, dilute acid, dilute alkali, organic solvants or by fuming with concentrated HCl. It constituted a large and unsystematic blank.

The ampoules were prepared by a leading supplier of radioactive compounds. The detritus could be seen easily by microscopic examination. We conclude that when apparent high dark fixation of carbon is encountered, the presence of detritus in the ampoules, as well as bacterial contamination should be suspected. If there is any doubt, the contents of the ampoules should be filtered immediately before use.

4. Zooplankton

Samples of zooplankton for chemical analysis were obtained by vertical tows with a 0.5 m diameter 366μ mesh size (#2) metered net. On each station five metered vertical tows were made from 50 m to surface. The catch was rinsed quickly in distilled water and transferred to a plastic bag, which was frozen and stored at -20°C until required. The samples were freeze-dried and the dry weight determined. About 5 mg of the freeze-dried material were used for carbon analysis by the method outlined above. About 0.5 g were heated to 600°C for 30 minutes (or until constant weight was achieved) for determination of % ash. Finally, about 1 g of the freeze-dried material was used for measurement of calorific value with a Parr bomb calorimeter. The calorific values measurements were made by Dr. V. M. Brawn; the technique is described in Brawn *et al* (1968).

5. Precision of the Chemical Measurements

To decide whether small variations in nutrient concentration or biomass estimates between samples are significant, we need some knowledge of the precision of the individual measurements. We have determined the standard deviation of each of our chemical analyses. For example, to determine the precision of the silicate method, five replicate analyses were made on each of six sea-water samples containing differing amounts of silicate. The standard deviation was computed for each group and the coefficient of variation (standard deviation divided by mean) was found. As expected we find that the coefficient of variation is constant over the range of silicate concentrations examined, i.e. the standard deviation is directly proportional to the mean. In general, we have found this to be true of all our analyses and in what follows we make the assumption that the coefficient of variation of all analyses is constant over the range of values encountered in the study. The standard deviation of any given measurement can then be found by multiplying the value of the measurement by the corresponding coefficient of variation.

These coefficients are listed in Table 1.

Table 1. Coefficients of variation of chemical analyses.

Method	Coefficient of Variation (%)
Inorganic Phosphorus	5.0
Total Phosphorus	2.0
Particulate Phosphorus	2.0
Silicate	2.5
Nitrate	4.5
Ammonia	4.0
Salinity	0.008
Chlorophyll	8.0
Particulate Carbon	2.0

Method	Coefficient of Variation (%)
*Primary Production	10.0

*This value is taken from Cassie (1962).

We must also consider the precision of integrated values of any quantity. The integrated value of any nutrient represents the total amount of that nutrient in the water column beneath unit area of the sea surface. The integral is found by splitting the water column into layers, the divisions being made midway between the sampling depths. Let v_i be the value of a given nutrient in the i^{th} layer of thickness t_i. The integral I_v is then given by:

$$I_v = \sum_{i=1}^{N} v_i t_i$$

where N = number of layers = number of sampling depths. Following Goldman (1965), we can compute the standard deviation of I_v if we know the s_i, the standard deviations of the v_i.

The variance of the integral is given by:

$$s_I^2 = \sum_{i=1}^{N} s_i^2 t_i^2$$

whence the standard deviation is

$$s_I = \left(\sum_{i=1}^{N} s_i^2 t_i^2 \right)^{1/2}$$

For the work at station A we had seven sampling depths. These depths and the corresponding layer thicknesses are tabulated below:

Depth (Metres)	Thickness of layer (m)
*1	2.5

*It is assumed that this sample represents the conditions at 0m.

Depths (Metres)	Thickness of layer (m)
5	5.0
10	5.0
15	7.5
25	12.5
40	15.0
55	7.5

Since we can always find the standard deviation of our chemical measurements by using the coefficients of variation in Table 1, we can now compute the precision of any integrated measurement.

6. Optical Measurements

(a) Incident radiation

Incident radiation was measured by two Eppley 50-junction pyranometers. One of these was mounted on a barge moored one mile east of station A; the other was mounted on the roof of a trailer parked adjacent to the Mill Cove Government Wharf. The output from the pyranometers was measured by potentiometric strip chart recorders on the chart record, the area under the curve corresponding to the duration of the C^{14} primary production experiments was determined by planimeter integration. This integral represented the total radiant energy incident on a unit area of sea surface during the experiment (cal/cm^{2}hr). The two pyranometers were not always functional simultaneously. For those days on which we have records from both instruments we have computed the correlation coefficient, r = 0.89 (P = 0.001). Records from either instrument are therefore adequate for our purpose. For days on which we have duplicate measurements we have used the mean of the two.

The values of incident energy measured in this way represent the energy in spectral region 300-5000 mμ. To get the fraction of the incident energy in the photosynthetic range 380-720 mμ we multiply by 0.5 (Strickland, 1958). To allow for losses at the sea surface we make a further reduction of 10%; the radiation useful to the phytoplankton community is therefore estimated to be 45% of the total as measured by the pyranometer.

(b) Transparency

Measurements of water transparency were made down to 30 m using a two-cell hydrophotometer with a green filter. Peak sensitivity of the system was at 530 mμ with a band width of 70 mμ. The deck and sea cells had separate ammeter readouts, a less satisfactory arrangement than a direct ratio readout. The optical transmission of the water was measured as the ratio of the output of the sea cells to that of the deck cell. The logarithm of this ratio was plotted against depth. From this graph we determined the value of the extinction coefficient k in the equation

$$\frac{I_z}{I_o} = e^{-kz}$$

where z is the depth in metres and I_o is the irradiance at z = 0. The units of k are $(\text{metres})^{-1}$; it represents the average extinction coefficient of the upper 30 m of the water column.

Because the manufacturer was grossly overdue on the delivery date for the photometer, measurements of extinction coefficient are available only from 28 August onwards. For the period 28 August - 12 December we have compared the measured extinction coefficients with the average chlorophyll concentrations in the water column (mg/m3). The regression equation is

$$k = 0.081 + 0.108 \times (\text{Chla})$$

The coefficient of correlation is $r = 0.85$ ($P = 0.001$). From the regression equation we can estimate the value of the extinction coefficient on the days when it was not measured in the early part of the year. Armed with a list of values of k we can calculate the fraction of the incident radiant energy $\frac{I_z}{I_o}$ which is available on any day to the phytoplankton at any depth.

It is of interest to examine the precision of a measurement of extinction coefficient made with a two-cell photometer. The ammeters are rated at ±2% full-scale reading. Typically we read the deck cell at 7 mA and the sea cell at 15μA. Full scale readings are 25mA and 25μA respectively. Error in the deck cell is then ∿8% and in the sea cell ∿4%. The error in the ratio $R = I_z/I_o$ is then ∿4%.

We have $$\delta K \simeq \frac{\partial K}{\partial z}\delta z + \frac{\partial K}{\partial R}\delta R \quad \text{and } K = -\frac{1}{z}\log R$$

Then $$\delta K \simeq -\log R \cdot \frac{1}{z^2}\delta z + \frac{1}{zR}\delta R$$

or $$\frac{\delta K}{K} \simeq \frac{\delta z}{z} - \frac{1}{\log R}\frac{\delta R}{R}$$

Assuming that the error in the depth measurement is negligible compared to the error in R we can ignore the first term on the right. Typically $R = 0.85\ M^{-1}$, $\log R = -0.16$ and $\frac{\delta R}{R} = 4\% = 0.04$. In this case we have that $\frac{\delta k}{k} = 0.25$ so that $k = 0.16 \pm 0.04$. The error is large for a single measurement; however the extinction coefficient that we have used averages the data from 30 measurements and we can expect a considerable reduction in the error. At the same time we should recognize that in reality the extinction coefficient will not be independent of depth but will show vertical variations depending in part on the presence of local concentrations of phytoplankton.

RESULTS

I Station A

The results obtained at station A are listed in Appendix 1.

1. Temperature and Salinity

During the winter months the water column was well mixed from surface to bottom with temperatures in the range 0° - 1°C and salinities in the range 30 - 31.5^{o}/oo. The coldest point was reached on March 19 when the upper 10 m was all at less than 0°C and only that part of the water column below 40 m had a temperature greater than 1°C. From this time on there was evidence of surface warming, and a pattern was established of the formation of incipient thermoclines and their destruction by wind action. By April 13 the column was mixed down to 30 m with a temperature of 1.4°C and salinity 30.99^{o}/oo. Subsequently a period of settled weather permitted surface warming to 2.0°C and the formation of a thermocline at 15 m. It was during this period that the spring flowering of the phytoplankton occurred. However, by April 24 when the biomass of the phytoplankton was at its peak for the year, the thermocline was all but destroyed. During the latter half of April and the month of May, there occurred from time to time thin layers of low salinity water (29^{o}/oo or less) at the surface, these were due to the increased freshwater run-off associated with the spring thaw.

It was only in late May that strong thermoclines began to develop. On June 8 the upper 10 m were at 8°C with salinity 30.6^{o}/oo while below 10 m the temperature was 4°C and the salinity 31.2^{o}/oo. From here on surface warming was rapid. The maximum surface temperature recorded in 1967 was 20°C on July 24, when the thermocline was at 4 m.

Between August 28 and September 5 a profound change took place in the hydrography of St. Margaret's Bay. On August 28 the surface temperature was 15.6°C, salinity 29.36^{o}/oo and there was a strong thermocline at 7 m. Seven days later the surface temperature had dropped to 6.9°C, the salinity was 31.26^{o}/oo and there was no thermocline (Fig. 2). Between September 11 and September 18, the surface temperature increased from 7.8°C to 12.4°C and by September 25 the temperature was uniform at 14°C from surface to 36 m. Hydrographic conditions continued to be unstable throughout October. As late as November 6 the surface layer was over 30 m thick and the temperature was 11°C. By December 8 the water had cooled considerably and the typical winter situation had become established with the bottom temperature greater than the surface temperature.

Bottom salinity showed little variation throughout the year; between January and August it was in the range 31.3 - 31.7^{o}/oo and during the remainder of the year in the range 31.8 - 32.1^{o}/oo. The annual range of bottom temperatures was only 5°. Highest bottom temperatures were found in the late fall and early winter.

The bottom temperature on January 16 was 4.8°C but this had fallen to 1.3°C by February 15. The lowest value was 0.3°C on April 1. This had increased to 1.3°C by May 11. During the summer months the bottom temperature was about 2.5°C, increasing to 3.6°C in early October. The maximum value of 5.1°C was recorded on November 6.

2. Oxygen

The water at station A is saturated, or very nearly saturated with oxygen throughout the year. The seasonal variation in

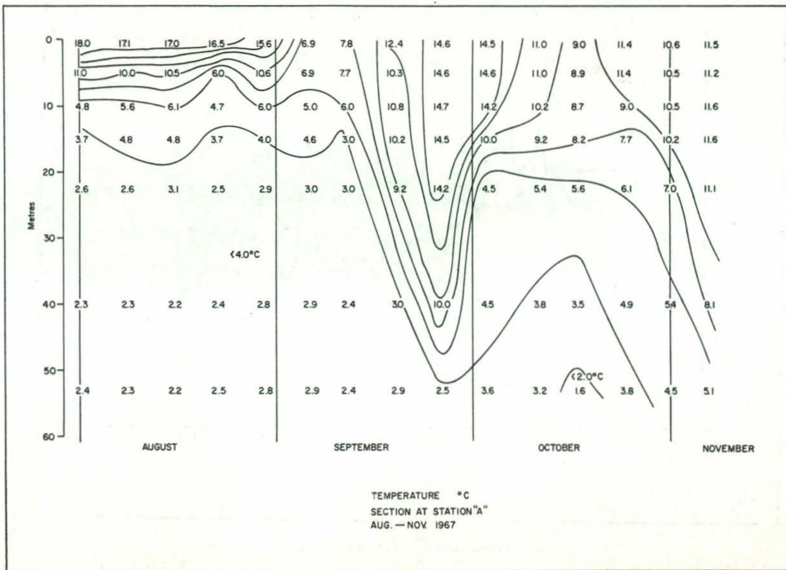
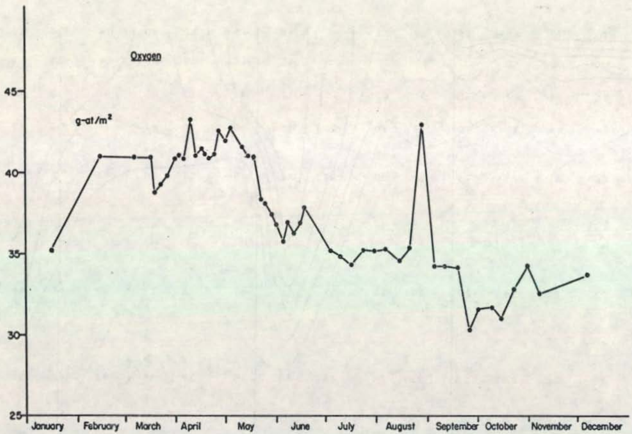


Fig. 2. Temperature profiles at Stn. "A" between August and November, 1967.



• Fig. 3. Seasonal variation in dissolved oxygen at Stn. "A", 1967.

dissolved oxygen is shown in Fig. 3. Between January and May the dissolved oxygen concentration was uniform throughout the water column at 0.65 - 0.75 g-at/m^3. In the summer months the vertical profile of dissolved oxygen showed typically a surface value of ~0.55 g-at/m^3 and a peak of ~0.7 g-at/m^3 at 10 - 15 m. In general this peak was located somewhat deeper in the water column than the peak in the photosynthesis-depth profile. During September and early October the vertical profile of dissolved oxygen was disturbed by the unstable hydrographic conditions; however on October 30 and November 6 we again observed an oxygen maximum in the surface layer. By December 8 the oxygen profile was typical of the winter observations made earlier in the year.

3. Silicate

The seasonal variation of the integrated value of the dissolved silicate in the water column at station A is shown in Fig. 4. In winter the silicate is fairly constant at ~430 mg-at/m^2. During March, silicate increased to a maximum of 600 mg-at/m^2. Beginning in April, there was a progressive decline in silicate as it was utilized by the phytoplankton. By May 11 the silicate level had fallen to 156 mg-at/m^2. There followed a gradual increase to a value of 450 mg-at/m^2 on August 21. Subsequently the silicate level showed marked oscillations, reflecting the unstable hydrographic conditions. The minimum value recorded for the year was 142 mg-at/m^2 on September 25. By December 8 the silicate level was at the same value as was measured during the first three months of the year.

Utilization of silicate in the euphotic zone was rapid during the spring bloom. There was generally a minimum in the silicate

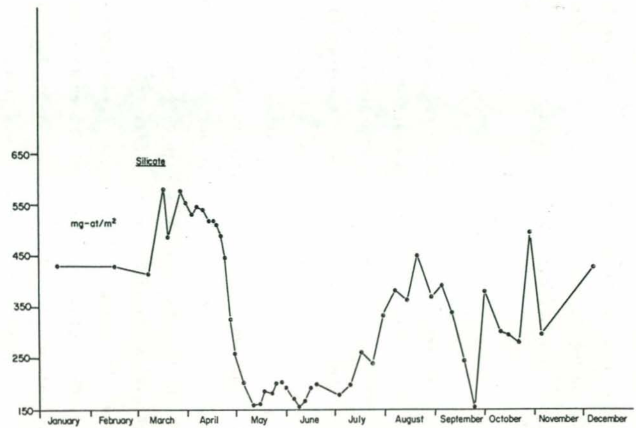


Fig. 4. Seasonal variation in dissolved silicate at Stn. "A", 1967.

profile at 5 - 10 m; this is also the depth at which the maximum in the photosynthesis profile occurs. The true depletion rate of silicate was higher than would be estimated by following the changes in the surface layer: the concentration of silicate at depth was also decreasing at this time as a result of vertical mixing. For example the bottom silicate decreased from 10 mg-at/m^3 on April 24 to 3 mg-at/m^3 on May 15. It is of interest to note the rapid recovery of the bottom silicate, which had increased to 11.3 mg-at/m^3 by 17 July.

4. Phosphate

The seasonal variation of the integrated value of the inorganic phosphate in the water column, as illustrated in Fig. 5 is very similar to that for silicate. There was a gradual increase through the winter in the amount of phosphate in the column to a maximum of 54 mg-at/m^2 on March 19. Depletion of phosphate was rapid during the bloom; the phosphate concentration had fallen to 22.9 mg-at/m^2 by May 4. There followed a steady increase in the amount of inorganic phosphate in the water column. Between September and November wide oscillations in inorganic phosphate were observed.

In the vertical distribution of inorganic phosphate the minimum was usually at the surface. On April 27, towards the end of the spring bloom, the surface phosphate had fallen to 0.19 mg-at/m^3.. Lower values were observed during the months of July and August; the minimum for the year, 0.02 mg-at/m^3 was recorded on August 28. The maximum phosphate concentration in the water column was invariably found at the bottom: the annual range in the bottom phosphate concentration was quite small, the vast majority of readings

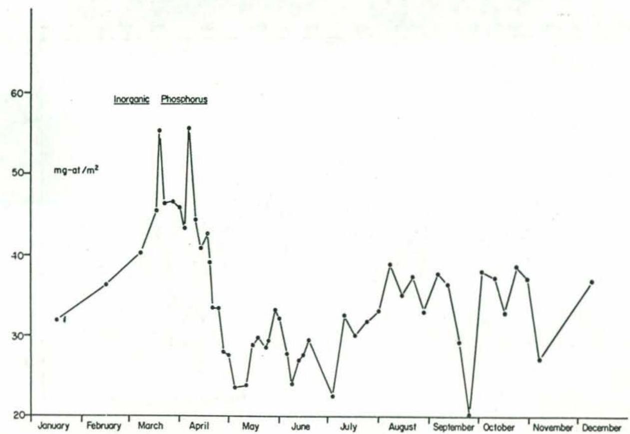


Fig. 5. Seasonal variation in inorganic phosphate at Stn. "A", 1967.

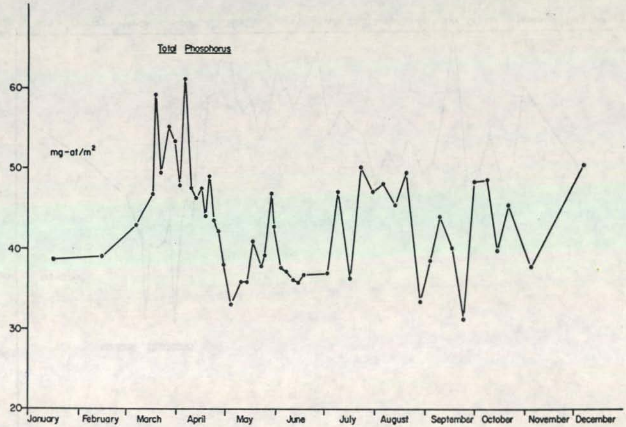


Fig. 6. Seasonal variation in total dissolved phosphate at Stn. "A", 1967.

being in the range 0.7 - 0.9 mg-at/m^3.

The seasonal variation in total dissolved phosphate is shown in Fig. 6. Dissolved organic phosphate was estimated as the difference between total dissolved phosphate and inorganic phosphate. Winter values of dissolved organic phosphorus were about 3 mg-at/m^2; summer values were in the range 10 - 15 mg-at/m^2. Dissolved organic phosphate varied from 3% - 42% of the total dissolved phosphate. Prior to the onset of the plankton bloom this fraction averaged 10.6%; it increased from 10.5% to 22.1% between April 17 and April 19, coincident with the onset of the spring bloom. During the summer months, dissolved organic phosphate averaged 29% of the total dissolved.

5. Nitrate

As shown in Fig. 7, the gross features of the seasonal variation of nitrate are very similar to those of silicate and inorganic phosphate. Nitrate increased through the winter reaching a peak at 323 mg-at/m^2 on March 17. Following the spring bloom, nitrate fell to 61.7 mg-at/m^2 on May 15. There was a steady increase in nitrate through the summer months. In September and October the nitrate content of the water column varied between wide limits corresponding to the unstable hydrographic conditions at that time. By December 8 the nitrate level was back at the typical winter value of 275 mg-at/m^2. The minimum nitrate recorded was 20.7 mg-at/m^2 on September 25.

During the winter, the surface nitrate concentration averaged about 5 mg-at/m^3; immediately prior to the onset of the spring bloom it was 4 mg-at/m^3. Nitrate was removed very quickly from the euphotic zone by the growing phytoplankton and by April 24 was less

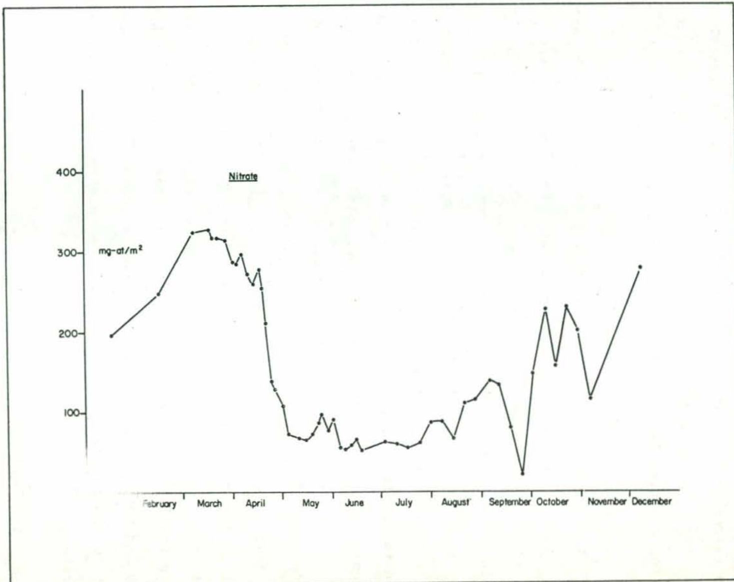


Fig. 7. Seasonal variation in dissolved nitrate at Stn. "A", 1967.

than 1 mg-at/m^3. Nitrate concentration in the upper 10 m did not exceed 1 mg-at/m^3 until the following December. During the months of June, July and August, the euphotic zone nitrate concentration was extremely low, the average for the upper 10 m frequently being less than 0.1 mg-at/m^3. However the nitrate concentration at the bottom was usually greater than 2 mg-at/m^3 all summer.

6. Ammonia

Because of possible contamination of reagents during part of the analysis of ammonia samples, we have chosen not to report ammonia values for the period July 3 to September 11. For the rest, there is in general an inverse relationship between ammonia and nitrate. The depletion of nitrate during the spring bloom was accompanied by a steady increase in ammonia; in other words ammonia was being generated faster than it was being consumed or oxidized. By early June ammonia represented nearly half of the total inorganic nitrogen content of the water column. Throughout the rest of the year when we had ammonia samples, the fraction of inorganic nitrogen which was in the form of ammonia was considerably less than this. There are no large reserves of ammonia close to the bottom; whereas in winter it would not be unusual to find 5 mg-at/m^3 of nitrate at 55 m, the concentration of ammonia was usually less than 1 mg-at/m^3. When we consider just the surface waters, however, during May and June there were considerablymore inorganic nitrogen present as ammonia than nitrate.

7. Primary Production

The seasonal variation in primary production at station A is shown in Fig. 8. The dominant feature is of course the spring bloom

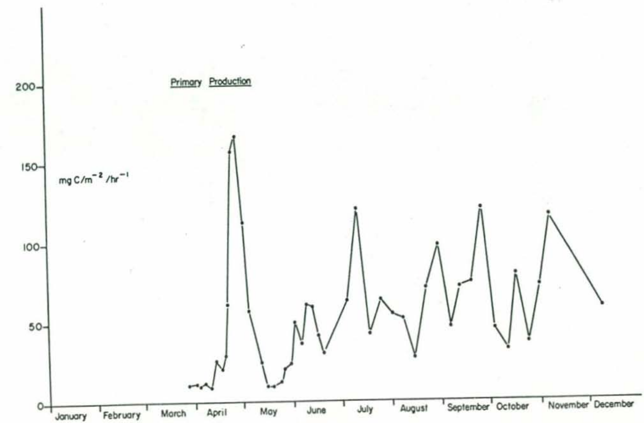


Fig. 8. Seasonal variation in primary production at Stn. "A", 1967.

in late April. However, the duration of the bloom, as measured by the full width at half maximum, was only 12 days, so that the total production during the bloom did not represent a very large contribution to the total annual production. Primary production measurements prior to the spring bloom averaged about 10 mgC/m^2hr. Production at the peak of the spring bloom was 168 mgC/m^2hr on April 27. At the end of the spring bloom, production was reduced to the winter level of 10 mgC/m^2hr, but quickly recovered and by June 1 had reached 50 mgC/m^2hr. For the rest of the year the production oscillated about a mean of 60 mgC/m^2hr.

The production estimates plotted in Fig. 8 are not corrected for differences in incident radiation or phytoplankton biomass. It is instructive to consider the effect of normalising the production with respect to these two variables. In Table 2 we have listed values of integrated production per unit incident radiation, and integrated production per unit incident radiation per unit biomass.

The average value for production per unit incident radiation was $4.58 \times 10^{-4} (mgC/m^2hr)/(cal/m^2hr)$ with a coefficient of variation of 71%. If we assume that 1gC is equal to 2.9g dry weight (unpublished data for Bedford Basin phytoplankton) and take the calorific value of phytoplankton as 4.6 cal/mg dry weight (V. M. Brawn, unpublished, Bedford Basin phytoplankton) then 1 gC is equivalent to 13.3 Kcal. In this case the primary production per unit area of sea surface is 0.61% of the incident radiation. The mean value of production per unit incident radiation per unit biomass was 0.14×10^{-4} $mgC/cal(mgChla/m^2)$ or $0.019\%/(mgChla/m^2)$ with

Table 2 Estimates of primary production normalised to incident radiation and phytoplankton biomass.

Date		$\frac{\int P(z)dz}{I_o}$ $\frac{mgC/m^2hr}{cal/m^2hr}$	$\frac{\int P(z)dz}{I_o \int B(z)dz}$ $\frac{mgC/m^2hr}{(cal/m^2hr)(mgChla/m^2)}$
April	6	0.42×10^{-4}	0.018×10^{-4}
	13	0.74×10^{-4}	0.025×10^{-4}
	17	0.54×10^{-4}	0.020×10^{-4}
	19	1.15×10^{-4}	0.026×10^{-4}
	21	4.20×10^{-4}	0.052×10^{-4}
	24	6.31×10^{-4}	0.033×10^{-4}
	27	5.90×10^{-4}	0.017×10^{-4}
May	1	3.27×10^{-4}	0.013×10^{-4}
June	5	1.36×10^{-4}	0.038×10^{-4}
	8	3.56×10^{-4}	0.061×10^{-4}
	12	15.45×10^{-4}	0.639×10^{-4}
	15	7.23×10^{-4}	0.447×10^{-4}
	18	3.98×10^{-4}	0.161×10^{-4}
July	3	7.47×10^{-4}	0.178×10^{-4}
	10	10.72×10^{-4}	0.281×10^{-4}
	17	2.81×10^{-4}	0.104×10^{-4}
	24	4.20×10^{-4}	0.138×10^{-4}
	31	6.64×10^{-4}	0.235×10^{-4}
Aug.	14	3.85×10^{-4}	0.119×10^{-4}
	21	2.49×10^{-4}	0.113×10^{-4}
	28	5.91×10^{-4}	0.238×10^{-4}
Sept.	5	4.61×10^{-4}	0.243×10^{-4}
	11	2.56×10^{-4}	0.082×10^{-4}
	18	2.67×10^{-4}	0.082×10^{-4}
	25	6.84×10^{-4}	0.130×10^{-4}
Oct.	2	3.54×10^{-4}	0.147×10^{-4}
Nov.	6	5.19×10^{-4}	0.098×10^{-4}

$P(z)$ is the primary production at depth z.

$B(z)$ is the biomass of phytoplankton at depth z.

I_o is the incident radiation at the surface.

a coefficient of variation of 104%. The heterogeneity was increased, rather than decreased, when the production was normalised with respect to the biomass.

In the vertical distribution of primary production the maximum was found most often at the surface, although there was frequently evidence of surface inhibition in which case the peak was at 5 m. Production at 40 m was usually zero.

8. Estimate of Annual Primary Production

It is of interest to make an estimate of the contribution of the phytoplankton community to the annual primary production of St. Margaret's Bay. The measurements of photosynthetic rate at station A refer to the quantity of carbon fixed during the period 1000-1400 hr. local time; from them we can approximate the daily rate on the assumption that the photosynthesis per unit incident radiation is constant throughout the day.

We consider that the time dependence of the incident radiant energy through the day may be described by the equation

$$I_o(t) = I_o(max)\ 1/2\ (1 + \text{Cos}\ \frac{2\pi}{\lambda} t), \quad \text{(Vollenweider, 1965)}$$

In this equation the origin of time, t = o, is taken to be at local noon, $I_o(max)$ is the incident radiation at t = o and λ is the day length factor (number of hours between local sunrise and sunset). λ can be calculated from data in nautical almanacs. It is listed in Table 3 for the 15th day of each month at latitude 45°N. The total incident energy, $T(t_1, t_2)$, between times t_1 and t_2 can be expressed in terms of the noon value as follows:

$$T(t_1, t_2) = \int_{t_1}^{t_2} I_o(t)\,dt = I_o(max)\int_{t_1}^{t_2} \tfrac{1}{2}.\left(1 + \text{Cos}\,\frac{2\pi}{\lambda}t\right)dt.$$

or
$$T(t_1,t_2) = \frac{1}{2} I_o(max) \left[t + \frac{\lambda}{2\pi} \sin \frac{2\pi}{\lambda} t \right]_{t_1}^{t_2}$$

For a full day $t_1 = -\lambda/2$ and $t_2 = +\lambda/2$ so that $T(24\ hr) = 1/2\ I_o(max)\lambda$.

If the primary production experiment is spaced symmetrically about noon, $t_2 = -t_1$

Then
$$T(t_1,t_2) = \frac{1}{2} I_o(max) \left[(t_2+t_1) + \frac{\lambda}{\pi} \sin \left(\frac{t_1+t_2}{\lambda}\right)\pi \right]$$

Hence the fraction of the daily radiation which is incident during the period of the experiment is F, where

$$F = \frac{T(t_1,t_2)}{T(24\,hr)} = \frac{1}{\lambda} \left[(t_2+t_1) + \frac{\lambda}{\pi} \sin \left(\frac{t_1+t_2}{\lambda}\right)\pi \right]$$

The quantity $(t_2 + t_1)$ is simply the experiment duration in hours.

Monthly average values of F for a 4 hr. experiment are listed in Table 3. We can estimate the daily photosynthetic rates by dividing the total production in the experiment by F. The monthly averages of daily primary production allow us to make an estimate of annual primary production. Since we are lacking production data for the months of January and February we have assumed that the photosynthesis per unit radiation is constant between December and January and between February and March.

Table 3 Monthly averages of daily primary production.

Month	(hr) Day length	F Energy fraction	Primary Prod^n mgC/m^2(4hr)	Daily Prod^n mgC/m^{2}day	Fc	Corrected daily Prod^n
Jan	9.15	0.75	230.1	307	0.70	329
Feb	10.38	0.69	42.6	62	0.64	66
Mar	11.93	0.62	42.6	68	0.51	83
Apr	13.48	0.56	202.6	365	0.46	442
May	14.85	0.51	136.1	268	0.42	323
June	15.58	0.49	186.7	382	0.37	499
July	15.23	0.50	277.9	561	0.38	736
Aug	14.18	0.53	247.2	468	0.40	613
Sept	12.28	0.60	312.4	521	0.50	631
Oct	10.90	0.66	210.6	319	0.54	388
Nov	9.53	0.73	463.2	636	0.60	769
Dec	8.78	0.77	230.3	299	0.72	320

The annual primary production estimated in this way is 127gC/m^{2}yr. Vollenweider (1965) has considered the effect of various possible modifying factors on the value of F. His calculations suggest that the maximum conversion factors are higher (i.e. F's are lower) by about 1.07 for the winter months, 1.31 for the summer months and 1.21 during spring and autumn. The adjusted F factors are listed in Table 3 as F_c, together with the corresponding estimates of the daily production. With this modification the annual production works out to be 156gC/m^{2}yr.

We can estimate then that the annual production by the phytoplankton community in St. Margaret's Bay in 1967 was between 125 and 155 gC/m^2yr. The error of $\pm10\%$ in the estimate is consistent with the suggestion of Vollenweider (1965). Using the conversion factor suggested above, that 1g carbon is equivalent to 13.3 K cal, we can calculate that the energy produced by the phytoplankton population was in the range $1.7\text{-}2.0 \times 10^6$ cal/m^2yr.

9. Phytoplankton Biomass

The seasonal variations in chlorophyll, particulate carbon and particulate phosphorus at station A are shown in Figs. 9, 10 and 11 respectively. The chlorophyll curve is dominated by the diatom peak of the spring bloom. Prior to this, winter chlorophyll levels averaged about 30 mg/m^2. At the height of the spring bloom chlorophyll reached 342 mg/m^2. Throughout the summer chlorophyll averaged about 40 mg/m^2. The maximum value obtained during the fall bloom was 98 mg/m^2. In the vertical distribution of chlorophyll the maximum was usually found at 10 m. The highest chlorophyll concentration observed was 11.1 mg/m^3 at 15 m on April 27.

The seasonal curve for particulate phosphorus is essentially the same as that for chlorophyll although the peak corresponding to the spring bloom is not so prominent. In winter particulate phosphorus averaged about 5 $mg\text{-}at/m^2$. The maximum value for the year, 13.1 $mg\text{-}at/m^2$ was reached on May 1. During the summer particulate phosphorus averaged about 8.5 $mg\text{-}at/m^2$. In the vertical distribution of particulate phosphate the maximum was found at 55 m during the winter months. However, after the phytoplankton population began to increase in late April the peak was found in the surface layer (0-10 m); this was the case for the rest of the year.

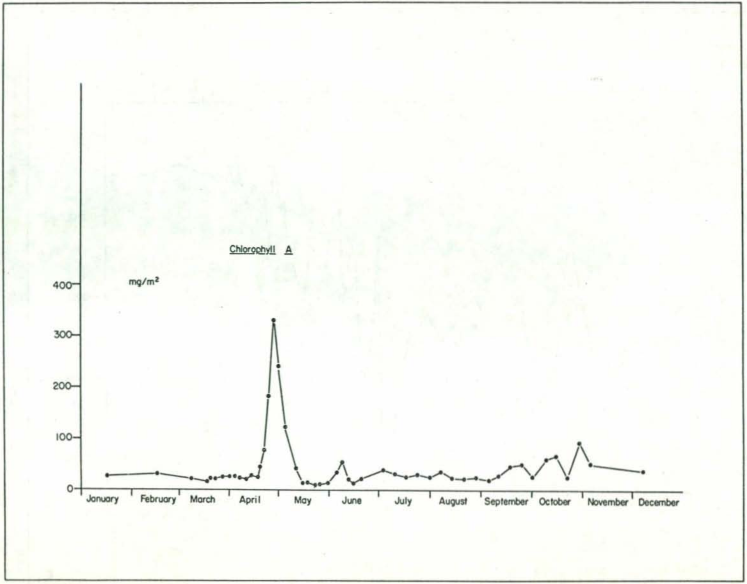


Fig. 9. Seasonal variation in chlorophyll at Stn. "A", 1967.

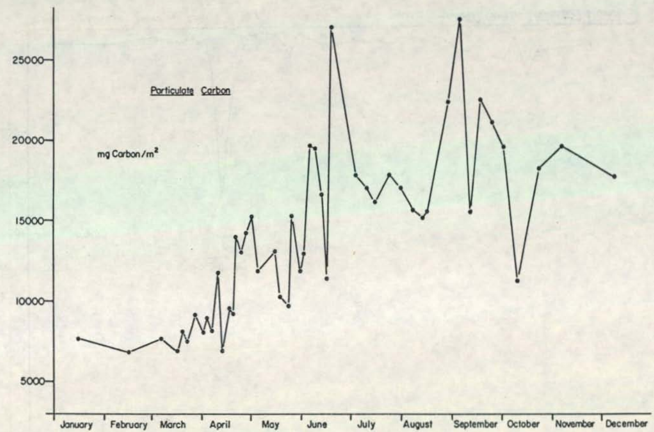


Fig. 10. Seasonal variation in Particulate Carbon at Stn. "A", 1967.

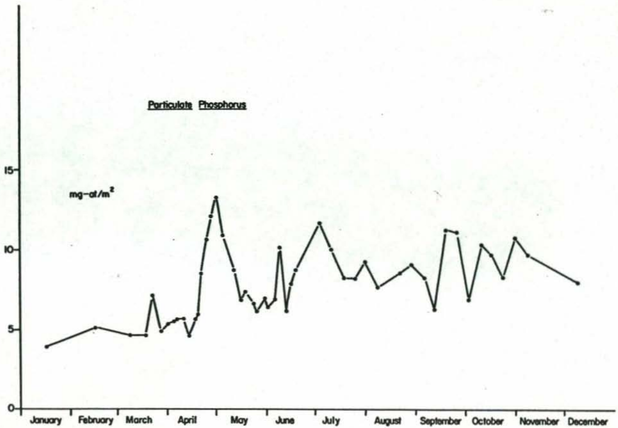


Fig. 11. Seasonal variation in Particulate Phosphorus at Stn. "A", 1967.

The agreement between chlorophyll and particulate phosphate over the whole year was good ($r = 0.57$; 49 d.f.). This much cannot be said for the particulate carbon measurement. The correlation coefficient between chlorophyll and particulate carbon taken over the whole year was $r = 0.06$ (48 d.f.). The most striking difference between the curve for carbon and those for chlorophyll and phosphorus is that in the carbon curve the spring bloom does not stand out as a dominant feature; the picture is rather one of a steadily increasing biomass with a peak of 25 g c m^{-2} in mid-June.

10. Zooplankton

In this section we discuss the seasonal variation of the St. Margaret's Bay zooplankton; its biomass, calorific value and species composition. The data is based on samples from metered vertical tows made with a 0.5 m diameter 366μ net and describes only those animals vulnerable to such a net. On each sampling day, five replicate tows were made and the catch pooled and frozen for chemical analysis. The seasonal variation in zooplankton biomass is shown in Fig. 12. During the winter the biomass was fairly constant at about 30 mg dry wt/m^3. The high value of 120 mg/m^3 on April 6 was associated with a swarm of ctenophores (*Pleurobrachia pileus*). In April the biomass increased to ~ 60 mg/m and was sustained at about this level for most of May. There was a pronounced decrease in late May to about 10 mg/m^3. During the months of June, July and August the biomass varied between 60 and 90 mg/m^3. At the end of August a steady decline in zooplankton biomass began; in December the biomass was 20 mg/m^3, slightly lower than during the previous winter. Fig. 12 also shows the seasonal variation in the biomass expressed as ash-free dry weight.

Fig. 13 shows the seasonal variation in carbon content and calorific value of zooplankton. The correlation between the two measurements is highly significant (r = 0.94, 21 d.f.), Fig. 14. The most striking feature of this figure is the five-fold variation through the year in the calorific value of the zooplankton expressed as calories per unit dry weight. The amount of variation could be reduced to about three-fold by expressing the calorific value as calories per unit ash-free dry weight but this would be misleading since carnivores ingest bulk tissue, not ash-free tissue. The calorific value of the zooplankton declined steadily through the winter from 2760 cal/g dry weight in January to 750 cal/g dry weight in early April. There was a peak in late May and a second, higher peak in October. The data on calorific value, carbon content and ash content are presented in Table 4. On the basis of this data we can establish regression equations which would allow us to predict the calorific value of St. Margaret's Bay zooplankton if a simpler measurement such as % carbon or % ash were made. These equations are listed below.

	Correlation Coefficient	n.d.f.
Cal/g dry wt. = -227 + 152 x (% carbon)	+0.94	21
Cal/g dry wt. = 4662 - 58.5 x (% ash)	-0.95	16
Cal/g ash free dry wt. = 1724 + 114 (% carbon)	+0.81	16
% carbon = 31.98 - 0.358 x (% ash)	-0.93	39

If both the % carbon and % ash are known, the best estimate of calorific value can be made from the following multiple regression equation:

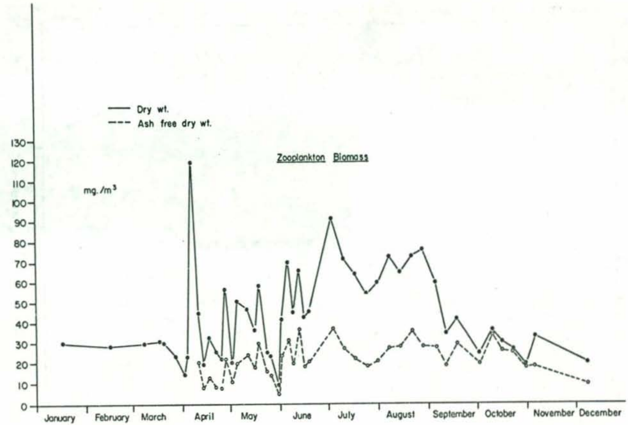


Fig. 12. Seasonal variation in zooplankton biomass at Stn. "A", 1967.

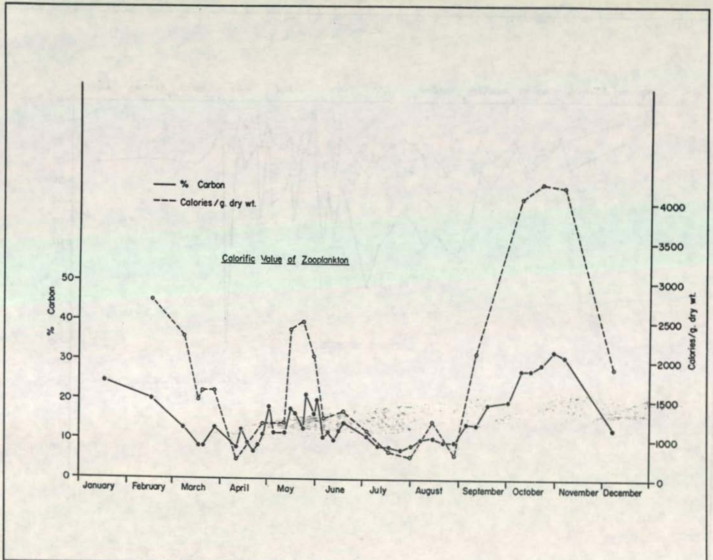


Fig. 13. Seasonal variation in calorific value of zooplankton at Stn. "A", 1967.

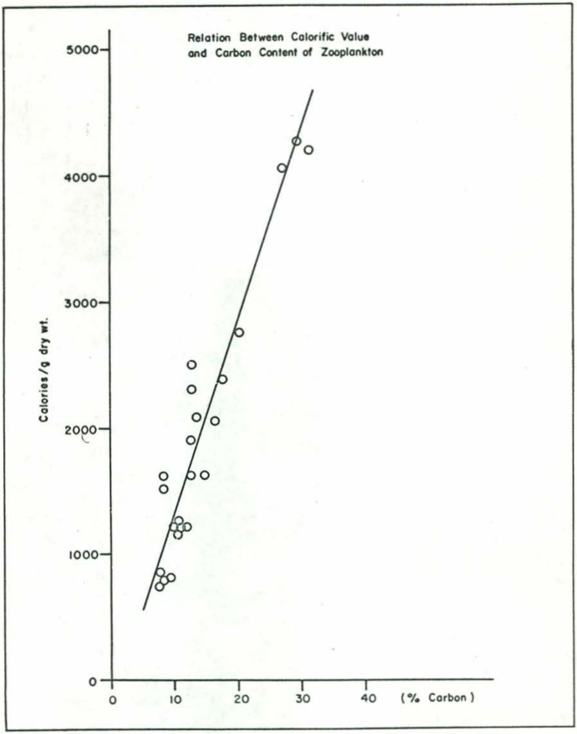


Fig. 14. Relation between calorific value and carbon content of zooplankton.

$$\text{Cal/g dry wt.} = 1351 + 106 \times (\%\ \text{carbon}) - 21.2 \times (\%\ \text{ash})$$

The multiple correlation coefficient is 0.98 (16 d.f.); the standard error of the estimate is 253 cal.

The species composition of these samples has been studied by Dr. D. Faber and the Canadian Oceanographic Identification Centre. A complete species list is given in Appendix 2. The proportion of the dominant groups, as % of the total number of individuals in the sample, is given in Table 5. The samples represent approximately 8.5 m^3 of water. In terms of numbers of individuals, calanoid copepods were the dominant group at all times of the year. Ctenophores represented more than 1% of the sample between January and May only. Chaetognaths were similarly distributed, although they constituted more than 1% of the sample for a short period in July. Medusae were most abundant in June and July. Cladocera were entirely absent before mid-June and disappeared in October, but formed a substantial fraction of the biomass during this period.

Table 4 Calorific value and carbon content of zooplankton.

Date	Dry weight mg/m^3	Carbon mg/m^3	Carbon %	Ash %	Ash free dry wt. mg/m^3	Calories gm/dry wt.	Calories gm/ash free	Calories/ gm carbon
16/ 1	30.0	7.35	24.5	--	--	--	--	--
15/ 2	28.2	5.69	20.17	--	--	2763	--	13698
7/ 3	29.6	3.83	12.93	--	--	2327	--	17996
17/ 3	30.6	2.54	8.3	--	--	1516	--	18265
19/ 3	29.7	2.47	8.32	--	--	1602	--	19302
27/ 3	23.3	2.99	12.8	--	--	1622	--	12671
1/ 4	14.4	--	--	--	--	--	--	--
3/ 4	23.0	--	--	--	--	--	--	--
6/ 4	119.0	--	--	--	--	--	--	--
10/ 4	44.68	3.62	8.01	54.21	20.46	752	1642	9388
13/ 4	18.78	2.36	12.59	58.49	7.80	--	--	--
17/ 4	32.85	3.01	9.17	62.89	12.19	--	--	--
21/ 4	25.91	1.82	7.03	68.57	8.14	--	--	--
24/ 4	22.01	1.86	8.47	64.88	7.73	--	--	--
27/ 4	56.45	6.43	11.39	60.96	22.04	1207	3091	10597
1/ 5	19.85	3.63	18.28	46.48	10.62	--	--	--
4/ 5	50.68	5.93	11.71	60.83	19.83	--	--	--
11/ 5	46.75	5.43	11.61	48.44	24.10	1209	2345	10413
15/5	35.95	6.36	17.69	50.30	17.87	2400	4829	13566
18/ 5	57.95	9.70	16.73	49.17	29.46	--	--	--
23/ 5	25.33	3.26	12.88	39.17	15.41	2507	4121	19464
25/ 5	23.73	5.08	21.40	42.18	13.72	--	--	--
29/ 5	8.92	1.48	16.57	47.75	4.66	2063	3948	12450
1/ 6	41.44	8.32	20.08	43.42	23.45	--	--	--
5/ 6	69.30	7.37	10.63	54.48	31.54	1255	2757	11806
8/ 6	44.71	5.34	11.94	56.36	19.51	--	--	--
12/ 6	65.92	6.53	9.91	59.44	26.75	--	--	--
15/ 6	40.28	4.90	12.17	55.25	18.02	--	--	--
18/ 6	45.71	6.62	14.48	56.09	20.07	1625	3700	11222
3/7	91.86	9.87	10.75	59.61	37.02	1164	2882	10827
10/ 7	71.14	5.98	8.41	62.96	26.96	--	--	--
17/ 7	63.77	5.09	7.98	65.22	22.13	858	2466	10751
24/ 7	53.96	3.99	7.39	66.21	18.18	--	--	--
31/ 7	59.81	5.05	8.44	64.84	20.99	771	2193	9135
7/ 8	72.91	7.25	9.94	61.99	27.43	--	--	--
14/ 8	64.33	6.59	10.24	56.68	27.85	1241	2865	12119
21/ 8	72.31	6.81	9.42	51.07	35.36	--	--	--
28/ 8	75.82	6.91	9.11	63.11	27.90	798	2163	8759
5/9	59.12	8.30	14.04	54.19	27.08	--	--	--
11/ 9	34.77	4.68	13.74	46.66	18.60	2099	3920	15276
18/ 9	41.83	7.85	18.77	30.25	29.16	--	--	--
2/10	24.90	4.90	19.66	22.09	19.40	--	--	--
10/10	36.13	9.86	27.28	4.33	34.54	4055	4238	14864
16/10	30.28	8.35	27.59	15.67	25.53	--	--	--
23/10	26.51	7.71	29.08	2.72	25.77	4259	4378	14645
30/10	18.48	6.03	32.61	5.20	17.52	--	--	--
6/11	22.85	7.18	31.44	21.20	18.00	4193	5321	13336
8/12	19.84	2.52	12.72	55.17	8.89	1903	4245	14960

Table 5 Seasonal variation in species composition of zooplankton.

Date	% Calanoid Copepods	% Cladocera	% Chaetognaths	% Medusae	% Cteno-phores	Total No of Animals in Sample
16/ 1	94.5	--	1.82	--	1.01	8489
15/ 2	93.6	--	1.83	--	2.04	5374
7/ 3	96.1	--	--	--	--	5361
17/ 3	92.3	--	5.54	--	2.48	1409
19/ 3	76.9	--	13.5	--	3.6	416
22/ 3	92.4	--	4.3	--	0.9	2100
27/ 3	75.7	--	8.19	--	6.72	342
1/ 4	83.9	--	11.7	1.5	2.4	763
3/ 4	60.6	--	17.97	--	10.88	479
6/4	25.9	--	20.8	2.8	27.4	212
10/4	43.45	--	15.21	1.88	8.22	427
13/ 4	64.3	--	2.90	2.68	10.94	448
17/ 4	63.6	--	7.60	--	15.20	291
19/ 4	59.7	--	13.9	1.27	6.64	236
21/ 4	67.7	--	10.8	1.9	6.3	158
24/ 4	82.28	--	4.84	1.21	4.11	413
27/ 4	82.89	--	4.73	--	2.18	1096
1/ 5	88.1	--	4.0	--	1.3	1112
4/ 5	79.9	--	5.7	--	4.0	672
11/ 5	75.46	--	--	--	--	2846
15/ 5	72.86	--	--	1.28	--	4837
18/ 5	93.0	--	--	--	--	4646
23/ 5	69.17	--	--	1.02	--	5286
25/ 5	94.7	--	--	1.2	--	3378
29/ 5	90.69	--	--	1.83	--	2294
1/ 6	90.2	--	--	3.5	--	4370
5. 6	87.0	--	--	5.0	--	3565
8/ 6	92.15	--	--	2.97	--	5161
12/ 6	91.9	--	--	3.1	--	3850
15/6	81.6	--	--	10.66	--	5196
18/6	88.7	--	--	9.5	--	4218
3/7	81.4	6.2	--	4.7	--	9486
10/ 7	82.16	9.59	1.23	4.8	1.20	6336
17/ 7	76.45	9.09	--	10.44	--	7194
24/7	60.04	18.97	--	14.81	4.84	1633
31/ 7	61.20	36.6	--	1.02	--	8358
7/ 8	76.5	15.6	1.0	2.3	3.1	4314
14/ 8	69.74	25.45	--	1.37	--	4245
21/ 8	84.4	10.2	1.8	1.4	1.5	2358
28/ 8	64.0	32.0	--	--	1.0	3066
5/ 9	68.55	21.44	--	1.21	--	14514
11/ 9	78.87	8.16	--	--	--	17940
18/ 9	57.20	37.73	1.04	--	--	22015
2/10	86.4	1.7	--	2.2	--	10194
10/10	90.95	1.29	--	--	--	23651
16/10	88.87	4.42	--	1.36	--	12540
23/10	94.30	--	--	1.03	--	5908
30/10	94.94	--	--	--	--	12898
6/11	86.78	1.40	--	--	--	18140
8/12	92.02	--	--	--	--	6172

No entry is made if representation of group is less than 1% of total sample.

II Autumn Bloom Survey

Data in this section comprise the results of weekly sampling at nine stations for chlorophyll, inorganic phosphate and nitrate between October 3 and November 8, 1967. The data are listed in Appendix 3. The locations of the nine stations are shown in Fig. 15. The first point that emerges from the data is that there are significant differences between stations within St. Margaret's Bay. For example we may consider the between station variability for chlorophyll data. We have calculated the coefficients of variation between the nine stations for each of the five weeks for each of the following depths; 1m, 5m, 10m, 15m. Coefficients of variation range from 10% to 124% with a mean of 39%. The area occupied by the nine stations is about 13 square miles. The variability was greatest apparently at 5m (mean = 45%), but this includes the effect of an unreasonably high value at station 4 in week one. In reality the greatest variability was probably at 10m (42%) compared with 30% at surface and 37% at 15m.

In spite of the variability between stations the time trends at each station are in good agreement. Fig. 16 shows that the changes in chlorophyll followed essentially the same pattern at all nine stations. The agreement is especially good for the first three sampling periods. During week four the spread is rather high and between the fourth and fifth sampling period there was an increase in chlorophyll at Stations 3, 6 and 8 against the general trend of decreasing chlorophyll. The consistency in these results lends some support to the argument that measurements at one fixed station can be considered as representative in some way of the conditions in St. Margaret's Bay and gives further confidence in the serial data

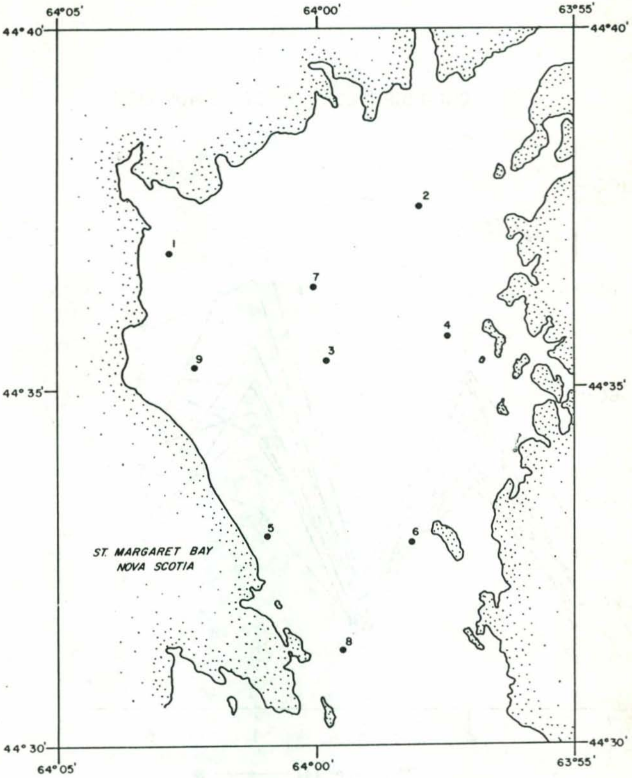


Fig. 15. Location of sampling stations in St. Margaret's Bay for autumn bloom survey.

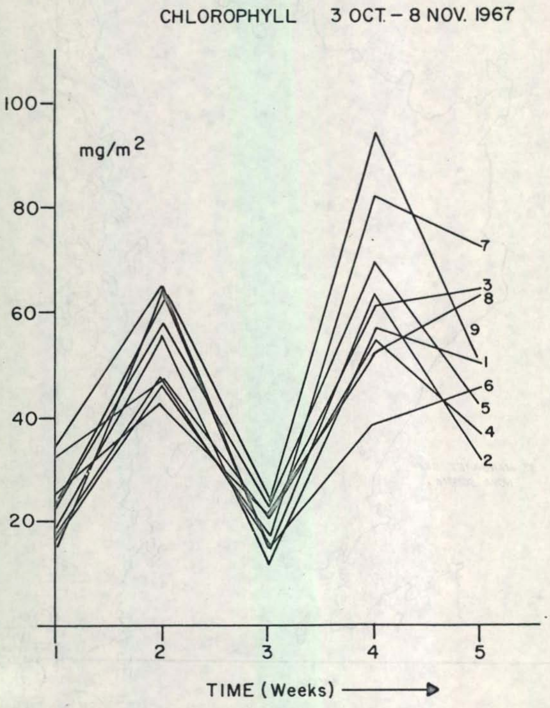


Fig. 16. Variation in chlorophyll at nine stations in St. Margaret's Bay between October 3 and November 8, 1967.

obtained at station A (station A is represented as station 9 in this section). As far as any generalization can be made about the spatial distribution of the measured variables, we can say that concentration of chlorophyll and nutrients tended to be higher to the north and west of the bay and lower to the south and east.

III Scotian Shelf

The data presented in this section comprise the results of two cruises on the Scotian Shelf; the first by *CNAV SACKVILLE* May 2 - May 17, 1967 (CODC # 01-67-003), the second by *RV E. E. PRINCE* September 7 - September 8, 1967 (CODC # 01-67-005). Chief scientist on both of these cruises was Dr. R. J. Conover. Station positions are shown in Fig. 1. Temperature and salinity data can be obtained from CODC data report; the rest of the data are listed in Appendix 4. Referring to the line of stations L1 through L7, in May there was little change in conditions in the euphotic zone as one progressed from the inshore to the offshore end of the section. In September, however, there was a sharp change in conditions between Station L4 and L5. On the inshore side we found surface layer chlorophylls $\sim$0.8 mg/m^3, silicates $\sim$5 mg-at/m^3, phosphates $\sim$0.4 mg-at/m^3 and nitrates $\sim$0.5 mg-at/m^3; on the offshore side we found chlorophylls $\sim$ 0.4 mg/m^3, silicates $\sim$2 mg-at/m^3, phosphates $\sim$0.2 mg-at/m^3 and nitrates $\sim$0.1 mg-at/m^3. We can make the generalization that in May the water mass inside St. Margaret's Bay was representative of the water outside on the Shelf, whereas in early September the water inside the bay was different in character from the water outside. These remarks are in agreement with the unpublished data of Dr. Conover on the zooplankton samples taken on these cruises.

Stations D1 to D8 were occupied in connection with a parachute drogue study. The drogue was set at 10 m. A station was made every day from May 10 to May 17. It is of interest to note the zone of low oxygen content found below 50 m on stations D5 to D8. The water in this zone was about 70% saturated with respect to oxygen; nitrates were about 10 mg-at/m^3, inorganic phosphates about 1.1 mg-at/m^3. The temperature was about 4°C.

DISCUSSION

1. Hydrography

The most important feature of the hydrography of St. Margaret's Bay, as observed in 1967, was the potentiality to exchange water with areas outside the bay. Thus, in the space of seven days at the end of August, the surface temperature was reduced from 15.6°C to 6.9°C, the surface salinity was increased from 29.36^{o}/oo to 31.26^{o}/oo and the thermocline was destroyed (Fig. 2). By September 11 the surface temperature had recovered only 0.9°C but in the next 14 days the temperature increased to 14.6°C and the surface layer was 36 m thick.

We suggest that the changes described above were due to upwelling along the coast caused by offshore winds set in the westerly to southwesterly direction throughout most of the month of August (Table 6). This is an example of the type described by Sverdrup, Johnson and Flemming (1942, p. 501). In their example the wind blows parallel to the coast with the coast on the left. In the Northern Hemisphere surface water is deflected to the right of the wind and light surface water is transported away from the coast, causing upwelling of cold, dense subsurface water along the coast.

By September 11 the period of sustained westerly winds was over and for the next 14 days the winds were mainly from the northerly to easterly quadrant. The system was now unstable, with cold, dense water against the coast and warm, lighter water offshore; further, with the wind blowing parallel to the coast with the coast on the right, the resultant force would tend to push surface water against the coast. There were thus two complementary forces acting; the result was an incursion of warm, offshore surface water into the

Table 6 Wind direction observations at Sable Island Station, 1200 h GMT, between August and November 1967.

Date	Direction	Date	Direction	Date	Direction	Date	Direction
Aug. 1	SW	Sept. 1	W	Oct. 1	S	Nov. 1	SE
2	W	2	SE	2	W	2	SE
3	S	3	SW	3	NW	3	SE
4	S	4	S	4	W	4	S
5	SW	5	W	5	W	5	SW
6	S	6	SW	6	N	6	W
7	SW	7	NW	7	N	7	N
8	S	8	NW	8	W	8	SE
9	SE	9	SW	9	W	9	W
10	SW	10	S	10	S	10	
11	SW	11	N	11	S	11	
12	SW	12	NE	12	W	12	
13	NE	13	NE	13	NW	13	
14	E	14	E	14	NE	14	
15	W	15	E	15	NE	15	
16	W	16	NE	16	N	16	
17	W	17	NW	17	SW	17	
18	W	18	SW	18	S	18	
19	SW	19	SW	19	S	19	
20	SW	20	NE	20	SW	20	
21	SW	21	SE	21	W	21	
22	W	22	SE	22	S	22	
23	W	23	SE	23	NW	23	
24	NW	24	SE	24	W	24	
25	W	25	SW	25	W	25	
26	SW	26	NW	26	SE	26	
27	S	27	W	27	W	27	
28	SW	28	W	28	Calm	28	
29	SW	29	SW	29	S	29	
30	SW	30	SW	30	NE	30	
31	SW			31	NE		

These data were provided by the Department of Transport, at the Halifax International Airport.

bay and a corresponding rise in surface temperature.

Further incursions of warm water occurred in October and November. As late as November 6 the surface layer was more than 30 m thick and the temperature was 11°C. Year to year variations in the extent of water replacement could be of direct importance in the timing of the winter cooling of St. Margaret's Bay.

Hachey (1956) has discussed the significance of water replacements to fisheries with particular reference to the Scotian Shelf. It is obvious that water exchange must have far-reaching effects on St. Margaret's Bay as an ecosystem.

2. Nutrients

The formation of a subsurface oxygen maximum during the summer months is of some interest. Similar summer subsurface oxygen maxima have been documented (Redfield, 1948, for the Gulf of Maine; Reid, 1962, for the California current, Pytkowicz, 1964, off the Oregon Coast). The mechanism proposed by Pytkowicz (1964) is that as the surface water warms up and becomes supersaturated with oxygen, oxygen from the layer above the thermocline is lost to the atmosphere by diffusion; the exchange at the interface is greater than the photosynthesised oxygen such that there is a net loss of oxygen from the surface layer. Reid (1964) considered that formation of a summer oxygen maximum was influenced by seasonal variation of surface temperature and that the effect of photosynthesis was minimal. Redfield (1948) concluded that in the Gulf of Maine, variation in dissolved oxygen was controlled by temperature; the effect of primary production was only important at the period of minimum temperature.

At the end of the spring bloom the quantity of silicate in the water column had been reduced to about 150 mg-at/m^2. The reduction was not confined to the surface waters; the silicate concentration at depth was decreasing as a result of vertical mixing. Thus, the bottom silicate decreased from 10 mg-at/m^3 on April 24 to 3 mg-at/m^2 on May 15. However, there was a rapid recovery in the level of dissolved silicate at the bottom. MacKenzie and Garrels (1965) have shown that silicate minerals quickly release silicate to seawater. Samples of aluminosilicate minerals weighing 1 g were suspended in 200 mls seawater. After six months concentrations of from 30 - 300 mg-at/m^3 dissolved silicate were produced. Amounts equal to or greater than half the final values were released within 10 days. We can expect that a similar mechanism exists at the sediment-water interface in St. Margaret's Bay.

There was also a tendency for the inorganic phosphate at bottom to be buffered. Most measurements throughout the year fell into the range 0.7 - 0.9 mg-at/m^3. These observations are similar to those of Ewins and Spencer (1967), for the Menai Straits. They quote the Pomeroy, Smith and Grant (1965) who showed that the phosphate concentration of sea water can be buffered through sorption reactions at the sediment-water interface.

Dissolved organic phosphate varied from 3% to 42% of the total dissolved phosphate. Before the plankton bloom the fraction averaged 10.6%. There was an increase from 10.5% to 22.1% in two days coincident with the onset of the spring bloom, presumably due to excretion by phytoplankton. During the summer months dissolved organic phosphate averaged 29% of the total dissolved. In the Menai Straits, Ewins and Spencer (1967) found a winter average of 28% and a summer average of 45%.

The values of inorganic nutrients measured at station A are in general relatively low for inshore water (c.f. Raymont, 1963). Pratt (1965) has summarised the data on the limitation of diatom blooms by inorganic nutrients. Estimates of the phosphate concentration below which phosphate limits phytoplankton production range from 0.40 mg-at/m^3 (Steele, 1958) to 0.55 mg-at/m^2 (Ketchum, 1939). Surface layer phosphates were considerably below this limit at the end of the spring bloom and for most of the summer. Surface layer nitrates were also low at station A during the summer (< 1 mg-at/m^3) but it is probably that considerable amounts of nitrogen were available as ammonia during this period. Pratt (1965) considered that the winter-spring diatom flowering in Narragansett Bay is limited by the concentration of nitrate and silicate. Ammonia was not measured. Silicate is undetectable during most of the winter and spring in Narragansett Bay. There is little data available on limiting concentration of silicate for marine phytoplankton. Lund (1950) gives 8.3 mg-at/m^3 as the silicate concentration limiting growth of *Asterionella formosa* in the English Lake District. Jorgensen (1953) observed cessation of cell division in diatom cultures at silicate concentrations of 1.0 - 1.4 mg-at/m^3. It is unlikely that phytoplankton growth in St. Margaret's Bay was limited by silicate. At the end of the spring bloom, surface layer silicates were about 3 - 5 mg-at/m^3. Primary production was sustained at a fairly high level throughout the summer, suggesting that the phytoplankton population was not unduly affected by the generally low nutrient levels at that time. There is a need for a revision of the estimates of limiting nutrient levels for natural populations of the dominant phytoplankton species.

Cushing and and Tungate (1963) have already provided evidence that formerly accepted levels are too high.

The quantity of inorganic nutrients in the water column was subject to wide fluctuations during September and October coincident with the alternate upwelling of cold water and incursion of warm water. This is evident from the graphs of the seasonal variations in the integrated nutrient values. In general the upwelled water was nutrient rich and the warm offshore water was relatively poor in nutrients. The lowest values of phosphate nitrate and silicate measured during the whole year were found on September 25 in water newly carried into the bay from offshore.

3. Primary Production and Phytoplankton Biomass

The annual cycle of primary production at station A as observed in 1967 differs in some respects from the classic type for temperate latitudes (cf Raymont, 1963). It is usually found that the cycle of production is strongly bimodal with a dominant peak in spring, a smaller peak in the autumn and little production at other times. In St. Margaret's Bay the annual production was spread more evenly throughout the year. The highest production was observed in the spring, but after an initial drop in May was sustained at a relatively high level until November. Indeed, the monthly averages for primary production listed in Table 3 show a maximum in November, but the November average is based on only one observation on an unusually clear day. In spite of this qualitative difference in the annual cycle of production, the estimated annual production, between 125 and 150 gc/m^2yr, is consistent with measurements in other areas at about latitude 45°N (e.g. Raymont, 1963). It is probable that daily estimates of production measured at station A do not always reflect the total areal primary production of the Bay; in the summer it is not uncommon for one half of the Bay to be fogged in while the other half enjoys bright sunshine.

The average value for production per unit incident radiation was 4.58×10^{-4} $(mgC/m^2.hr)/(cal/m^2.hr)$; that is the primary production per unit area of sea surface was 0.61% of the incident surface radiation. Considering the summer months only, the average was 0.77%. Patten (1961) obtained 0.88% for the waters of Raritan Bay during the summer months (June-August) of 1959.

The production per unit incident radiation had a coefficient of variation of 71% over the year. Production per unit incident radiation per unit biomass had a coefficient of variation of 104%. The heterogeneity was increased, rather than decreased when the production was normalised with respect to the biomass. This suggests that the relative photosynthetic response was quite variable as the species succession progressed and the physiological state of the population changed.

The values of production per unit biomass were higher in the summer than in the spring (Table 2), while the nutrient levels were generally lower. There was an increase in the size of the zooplankton population after the spring bloom of phytoplankton and the zooplankton biomass was maintained at a relatively high level throughout the summer. The implication is that it was primarily grazing that controlled the phytoplankton biomass; low nutrients apparently had little limiting effect judging by the higher production efficiencies. There is a suggestion that as the grazing pressure became more intense, with increasing zooplankton biomass, the low efficiency spring phytoplankton population was replaced by a faster turning over summer population.

The correlation between chlorophyll and particulate phosphorus measurements was highly significant. That between chlorophyll and particulate carbon was not significant. The role of detrital carbon is undetermined. It is obvious that a simple conversion factor cannot be deduced to relate particulate carbon to chlorophyll data. Steele and Baird (1961, 1962) have discussed the relations between carbon and chlorophyll in British waters; they have shown that the carbon: chlorophyll ratio is variable both seasonally and geographically. It is clear that particulate carbon is not necessarily a good estimate of phytoplankton biomass. It remains to be seen which measurement is the better estimate of the food available at the second trophic level; in other words what fraction of the organic carbon present can be used by the herbivorous zooplankton. A detailed analysis of the relations between chlorophyll, particulate carbon and particulate phosphorus will be presented in a later paper.

4. Zooplankton

The seasonal variations in the calorific value and species composition of zooplankton are shown in Tables 4 and 5. The gradual decline in calorific value in the early part of the year was associated with a decrease in the representation of calanoids in the plankton and an increase in the proportion of ctenophores and chaetognaths. It is likely that this effect was confounded with a decrease in the calorific value of the copepods themselves as they depleted their fat reserves. The peak in calorific value in late May was associated with the post spring-bloom increase in *Pseudocalanus minutus* and *Calanus finmarchicus* and a decline in the importance of ctenophores and chaetognaths. The calorific value of the total zooplankton dropped in late June as the medusae became more important. It is more difficult to account for the generally low calorific value during the rest of the summer. The zooplankton was dominated by copepods and cladocera. Ostapenya and Sergeev (1963) state that the caloric content of the cladocera of the Sea of Okhotsk is exceptionally high (up to 8.4 Kcal/gm ash free dry wt.) on account of their high fat content. Presumably the low calorific values observed during the summer in St. Margaret's Bay reflect a low calorific value of the copepods, probably because of a low fat content. Ostapenya & Sergeev (1963) maintain that it is variation in fat content that is most important in controlling the calorific value of animals. The gradual increase in carbon content of the plankton beginning in September is probably due to laying down of fat reserves by copepods for the winter. This process was complete by November. The general trend through the year of the caloric content of copepods implied by these data is not inconsistent with the observations of Orr (1934) on the seasonal variations in fat content of *Calanus finmarchicus*. Comita, Marshall and Orr (1966) have studied the seasonal change in weight, calorific value and organic matter of *Calanus finmarchicus*. They found peaks in calorific value during spring of two consecutive years as expected, but in addition found an unexpected peak in late autumn and winter. These results are very similar to the data from St. Margaret's Bay.

Ostapenya and Sergeev (1963) find that the average caloric content of various aquatic invertebrates is 5.6 Kcal/g ash free dry weight, when calculculated from the chemical composition of the animals. The average for the total zooplankton of St. Margaret's Bay, taken over the whole year and measured by direct calorimetry is 3.4 Kcal/g ash free dry weight, about 60% of the Russian value.

The values of zooplankton biomass, given as gC/m^3 should be considered minimal estimates, since our data describes only those animals vulnerable to a vertical tow made by a 0.5 m diameter, 366µ mesh net, and takes no account of those more motile animals that would be vulnerable to a higher speed sampler.

5. Variability

The data collected at nine stations during October gives some support to the argument that measurements at a fixed station can be considered as representative in some way of conditions in St. Margaret's Bay.

The double peak in the chlorophyll curve of Fig. 16 is probably a reflection of instability of the water masses on the Shelf at that time rather than a representation of the situation that would have developed given the initial conditions at week one and dynamic stability for the next four weeks. Thus, the chlorophyll values are higher in the colder water present during weeks two and four and lower in the warmer water present during weeks one, three and five. The occurrence and possible cause of the alternate upwelling of cold water and incursion of warm water during the fall of 1967 has been discussed in a previous section.

A sampling interval of one week is too long for the resolution in time of the differential progress of events within the bay. If such a program is undertaken again, it would be preferable to adopt a shorter sampling interval and to choose a time of year when there was a better chance of finding stable conditions in the bay. The data presented in this section will be discussed in detail in a later paper on heterogenity in St. Margaret's Bay.

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APPENDIX I Serial Data, Station A

In this section we list the data collected at Station A during 1967. The error of the integral is twice the standard deviation of the integral evaluated as described on page 10.

DATE 16/ 1/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	3.0	30.173	0.68	2.60	0.26
5	3.3	30.406	0.66	2.72	0.33
10	3.8	30.762	0.63	2.58	0.33
15	3.8	30.830	0.65	2.83	0.35
25	3.8	30.978	0.65	3.43	0.37
40	4.5	31.074	0.61	3.80	0.30
53	4.8	31.422	0.56	5.16	0.48
INTEGRAL		1701.497		192.80	19.30
ERROR		0.116		8.62	0.74

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	9.12	0.54	0.61	0.07	0.081
5	8.42	0.48	0.69	0.21	0.090
10	8.60	0.50	0.59	0.09	0.081
15	4.36	0.55	0.70	0.15	0.079
25	6.62	0.51	0.68	0.17	0.049
40	7.26	0.55	0.66	0.11	0.053
53	11.97	0.82	0.86	0.04	0.105
INTEGRAL	422.02	31.15	38.02	6.87	3.845
ERROR	14.31	1.33	1.62	0.32	0.062

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	1.06	0.00	0.081	-	87.6
5	1.06	0.00	0.116	-	51.7
10	0.67	0.00	0.131	-	26.7
15	0.63	0.00	0.116	-	13.8
25	0.25	0.00	0.081	-	3.7
40	0.27	0.00	0.210	-	0.5
53	0.46	0.00	0.062	-	0.1
INTEGRAL	26.64	0.00	6.935		
ERROR	1.65	0.00	0.143		

ZOOPLANKTON DRY WT 30.0 MG/M3
EXTINCTION COEFF 0.132 /M
INCIDENT RADIATION -

DATE 15/ 2/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	1.3	30.880	0.74	3.85	0.13
5	1.3	30.859	0.74	4.18	0.13
10	1.3	30.864	0.74	4.58	0.18
15	1.3	30.884	0.74	4.75	0.13
25	1.3	30.879	0.73	5.00	0.11
40	1.3	30.883	0.72	3.96	0.13
53	1.3	30.879	0.74	4.27	0.13
INTEGRAL		1698.270		242.97	7.15
ERROR		0.116		10.38	0.27

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	8.72	0.60	0.74	0.14	0.083
5	8.89	0.58	0.71	0.13	0.091
10	6.10	0.66	0.76	0.10	0.092
15	8.83	0.64	0.71	0.07	0.085
25	4.94	0.65	0.69	0.04	0.089
40	8.83	0.67	0.68	0.01	0.092
53	8.83	0.65	0.68	0.03	0.107
INTEGRAL	423.40	35.55	38.45	2.90	5.055
ERROR	14.64	1.53	1.62	0.12	0.086

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.63	0.00	0.122	-	86.8
5	0.[illegible]7	0.00	0.093	-	49.2
10	0.87	0.00	0.092	-	24.2
15	0.83	0.00	0.092	-	11.9
25	0.67	0.00	0.173	-	2.9
40	0.52	0.00	0.132	-	0.3
53	0.33	0.00	0.092	-	0.1
INTEGRAL	31.59	0.00	6.752		
ERROR	2.17	0.00	0.127		

ZOOPLANKTON DRY WT 28.2 MG/M3
EXTINCTION COEFF 0.142 /M
INCIDENT RADIATION -

DATE 7/ 3/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	0.0	30.724	0.77	4.65	0.07
5	0.2	30.800	0.77	5.01	0.09
10	0.5	30.918	0.77	4.95	0.18
15	0.8	31.162	0.75	4.58	0.24
25	1.0	31.475	0.73	5.58	0.24
40	1.4	31.173	0.71	6.65	0.30
53	1.4	31.771	0.69	7.05	0.26
INTEGRAL		1718.430		318.15	12.77
ERROR		0.117		14.20	0.55

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	9.59	0.57	0.73	0.16	0.090
5	9.88	0.60	0.74	0.14	0.101
10	9.70	0.60	0.65	0.05	0.077
15	9.30	0.71	0.71	0.00	0.083
25	9.70	0.68	0.77	0.09	0.070
40	2.44	0.79	0.81	0.02	0.078
53	7.84	0.82	0.84	0.02	0.109
INTEGRAL	408.27	39.25	42.17	2.92	4.600
ERROR	13.79	1.73	1.83	0.14	0.076

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.54	0.31	0.153	-	88.5
5	0.67	0.32	0.159	-	54.3
10	0.50	0.33	0.126	-	29.5
15	0.46	0.37	0.160	-	16.0
25	0.25	0.45	0.146	-	4.7
40	0.33	0.22	0.116	-	0.8
53	0.33	0.54	0.138	-	0.2
INTEGRAL	21.27	19.67	7.607		
ERROR	1.36	1.35	0.127		

ZOOPLANKTON DRY WT 29.6 MG/M3
EXTINCTION COEFF 0.122 /M
INCIDENT RADIATION -

DATE 17/ 3/67

DEPTH METRES	TEMP. DEG.C	SALINITY O/OO	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	0.2	30.984	0.78	5.75	0.89
5	0.2	30.997	0.77	4.69	0.35
10	0.2	31.003	0.77	4.73	0.26
15	0.3	31.006	0.78	5.60	0.46
25	0.4	31.354	0.73	6.44	0.35
40	1.2	31.631	0.71	6.37	0.41
53	1.4	31.640	0.68	5.75	0.35
INTEGRAL		1723.695		322.65	21.87
ERROR		0.118		14.34	0.83

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	9.82	0.76	0.87	0.11	0.091
5	9.82	0.78	0.82	0.04	0.087
10	9.94	0.71	0.78	0.07	0.080
15	9.94	0.74	0.87	0.13	0.088
25	10.28	0.79	0.85	0.06	0.071
40	10.75	0.89	0.82	0.00	0.082
53	11.00	0.85	0.85	0.00	0.110
INTEGRAL	570.15	44.50	46.00	2.55	4.665
ERROR	19.65	1.95	1.96	0.13	0.078

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN O/O
1	0.38	0.07	0.162	-	88.8
5	0.54	0.00	0.103	-	55.2
10	0.31	0.13	0.125	-	30.4
15	0.46	0.05	0.111	-	16.8
25	0.38	0.00	0.124	-	5.1
40	0.29	0.04	0.130	-	0.9
53	0.29	0.23	0.117	-	0.2
INTEGRAL	19.91	3.44	6.755		
ERROR	1.32	0.31	0.117		

ZOOPLANKTON DRY WT 30.6 MG/M3
EXTINCTION COEFF 0.119 /M
INCIDENT RADIATION -

DATE 19/ 3/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	-0.3	31.064	0.73	4.42	0.35
5	-0.2	31.070	0.73	4.94	0.24
10	-0.1	31.100	0.72	5.57	0.28
15	0.2	31.161	0.71	5.96	0.39
25	0.6	31.407	0.70	5.09	0.28
40	1.0	31.566	0.67	5.95	0.28
53	1.0	31.613	0.65	6.58	0.28
INTEGRAL		1725.392		310.52	16.20
ERROR		0.118		13.40	0.62

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	6.16	0.75	0.71	0.00	0.076
5	9.82	0.89	0.91	0.02	0.093
10	9.35	0.91	0.94	0.03	0.074
15	8.95	1.00	0.92	0.00	0.073
25	9.64	0.75	0.71	0.00	0.074
40	6.68	1.32	1.60	0.28	0.085
53	10.75	0.88	0.96	0.08	0.110
INTEGRAL	479.70	54.15	58.00	5.05	4.597
ERROR	16.08	2.50	2.83	0.42	0.078

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.42	0.00	0.148	-	88.4
5	0.67	0.00	0.113	-	54.1
10	0.71	0.00	0.218	-	29.2
15	0.54	0.00	0.150	-	15.8
25	0.25	0.12	0.139	-	4.6
40	0.33	0.00	0.149	-	0.7
53	0.25	0.03	0.119	-	0.1
INTEGRAL	22.00	1.68	8.015		
ERROR	1.43	0.24	0.137		

ZOOPLANKTON DRY WT 29.7 MG/M3
EXTINCTION COEFF 0.123 /M
INCIDENT RADIATION -

DATE 22/ 3/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	0.1	31.051	0.73	5.32	0.59
5	0.1	31.061	0.72	5.89	0.30
10	0.2	31.075	0.73	4.45	0.28
15	0.3	31.088	0.74	4.76	0.11
25	0.6	31.124	0.72	5.58	0.18
40	1.0	31.470	0.68	6.11	0.15
53	1.3	31.604	0.65	6.53	0.52
INTEGRAL		1719.597		311.07	13.60
ERROR		0.117		13.59	0.51

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	10.23	0.77	0.71	0.00	0.072
5	9.41	0.77	0.84	0.07	0.085
10	9.30	0.74	0.84	0.10	0.078
15	9.94	0.80	0.86	0.06	0.335
25	9.53	0.78	0.87	0.09	0.084
40	9.88	0.87	0.96	0.09	0.093
53	11.16	0.95	0.90	0.00	0.149
INTEGRAL	544.70	45.40	48.65	3.78	7.070
ERROR	18.55	1.96	2.12	0.19	0.133

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.50	0.00	0.134	-	88.4
5	0.50	0.00	0.128	-	54.1
10	0.54	0.00	0.174	-	29.2
15	0.46	0.03	0.122	-	15.8
25	0.46	0.00	0.116	-	4.6
40	0.25	0.04	0.131	-	0.7
53	0.33	0.09	0.167	-	0.1
INTEGRAL	21.90	1.48	7.427		
ERROR	1.43	0.15	0.124		

ZOOPLANKTON DRY WT -
EXTINCTION COEFF 0.123 /M
INCIDENT RADIATION -

DATE 27/ 3/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	0.6	31.103	0.72	4.18	0.33
5	0.6	31.113	0.73	4.98	0.78
10	0.4	31.107	0.74	5.22	0.09
15	0.4	31.118	0.74	5.50	0.28
25	0.3	31.266	0.73	5.55	0.24
40	0.6	31.423	0.69	6.04	0.48
53	0.9	31.579	0.66	6.13	0.39
INTEGRAL		1721.255		308.65	20.40
ERROR		0.118		13.51	0.85

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	9.64	0.71	0.53	0.00	0.074
5	9.81	0.70	0.80	0.10	0.070
10	10.11	0.66	0.77	0.11	0.073
15	9.99	0.73	0.75	0.02	0.073
25	9.76	0.88	1.24	0.36	0.074
40	10.46	0.90	1.04	0.14	0.096
53	12.20	0.93	1.12	0.19	0.132
INTEGRAL	569.02	45.52	54.30	9.22	4.802
ERROR	19.44	2.02	2.49	0.52	0.085

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.63	0.00	0.183	0.568	87.9
5	0.63	0.00	0.134	0.421	52.5
10	0.67	0.01	0.070	0.427	27.5
15	0.71	0.00	0.186	0.553	14.4
25	0.46	0.03	0.114	0.062	4.0
40	0.29	0.08	0.180	0.004	0.6
53	0.25	0.06	0.264	0.000	0.1
INTEGRAL	25.34	1.95	8.977	10.649	
ERROR	1.66	0.20	0.160	1.074	

ZOOPLANKTON DRY WT 23.3 MG/M3
EXTINCTION COEFF 0.129 /M
INCIDENT RADIATION -

DATE 1/ 4/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	0.5	31.232	0.72	5.58	0.28
5	0.5	31.231	0.74	5.08	0.07
10	0.5	31.218	0.74	5.16	0.11
15	0.4	31.277	0.74	3.87	0.18
25	0.3	31.322	0.74	4.60	0.33
40	0.3	31.327	0.72	5.45	0.09
53	0.3	31.447	0.71	6.23	0.17
INTEGRAL		1722.185		280.15	9.70
ERROR		0.118		12.05	0.43

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	9.53	0.72	0.79	0.07	0.140
5	9.82	0.71	0.79	0.08	0.088
10	9.35	0.71	0.84	0.13	0.084
15	9.70	0.65	0.82	0.17	0.099
25	9.70	0.82	0.94	0.12	0.085
40	10.28	0.99	1.18	0.19	0.100
53	10.46	0.79	0.91	0.12	0.103
INTEGRAL	546.32	44.80	52.55	7.75	5.287
ERROR	18.78	2.03	2.39	0.37	0.090

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.50	0.00	0.227	0.404	87.7
5	0.81	0.00	0.248	0.733	51.9
10	0.81	0.00	0.133	0.628	27.0
15	0.63	0.00	0.205	0.486	14.0
25	0.46	0.09	0.136	0.038	3.8
40	0.29	0.17	0.094	0.000	0.5
53	0.25	0.18	0.112	0.000	0.1
INTEGRAL	26.07	4.99	7.960	11.937	
ERROR	1.70	0.50	0.128	1.230	

ZOOPLANKTON DRY WT	14.4 MG/M3
EXTINCTION COEFF	0.131 /M
INCIDENT RADIATION	-

DATE 3/ 4/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	1.8	31.073	0.74	5.24	0.07
5	1.7	31.163	0.74	4.19	0.13
10	1.1	31.258	0.74	4.35	0.65
15	1.0	31.257	0.73	5.49	0.13
25	0.8	31.297	0.73	5.52	0.18
40	0.8	31.333	0.73	5.22	0.37
53	0.8	31.356	0.72	4.70	1.26
INTEGRAL		1720.592		279.52	22.30
ERROR		0.117		12.21	1.05

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	9.76	0.69	0.76	0.07	0.100
5	9.35	0.60	0.80	0.20	0.090
10	9.70	0.71	0.78	0.07	0.107
15	8.66	0.69	0.79	0.10	0.102
25	10.17	0.75	0.86	0.11	0.102
40	9.30	0.94	0.87	0.00	0.095
53	9.53	0.77	0.98	0.21	0.108
INTEGRAL	522.70	42.70	46.87	5.22	5.510
ERROR	17.90	1.93	2.02	0.25	0.093

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.71	0.00	0.106	1.183	87.4
5	0.63	0.00	0.314	0.429	50.9
10	0.71	0.00	0.189	0.409	25.9
15	0.50	0.00	0.106	0.260	13.2
25	0.46	0.00	0.212	0.060	3.4
40	0.50	0.00	0.133	0.015	0.5
53	0.38	0.05	0.086	0.000	0.1
INTEGRAL	28.26	0.41	8.865	10.070	
ERROR	1.87	0.06	0.157	0.937	

ZOOPLANKTON DRY WT 23.0 MG/M3
EXTINCTION COEFF 0.135 /M
INCIDENT RADIATION -

DATE 6/ 4/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	0.9	31.065	0.74	4.31	0.13
5	0.9	31.260	0.73	4.75	0.30
10	0.9	31.294	0.73	5.83	0.09
15	0.9	31.298	0.73	5.77	0.07
25	0.9	31.299	0.73	4.92	0.46
40	0.9	31.306	0.72	4.84	0.13
53	0.9	31.331	0.72	6.64	0.46
INTEGRAL		1720.977		290.85	13.95
ERROR		0.117		12.22	0.65

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	9.88	0.95	1.12	0.17	0.100
5	9.88	1.23	1.38	0.15	0.101
10	9.64	1.04	1.17	0.13	0.107
15	9.53	0.91	0.99	0.08	0.104
25	9.35	0.86	1.07	0.21	0.102
40	9.94	1.02	1.03	0.01	0.102
53	10.11	1.06	1.14	0.08	0.104
INTEGRAL	535.57	54.55	60.35	5.80	5.655
ERROR	18.26	2.30	2.52	0.30	0.096

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.42	0.01	0.092	0.289	88.2
5	0.54	0.00	0.086	0.513	53.3
10	0.50	0.02	0.163	0.316	28.4
15	0.46	0.05	0.065	0.615	15.1
25	0.46	0.05	0.189	0.174	4.3
40	0.38	0.13	0.192	0.023	0.6
53	0.33	0.15	0.109	0.000	0.1
INTEGRAL	23.56	4.15	8.022	12.003	
ERROR	1.58	0.36	0.158	1.196	

ZOOPLANKTON DRY WT 119.0 MG/M3
EXTINCTION COEFF 0.126 /M
INCIDENT RADIATION 28.41 Cal $cm^{-2}hr^{-1}$

DATE 10/ 4/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	1.9	30.780	0.75	5.12	0.39
5	1.7	31.119	0.77	4.91	0.26
10	1.5	31.157	0.77	4.25	0.26
15	1.4	31.251	0.76	4.63	0.24
25	1.0	31.316	0.76	3.62	0.39
40	1.0	31.300	0.73	5.68	0.48
53	0.5	31.408	0.77	5.74	0.39
INTEGRAL		1719.222		266.82	20.37
ERROR		0.117		11.65	0.86

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	10.11	0.70	0.84	0.14	0.104
5	9.41	0.75	0.70	0.00	0.099
10	9.41	0.76	0.83	0.07	0.105
15	9.30	0.75	0.84	0.09	0.098
25	9.30	0.77	0.83	0.06	0.088
40	9.88	0.82	0.90	0.08	0.107
53	10.17	0.87	0.90	0.03	0.120
INTEGRAL	529.85	43.37	46.67	3.55	5.620
ERROR	18.11	1.87	2.02	0.17	0.096

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.58	0.05	0.292	0.997	88.1
5	0.50	0.06	0.280	0.567	53.0
10	0.81	0.00	0.295	0.368	28.1
15	0.54	0.00	0.275	0.197	14.9
25	0.50	0.00	0.161	0.015	4.2
40	0.29	0.10	0.161	0.028	0.6
53	0.21	0.22	0.202	0.000	0.1
INTEGRAL	24.29	3.52	11.610	9.253	
ERROR	1.62	0.35	0.184	0.896	

ZOOPLANKTON DRY WT 44.7 MG/M3
EXTINCTION COEFF 0.127 /M
INCIDENT RADIATION -

DATE 13/ 4/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	1.4	30.909	0.73	4.27	0.28
5	1.4	30.314	0.74	3.74	0.24
10	1.4	30.943	0.72	4.38	0.20
15	1.4	30.991	0.73	4.86	0.15
25	1.3	31.079	0.73	4.95	0.20
40	0.6	31.178	0.73	4.47	0.24
53	0.5	31.316	0.75	5.09	0.26
INTEGRAL		1710.017		254.82	12.07
ERROR		0.117		10.98	0.47

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	9.59	0.70	0.81	0.11	0.092
5	9.59	0.71	0.80	0.09	0.090
10	9.64	0.72	0.77	0.05	0.092
15	9.88	0.65	0.81	0.16	0.089
25	9.35	0.72	0.84	0.12	0.083
40	8.77	0.75	0.82	0.07	0.077
53	9.30	0.79	0.90	0.11	0.084
INTEGRAL	512.40	39.95	45.50	5.55	4.630
ERROR	17.25	1.72	1.95	0.24	0.077

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.71	0.00	0.167	0.029	87.2
5	0.79	0.00	0.127	1.002	50.4
10	0.90	0.00	0.167	1.196	25.4
15	0.67	0.01	0.110	1.667	12.8
25	0.46	0.10	0.150	0.239	3.3
40	0.46	0.12	0.087	0.004	0.4
53	0.21	0.20	0.127	0.000	0.1
INTEGRAL	29.40	4.59	6.845	26.620	
ERROR	1.94	0.42	0.114	3.008	

ZOOPLANKTON DRY WT 18.8 MG/M3
EXTINCTION COEFF 0.137 /M
INCIDENT RADIATION 36.11 Cal $cm^{-2}hr^{-1}$

DATE 17/ 4/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	2.1	30.943	0.73	4.03	0.13
5	2.0	30.958	0.74	4.36	0.24
10	2.0	30.976	0.74	4.43	0.18
15	1.0	31.335	0.74	5.24	0.24
25	0.7	31.552	0.74	4.96	0.26
40	0.7	31.532	0.74	5.28	0.18
53	0.8	31.574	0.74	5.03	0.43
INTEGRAL		1726.225		272.25	13.40
ERROR		0.118		11.90	0.52

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	9.76	0.66	0.76	0.10	0.105
5	10.05	0.63	0.59	0.00	0.110
10	9.82	0.67	0.55	0.00	0.090
15	9.41	0.77	0.97	0.20	0.087
25	9.01	0.82	0.84	0.02	0.099
40	8.95	0.83	0.96	0.13	0.088
53	9.18	0.79	0.92	0.13	0.140
INTEGRAL	510.05	42.55	46.67	4.92	5.522
ERROR	17.15	1.88	2.09	0.27	0.093

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.90	0.00	0.210	0.637	87.5
5	0.85	0.00	0.210	1.341	51.4
10	0.85	0.00	0.196	1.066	26.4
15	0.46	0.10	0.144	0.572	13.6
25	0.38	0.18	0.222	0.157	3.6
40	0.33	0.23	0.138	0.089	0.5
53	0.42	0.20	0.138	0.000	0.1
INTEGRAL	27.06	7.92	9.515	21.203	
ERROR	1.68	0.71	0.163	1.999	

ZOOPLANKTON DRY WT 32.8 MG/M3
EXTINCTION COEFF 0.133 /M
INCIDENT RADIATION 39.03 Cal $cm^{-2}hr^{-1}$

DATE 19/ 4/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	1.8	30.808	0.72	3.77	0.22
5	1.8	30.809	0.73	3.74	0.18
10	1.8	31.108	0.75	5.04	0.26
15	1.5	31.171	0.74	5.21	0.20
25	1.3	31.229	0.73	3.06	0.44
40	0.5	31.382	0.73	5.34	0.33
53	0.5	31.373	0.74	5.40	0.04
INTEGRAL		1716.777		251.25	15.00
ERROR		0.117		11.01	0.70

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	9.82	0.54	0.77	0.23	0.129
5	9.30	0.68	0.82	0.14	0.129
10	9.01	0.58	0.84	0.26	0.115
15	9.01	0.68	0.87	0.19	0.112
25	8.95	0.75	0.92	0.17	0.100
40	8.95	0.76	0.96	0.20	0.087
53	9.70	0.73	0.99	0.26	0.135
INTEGRAL	502.55	39.00	50.07	11.07	5.950
ERROR	17.01	1.72	2.18	0.47	0.097

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.94	0.00	0.376	1.800	85.0
5	1.06	0.00	0.115	1.323	44.3
10	1.15	0.00	0.242	1.309	19.6
15	1.02	0.00	0.179	1.067	8.7
25	0.81	0.09	0.141	0.251	1.7
40	0.54	0.17	0.159	0.019	0.1
53	0.56	0.09	0.180	0.000	0.0
INTEGRAL	43.58	4.47	9.565	29.089	
ERROR	2.83	0.47	0.155	2.689	

ZOOPLANKTON DRY WT -
EXTINCTION COEFF 0.163 /M
INCIDENT RADIATION 25.22 Cal $cm^{-2}hr^{-1}$

DATE 21/ 4/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	2.0	30.947	0.74	2.91	0.11
5	2.0	30.910	0.74	3.50	0.20
10	2.0	30.887	0.74	2.66	0.43
15	2.0	30.947	0.74	3.60	0.40
25	1.7	31.353	0.73	3.52	0.30
40	0.7	31.539	0.73	4.09	0.26
53	0.8	31.572	0.72	4.74	0.46
INTEGRAL		1720.242		205.97	17.52
ERROR		0.118		9.07	0.67

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	8.95	0.59	0.84	0.25	0.162
5	8.95	0.49	0.84	0.35	0.185
10	8.66	0.58	0.71	0.13	0.241
15	8.83	0.56	0.75	0.19	0.186
25	8.72	0.47	0.92	0.45	0.151
40	8.42	0.67	0.93	0.26	0.105
53	9.53	0.76	1.04	0.28	0.137
INTEGRAL	483.42	32.65	48.72	16.07	8.420
ERROR	16.34	1.42	2.13	0.76	0.136

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	2.02	0.00	0.208	4.097	79.1
5	2.21	0.00	0.173	4.207	30.9
10	2.17	0.00	0.188	2.959	9.5
15	2.46	0.00	0.288	1.737	2.9
25	1.23	0.00	0.370	0.086	0.3
40	0.98	0.00	0.196	0.071	0.0
53	0.71	0.00	0.231	0.000	0.0
INTEGRAL	80.81	0.00	13.782	61.253	
ERROR	5.27	0.00	0.252	6.127	

ZOOPLANKTON DRY WT 25.9 MG/M3
EXTINCTION COEFF 0.235 /M
INCIDENT RADIATION 14.60 Cal $cm^{-2}hr^{-1}$

DATE 24/ 4/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	2.0	30.674	0.74	0.96	0.13
5	2.0	30.741	0.76	0.99	0.22
10	1.8	30.953	0.75	0.84	0.11
15	1.3	31.006	0.76	1.19	0.20
25	0.8	31.273	0.73	3.60	0.22
40	0.6	31.392	0.72	4.71	0.61
53	0.7	31.531	0.73	5.01	0.54
INTEGRAL		1715.975		173.70	19.42
ERROR		0.117		9.25	0.95

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	7.67	0.50	0.60	0.10	0.253
5	7.20	0.45	0.61	0.16	0.250
10	6.62	0.46	0.62	0.16	0.285
15	6.10	0.44	0.62	0.18	0.252
25	8.08	0.59	0.86	0.27	0.132
40	8.42	0.65	0.87	0.22	0.107
53	9.99	0.86	1.01	0.15	0.273
INTEGRAL	436.25	32.67	43.67	11.00	10.500
ERROR	15.31	1.46	1.96	0.52	0.165

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	5.32	0.00	0.593	11.993	64.2
5	6.17	0.00	0.271	13.624	10.9
10	8.22	0.00	0.300	7.804	1.2
15	6.57	0.00	0.173	2.454	0.1
25	2.46	0.00	0.187	0.144	0.0
40	1.23	0.02	0.173	0.011	0.0
53	0.90	0.40	0.292	0.000	0.0
INTEGRAL	190.44	3.34	12.757	157.497	
ERROR	12.97	0.48	0.200	17.209	

ZOOPLANKTON DRY WT 22.0 MG/M3
EXTINCTION COEFF 0.443 /M
INCIDENT RADIATION 24.95 Cal $cm^{-2}hr^{-1}$

DATE 27/ 4/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	2.4	29.640	0.82	0.13	0.15
5	2.0	30.754	0.80	0.10	0.33
10	1.7	30.981	0.81	0.24	0.11
15	1.3	31.048	0.77	1.10	0.13
25	0.7	31.336	0.76	2.94	0.78
40	0.7	31.388	0.74	2.92	0.43
53	0.6	31.436	0.72	4.08	0.43
INTEGRAL		1713.925		121.42	22.97
ERROR		0.117		6.54	1.11

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	6.39	0.19	0.41	0.22	0.276
5	3.48	0.24	0.62	0.38	0.322
10	3.31	0.32	0.49	0.17	0.317
15	5.77	0.38	0.61	0.23	0.276
25	5.46	0.54	0.85	0.31	0.183
40	6.39	0.59	0.85	0.26	0.168
53	8.89	0.73	0.93	0.20	0.146
INTEGRAL	323.97	27.20	41.50	14.30	11.857
ERROR	11.59	1.29	1.90	0.63	0.190

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	4.94	0.00	0.372	9.425	48.0
5	9.03	0.00	0.239	15.315	2.6
10	10.28	0.00	0.268	8.889	0.1
15	11.09	0.00	0.263	2.847	0.0
25	5.73	0.00	0.260	0.144	0.0
40	4.53	0.00	0.245	0.000	0.0
53	1.44	0.05	0.219	0.000	0.0
INTEGRAL	342.46	0.34	14.005	167.736	
ERROR	23.53	0.06	0.236	18.818	

ZOOPLANKTON DRY WT 56.4 MG/M3
EXTINCTION COEFF 0.733 /M
INCIDENT RADIATION 28.41 Cal $cm^{-2}hr^{-1}$

DATE .1/ 5/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	1.8	30.628	0.75	0.20	0.26
5	1.4	30.781	0.75	0.29	0.67
10	1.2	30.979	0.75	1.19	0.24
15	1.0	31.076	0.76	1.27	0.65
25	1.0	31.137	0.76	1.24	0.20
40	0.5	31.299	0.74	2.82	0.43
53	0.4	31.389	0.74	4.03	0.57
INTEGRAL		1712.555		105.45	23.30
ERROR		0.117		5.54	0.91

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	3.20	0.29	0.52	0.23	0.285
5	3.20	0.34	0.60	0.26	0.282
10	4.07	0.38	0.52	0.14	0.256
15	3.08	0.41	0.57	0.16	0.244
25	3.54	0.42	0.66	0.24	0.256
40	5.29	0.59	0.74	0.15	0.208
53	8.31	0.74	0.92	0.18	0.208
INTEGRAL	253.37	27.05	37.42	10.37	13.112
ERROR	9.26	1.24	1.66	0.45	0.219

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	3.71	0.00	0.271	6.245	56.6
5	5.32	0.00	0.295	10.293	5.8
10	4.53	0.00	0.254	6.144	0.3
15	5.32	0.00	0.265	1.790	0.0
25	5.32	0.00	0.202	0.182	0.0
40	4.53	0.00	0.303	0.015	0.0
53	2.88	0.00	0.340	0.000	0.0
INTEGRAL	254.31	0.00	15.030	113.726	
ERROR	17.81	0.00	0.258	12.683	

ZOOPLANKTON DRY WT 19.8 MG/M3
EXTINCTION COEFF 0.569 /M
INCIDENT RADIATION 34.80 Cal $cm^{-2}hr^{-1}$

DATE 4/ 5/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	3.7	28.912	0.78	0.13	0.74
5	2.0	30.942	0.76	0.12	0.22
10	1.4	31.030	0.77	0.20	0.15
15	1.1	31.095	0.77	0.74	0.13
25	1.0	31.046	0.76	1.76	0.70
40	1.0	32.074	0.76	1.69	0.30
53	0.7	32.133	0.75	2.07	0.28
INTEGRAL		1725.535		70.35	20.02
ERROR		0.118		3.74	0.93

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	7.03	0.26	0.34	0.08	0.164
5	6.39	0.29	0.34	0.05	0.161
10	2.44	0.38	0.48	0.10	0.256
15	2.67	0.42	0.63	0.21	0.253
25	2.85	0.43	0.54	0.11	0.173
40	3.14	0.38	0.64	0.26	0.180
53	4.88	0.63	0.85	0.22	0.201
INTEGRAL	201.07	22.95	32.40	9.45	10.762
ERROR	6.55	1.00	1.45	0.48	0.180

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.88	0.13	0.245	3.168	72.5
5	0.58	0.19	0.110	1.830	20.0
10	1.98	0.00	0.245	2.277	4.0
15	5.32	0.00	0.222	3.414	0.8
25	2.46	0.24	0.178	0.229	0.0
40	1.81	0.23	0.254	0.033	0.0
53	1.73	0.12	0.208	0.000	0.0
INTEGRAL	125.85	8.63	11.647	57.425	
ERROR	9.54	0.76	0.207	6.132	

ZOOPLANKTON DRY WT 50.7 MG/M3
EXTINCTION COEFF 0.322 /M
INCIDENT RADIATION -

DATE 11/ 5/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	5.0	30.267	0.71	0.24	0.33
5	3.5	30.586	0.73	0.34	0.40
10	2.7	30.795	0.74	0.46	0.43
15	2.3	31.010	0.73	0.42	0.48
25	1.8	31.097	0.75	1.14	0.56
40	1.2	31.315	0.75	1.70	0.56
53	1.3	31.358	0.74	2.32	0.78
INTEGRAL		1708.770		64.90	29.82
ERROR		0.117		3.43	1.19

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	3.08	0.28	0.46	0.18	0.157
5	2.38	0.35	0.48	0.13	0.232
10	2.61	0.30	0.54	0.24	0.185
15	2.21	0.34	0.60	0.26	0.159
25	2.03	0.39	0.51	0.12	0.116
40	3.14	0.52	0.80	0.28	0.162
53	4.65	0.55	0.82	0.27	0.137
INTEGRAL	156.57	23.30	35.27	11.97	8.577
ERROR	5.50	1.07	1.60	0.55	0.143

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.33	0.00	-	1.133	85.1
5	0.75	0.00	-	1.838	44.7
10	0.92	0.00	-	1.157	20.0
15	0.50	0.00	-	0.529	8.9
25	0.88	0.00	-	0.220	1.8
40	0.79	0.20	-	0.000	0.2
53	0.75	0.49	-	0.000	0.0
INTEGRAL	41.39	6.63		24.533	
ERROR	2.96	0.75		2.444	

ZOOPLANKTON DRY WT 46.8 MG/M3
EXTINCTION COEFF 0.161 /M
INCIDENT RADIATION -

DATE 15/ 5/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	3.8	30.888	0.72	0.28	0.72
5	3.5	30.607	0.73	0.45	1.22
10	2.1	31.148	0.73	0.58	0.46
15	1.7	31.295	0.74	0.76	0.07
25	1.5	31.263	0.73	0.97	0.50
40	1.3	31.359	0.73	1.40	0.67
53	1.3	31.381	0.74	2.27	0.54
INTEGRAL		1717.237		61.70	31.07
ERROR		0.117		3.04	1.28

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	2.50	0.45	0.59	0.14	0.094
5	2.50	0.57	0.52	0.00	0.129
10	1.98	0.41	0.49	0.08	0.128
15	1.98	0.43	0.52	0.09	0.092
25	2.38	0.43	0.57	0.14	0.088
40	4.13	0.61	0.78	0.17	0.139
53	3.14	0.57	0.80	0.23	0.170
INTEGRAL	158.75	28.05	35.25	7.45	6.670
ERROR	6.09	1.24	1.59	0.36	0.117

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.13	0.14	0.366	0.644	89.5
5	0.21	0.28	0.283	0.863	57.4
10	0.50	0.00	0.327	0.411	33.0
15	0.33	0.13	0.201	0.192	18.9
25	0.29	0.23	0.179	0.011	6.2
40	0.29	0.11	0.245	0.000	1.2
53	0.17	0.01	0.206	0.000	0.3
INTEGRAL	15.64	7.37	12.930	9.558	
ERROR	1.11	0.60	0.214	1.049	

ZOOPLANKTON DRY WT 36.0 MG/M3
EXTINCTION COEFF 0.111 /M
INCIDENT RADIATION –

DATE 18/ 5/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	4.1	30.707	0.71	0.69	0.30
5	2.0	30.774	0.75	0.50	0.52
10	1.6	30.996	0.75	1.06	0.39
15	1.2	31.096	0.74	0.89	0.15
25	1.2	31.155	0.73	0.48	0.70
40	1.3	31.314	0.72	1.74	0.52
53	1.3	31.402	0.73	2.80	0.59
INTEGRAL		1713.500		69.30	27.40
ERROR		0.117		3.52	1.17

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	2.67	0.45	0.61	0.16	0.109
5	2.38	0.44	0.54	0.10	0.106
10	2.67	0.48	0.56	0.08	0.141
15	1.57	0.44	0.67	0.23	0.136
25	3.31	0.53	0.79	0.26	0.110
40	5.52	0.64	0.90	0.26	0.128
53	1.63	0.52	0.75	0.23	0.198
INTEGRAL	180.10	29.15	41.05	11.90	7.307
ERROR	7.68	1.32	1.88	0.57	0.124

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.17	0.14	0.267	0.720	89.4
5	0.17	0.18	0.201	0.377	57.1
10	0.42	0.16	0.270	0.659	32.6
15	0.33	0.36	0.206	0.369	18.6
25	0.42	0.40	0.234	0.038	6.1
40	0.21	0.47	0.071	0.002	1.1
53	0.25	0.47	0.215	0.000	0.3
INTEGRAL	16.06	20.24	10.170	10.243	
ERROR	1.15	1.56	0.169	1.010	

ZOOPLANKTON DRY WT 28.0 MG/M3
EXTINCTION COEFF 0.112 /M
INCIDENT RADIATION -

DATE 23/ 5/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	5.7	29.998	0.66	0.53	0.18
5	4.7	30.327	0.68	0.60	0.33
10	1.6	31.048	0.69	1.37	0.70
15	1.3	31.338	0.69	1.48	0.89
25	1.3	31.499	0.69	1.33	0.50
40	1.2	31.716	0.68	1.93	0.74
53	1.2	31.738	0.66	2.18	0.63
INTEGRAL		1724.417		84.20	34.35
ERROR		0.118		3.95	1.41

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	3.60	0.36	0.56	0.20	0.125
5	2.96	0.39	0.59	0.20	0.132
10	2.96	0.46	0.68	0.22	0.105
15	3.25	0.54	0.68	0.14	0.121
25	3.42	0.51	0.65	0.14	0.101
40	3.14	0.55	0.73	0.18	0.120
53	3.54	0.55	0.73	0.18	0.136
INTEGRAL	179.37	27.95	37.40	9.45	6.487
ERROR	6.13	1.23	1.63	0.40	0.110

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.67	0.00	0.201	2.292	90.1
5	0.54	0.04	0.168	0.858	59.5
10	0.17	0.41	0.217	0.266	35.3
15	0.17	0.37	0.140	0.090	21.0
25	0.13	0.39	0.206	0.026	7.4
40	0.17	0.41	0.140	0.027	1.6
53	0.17	0.51	0.193	0.000	0.4
INTEGRAL	11.78	19.95	9.600	12.743	
ERROR	0.76	1.51	0.162	1.466	

ZOOPLANKTON DRY WT 25.3 MG/M3
EXTINCTION COEFF 0.104 /M
INCIDENT RADIATION -

DATE 25/ 5/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	5.5	28.743	0.69	0.40	0.05
5	4.0	30.006	0.69	0.59	0.07
10	1.5	31.419	0.70	1.63	0.74
15	1.3	31.560	0.69	1.06	0.50
25	1.3	31.708	0.68	1.27	0.52
40	1.3	32.018	0.66	2.44	0.95
53	1.3	32.064	0.68	2.86	0.74
INTEGRAL		1732.782		93.97	34.22
ERROR		0.119		4.68	1.57

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	6.39	0.32	0.60	0.28	0.115
5	3.72	0.34	0.51	0.17	0.142
10	3.83	0.53	0.73	0.20	0.109
15	3.37	0.45	0.63	0.18	0.101
25	2.90	0.48	0.65	0.17	0.084
40	3.54	0.61	0.76	0.15	0.154
53	4.07	0.61	0.86	0.25	0.048
INTEGRAL	198.87	28.25	38.40	10.15	6.020
ERROR	6.53	1.28	1.68	0.41	0.113

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.67	0.22	0.220	2.713	89.9
5	0.67	0.15	0.503	1.640	58.6
10	0.19	0.36	0.173	0.192	34.3
15	0.13	0.24	0.193	0.119	20.1
25	0.17	0.14	0.352	0.196	6.9
40	0.21	0.28	0.231	0.059	1.4
53	0.21	0.22	0.248	0.000	0.3
INTEGRAL	13.66	12.45	15.102	20.173	
ERROR	0.91	0.88	0.266	2.207	

ZOOPLANKTON DRY WT 23.7 MG/M3
EXTINCTION COEFF 0.107 /M
INCIDENT RADIATION -

DATE 29/ 5/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	4.1	30.561	0.68	0.69	0.18
5	3.8	30.554	0.69	0.66	0.30
10	3.7	30.564	0.67	0.81	0.30
15	2.4	31.091	0.68	0.96	0.28
25	1.4	31.657	0.67	1.38	0.30
40	1.2	31.761	0.66	1.42	0.89
53	1.2	31.908	0.65	2.62	0.65
INTEGRAL		1726.612		74.47	27.52
ERROR		0.118		3.49	1.35

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	3.12	0.56	0.62	0.06	0.127
5	3.89	0.41	0.74	0.33	0.136
10	3.43	0.46	0.70	0.24	0.140
15	3.19	0.45	0.74	0.29	0.105
25	2.90	0.65	0.85	0.20	0.092
40	3.83	0.63	0.90	0.27	0.107
53	5.52	0.76	1.10	0.34	0.216
INTEGRAL	203.42	32.40	46.67	14.27	6.860
ERROR	6.99	1.45	2.06	0.62	0.115

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.58	0.27	0.198	2.450	89.7
5	0.54	0.40	0.234	1.712	58.0
10	0.60	0.64	0.305	1.001	33.6
15	0.46	0.45	0.215	0.513	19.5
25	0.06	0.76	0.204	0.022	6.6
40	0.13	0.18	0.182	0.012	1.3
53	0.23	0.62	0.217	0.000	0.3
INTEGRAL	15.01	26.21	11.710	23.991	
ERROR	0.98	1.93	0.192	2.456	

ZOOPLANKTON DRY WT 8.9 MG/M3
EXTINCTION COEFF 0.109 /M
INCIDENT RADIATION -

DATE 1/ 6/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	5.0	30.521	0.69	0.60	0.13
5	4.3	30.761	0.66	0.65	0.15
10	3.9	30.909	0.66	0.87	0.33
15	3.0	31.154	0.66	0.98	0.35
25	2.5	31.468	0.66	1.88	0.20
40	1.4	31.762	0.66	1.88	0.33
53	1.4	31.996	0.62	2.68	1.37
INTEGRAL		1728.057		88.25	23.07
ERROR		0.118		4.29	1.09

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	4.13	0.49	0.72	0.23	0.140
5	5.52	0.45	0.68	0.23	0.186
10	3.66	0.43	0.56	0.13	0.140
15	2.73	0.56	0.79	0.23	0.099
25	2.61	0.51	0.66	0.15	0.094
40	2.61	0.62	0.81	0.19	0.099
53	5.52	0.79	1.01	0.22	0.127
INTEGRAL	189.87	31.42	41.90	10.48	6.335
ERROR	6.16	1.38	1.82	0.44	0.102

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.75	0.31	0.261	3.261	88.9
5	1.00	0.30	0.297	5.648	55.4
10	0.73	0.26	0.245	1.170	30.7
15	0.60	0.25	0.275	0.930	17.0
25	0.17	0.18	0.176	0.034	5.2
40	0.08	0.23	0.149	0.047	0.9
53	0.21	0.53	0.374	0.000	0.2
INTEGRAL	9.97	15.06	12.665	50.341	
ERROR	1.35	1.02	0.204	6.157	

ZOOPLANKTON DRY WT 41.4 MG/M3
EXTINCTION COEFF 0.118 /M
INCIDENT RADIATION -

DATE 5/ 6/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	7.0	30.619	0.69	0.11	0.13
5	6.0	30.691	0.68	0.05	0.13
10	5.3	30.756	0.67	0.18	0.28
15	4.5	31.292	0.67	0.35	0.07
25	3.7	31.343	0.62	0.62	0.28
40	1.6	31.675	0.62	1.86	0.93
53	1.5	31.822	0.61	1.81	1.04
INTEGRAL		1724.050		53.27	28.15
ERROR		0.118		3.21	1.48

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	2.73	0.32	0.51	0.19	0.134
5	2.91	0.32	0.51	0.19	0.150
10	3.02	0.36	0.53	0.17	0.152
15	2.56	0.37	0.60	0.23	0.182
25	2.03	0.46	0.63	0.17	0.097
40	3.60	0.62	0.80	0.18	0.103
53	4.13	0.66	0.81	0.15	0.118
INTEGRAL	166.02	26.97	36.92	9.95	6.852
ERROR	5.86	1.26	1.67	0.42	0.111

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.38	0.28	0.237	3.369	86.2
5	0.71	0.24	0.248	1.944	47.5
10	0.79	0.39	0.336	0.712	22.5
15	1.65	0.67	0.399	1.807	10.7
25	0.88	0.00	0.498	0.108	2.4
40	0.17	0.45	0.201	0.000	0.3
53	0.21	0.31	0.481	0.000	0.0
INTEGRAL	35.82	17.98	19.352	36.604	
ERROR	2.82	1.45	0.345	3.813	

ZOOPLANKTON DRY WT 69.3 MG/M3
EXTINCTION COEFF 0.149 /M
INCIDENT RADIATION 26.90 Cal $cm^{-2}hr^{-1}$

DATE 8/ 6/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	8.7	30.524	0.65	0.06	0.09
5	8.0	30.657	0.66	0.07	0.59
10	6.0	30.874	0.69	0.06	0.18
15	4.5	31.214	0.70	0.41	0.07
25	3.3	31.252	0.70	0.46	0.18
40	1.8	31.556	0.65	1.28	1.26
53	1.3	31.881	0.56	2.95	1.00
INTEGRAL		1721.167		50.95	33.25
ERROR		0.118		3.00	1.86

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	3.43	0.21	0.45	0.24	0.169
5	2.79	0.23	0.48	0.25	0.169
10	2.44	0.26	0.51	0.25	0.182
15	1.68	0.29	0.56	0.27	0.151
25	1.74	0.36	0.59	0.23	0.262
40	3.72	0.59	0.79	0.20	0.136
53	3.72	0.65	0.94	0.29	0.251
INTEGRAL	152.77	23.37	36.55	13.17	10.507
ERROR	5.62	1.14	1.66	0.54	0.185

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.75	0.10	0.336	2.787	82.5
5	0.54	0.19	0.267	2.541	38.3
10	0.71	0.20	0.209	3.229	14.7
15	2.44	0.00	0.448	1.013	5.6
25	2.06	0.06	0.396	0.908	0.8
40	0.29	0.17	0.341	0.454	0.0
53	0.21	0.45	0.415	0.000	0.0
INTEGRAL	58.18	8.98	19.757	61.566	
ERROR	5.17	0.73	0.347	5.304	

ZOOPLANKTON DRY WT 44.7 MG/M3
EXTINCTION COEFF 0.192 /M
INCIDENT RADIATION 17.29 Cal $cm^{-2}hr^{-1}$

DATE 12/ 6/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	10.1	30.306	0.61	0.02	0.22
5	8.5	30.630	0.66	0.03	0.09
10	4.5	31.073	0.68	0.04	0.18
15	3.7	31.148	0.69	0.12	0.22
25	3.2	31.267	0.64	0.67	0.33
40	2.4	31.589	0.64	1.72	0.96
53	2.1	31.722	0.63	2.64	1.17
INTEGRAL		1720.477		55.27	30.85
ERROR		0.118		3.36	1.57

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	2.79	0.23	0.44	0.21	0.173
5	2.38	0.25	0.47	0.22	0.129
10	1.80	0.29	0.47	0.18	0.115
15	2.15	0.35	0.54	0.19	0.116
25	1.92	0.42	0.58	0.16	0.092
40	4.36	0.64	0.76	0.12	0.132
53	6.51	0.73	0.93	0.20	0.059
INTEGRAL	182.22	26.22	35.47	9.25	6.095
ERROR	7.05	1.27	1.61	0.37	0.107

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.42	0.20	0.289	4.132	88.1
5	0.46	0.05	0.270	1.959	53.0
10	0.42	0.32	0.270	1.402	28.1
15	1.00	0.08	0.399	0.845	14.9
25	0.50	0.27	0.311	0.713	4.2
40	0.25	0.23	0.316	1.128	0.6
53	0.17	0.39	0.236	0.000	0.1
INTEGRAL	24.19	12.82	16.812	59.312	
ERROR	1.77	0.96	0.293	5.130	

ZOOPLANKTON DRY WT 65.9 MG/M3

EXTINCTION COEFF 0.127 /M

INCIDENT RADIATION 3.84 Cal $cm^{-2}hr^{-1}$

DATE 15/ 6/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	11.5	29.923	0.61	0.14	0.46
5	7.5	30.608	0.66	0.06	0.20
10	4.7	31.173	0.70	0.18	0.11
15	4.4	31.239	0.72	0.46	0.09
25	3.2	31.340	0.67	1.10	0.59
40	2.4	31.591	0.64	1.60	1.17
53	2.0	31.743	0.62	2.83	1.30
INTEGRAL		1721.692		63.97	38.05
ERROR		0.118		3.50	1.93

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	3.49	0.24	0.43	0.19	0.207
5	2.67	0.25	0.45	0.20	0.173
10	1.86	0.35	0.53	0.18	0.138
15	1.51	0.40	0.58	0.18	0.148
25	2.32	0.42	0.47	0.05	0.091
40	4.42	0.62	0.78	0.16	0.125
53	6.39	0.76	0.90	0.14	0.205
INTEGRAL	185.92	26.85	34.65	7.80	7.732
ERROR	7.16	1.27	1.58	0.33	0.126

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.46	0.09	0.229	5.139	89.4
5	0.21	0.22	0.193	1.596	57.1
10	0.33	0.09	0.234	0.678	32.6
15	0.50	0.20	0.222	0.623	18.6
25	0.21	0.24	0.168	1.016	6.1
40	0.25	0.06	0.205	0.005	1.1
53	0.29	0.13	0.212	0.000	0.3
INTEGRAL	16.16	8.08	11.137	41.671	
ERROR	1.07	0.60	0.187	4.115	

ZOOPLANKTON DRY WT 40.3 MG/M3
EXTINCTION COEFF 0.112 /M
INCIDENT RADIATION 5.76 Cal $cm^{-2}hr^{-1}$

DATE 18/ 6/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	9.5	30.226	0.61	0.14	0.13
5	7.3	30.894	0.67	0.07	0.26
10	6.4	31.003	0.70	0.17	0.13
15	4.7	31.194	0.71	0.22	0.24
25	3.2	31.298	0.67	0.84	0.07
40	2.4	31.631	0.65	1.04	0.93
53	2.1	31.804	0.60	2.71	1.65
INTEGRAL		1723.225		49.63	31.27
ERROR		0.118		2.78	1.69

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	2.91	0.26	0.45	0.19	0.164
5	2.09	0.28	0.48	0.20	0.173
10	1.51	0.30	0.52	0.22	0.158
15	1.45	0.41	0.48	0.07	0.185
25	2.67	0.45	0.59	0.14	0.100
40	3.78	0.65	0.77	0.12	0.125
53	8.77	0.89	0.98	0.09	0.257
INTEGRAL	192.00	28.67	36.00	7.32	8.505
ERROR	7.59	1.36	1.64	0.31	0.140

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.63	0.15	0.293	2.106	88.7
5	0.33	0.46	0.417	1.104	54.9
10	0.75	0.20	0.576	0.622	30.1
15	1.25	0.49	0.776	1.214	16.5
25	0.29	0.11	0.427	0.028	5.0
40	0.17	0.22	0.359	0.479	0.8
53	0.29	0.27	0.583	0.000	0.2
INTEGRAL	24.71	14.11	26.612	30.533	
ERROR	1.84	0.97	0.445	2.845	

ZOOPLANKTON DRY WT 45.7 MG/M3
EXTINCTION COEFF 0.120 /M
INCIDENT RADIATION 7.68 Cal cm^{-2} hr^{-1}

DATE 3/ 7/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	13.3	30.449	0.58	0.17	-
5	12.8	30.377	0.58	0.06	-
10	11.3	30.748	0.60	0.13	-
15	9.5	30.950	0.63	0.26	-
25	5.5	31.196	0.68	1.24	-
40	2.3	31.583	0.64	1.68	-
53	1.7	31.536	0.58	2.21	-
INTEGRAL		1714.087		60.60	
ERROR		0.117		3.40	

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	1.68	0.15	0.39	0.24	0.304
5	1.98	0.19	0.39	0.20	0.255
10	1.98	0.26	0.46	0.20	0.219
15	1.98	0.30	0.54	0.24	0.228
25	1.80	0.33	0.59	0.26	0.187
40	3.83	0.56	0.79	0.23	0.167
53	7.26	0.60	1.00	0.40	0.243
INTEGRAL	173.25	21.90	36.00	14.10	11.505
ERROR	6.79	1.08	1.67	0.61	0.185

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	1.00	0.28	0.354	5.495	85.0
5	0.83	0.21	0.342	1.502	44.5
10	0.92	0.01	0.203	2.111	19.8
15	0.96	0.30	0.376	1.310	8.8
25	0.63	0.41	0.307	0.510	1.7
40	0.58	0.09	0.361	1.009	0.2
53	0.92	0.15	0.237	0.000	0.0
INTEGRAL	41.92	11.65	17.460	63.127	
ERROR	2.69	0.96	0.310	5.376	

ZOOPLANKTON DRY WT 91.9 MG/M3
EXTINCTION COEFF 0.162 /M
INCIDENT RADIATION 8.45 Cal $cm^{-2}hr^{-1}$

DATE 10/ 7/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	17.0	29.436	0.53	0.07	-
5	11.5	30.798	0.66	0.05	-
10	5.0	31.202	0.66	0.12	-
15	4.0	31.458	0.64	0.51	-
25	3.2	31.577	0.63	0.78	-
40	2.8	31.694	0.61	2.08	-
53	2.7	31.768	0.60	1.62	-
INTEGRAL		1727.907		57.95	
ERROR		0.118		3.51	

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	2.44	0.19	0.39	0.20	0.216
5	2.27	0.24	0.47	0.23	0.239
10	1.16	0.36	0.55	0.19	0.167
15	2.32	0.45	0.70	0.25	0.151
25	3.72	0.62	0.89	0.27	0.166
40	4.42	0.72	0.98	0.26	0.128
53	5.17	0.88	1.18	0.30	0.280
INTEGRAL	192.22	32.00	46.00	14.00	9.797
ERROR	7.40	1.54	2.14	0.61	0.161

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.88	0.21	0.239	12.401	85.7
5	0.88	0.46	0.290	5.171	46.3
10	0.33	0.24	0.244	1.510	21.4
15	0.67	0.07	0.290	1.618	9.9
25	1.65	0.00	0.327	2.115	2.1
40	0.17	0.14	0.268	1.177	0.2
53	0.25	0.14	0.425	0.000	0.0
INTEGRAL	38.21	7.69	16.737	120.635	
ERROR	3.53	0.57	0.288	10.667	

ZOOPLANKTON DRY WT 71.1 MG/M3
EXTINCTION COEFF 0.154 /M
INCIDENT RADIATION 11.25 Cal $cm^{-2} hr^{-1}$

DATE 17/ 7/67

DEPTH METRES	TEMP. DEG.C	SALINITY O/OO	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	17.0	29.252	0.54	0.03	-
5	11.5	30.670	0.61	0.05	-
10	9.2	30.860	0.61	0.02	-
15	7.3	30.923	0.63	0.00	-
25	3.2	31.376	0.63	0.34	-
40	2.3	31.547	0.61	1.72	-
53	2.2	31.663	0.60	2.89	-
INTEGRAL		1715.580		52.15	
ERROR		0.118		3.40	

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	2.73	0.15	0.39	0.24	0.212
5	2.67	0.28	0.52	0.24	0.170
10	2.09	0.29	0.52	0.23	0.159
15	2.20	0.29	0.42	0.13	0.135
25	2.44	0.48	0.58	0.10	0.130
40	6.04	0.73	0.69	0.00	0.126
53	11.27	1.00	1.15	0.15	0.190
INTEGRAL	252.75	29.85	35.55	6.30	8.127
ERROR	10.40	1.49	1.61	0.26	0.132

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN O/O
1	1.11	0.00	0.315	10.391	87.5
5	0.38	0.24	0.354	1.235	51.4
10	0.50	0.20	0.276	1.071	26.4
15	0.58	0.00	0.242	0.596	13.6
25	0.67	0.34	0.271	0.000	3.6
40	0.38	0.07	0.356	0.078	0.5
53	0.21	0.10	0.261	0.000	0.1
INTEGRAL	27.06	8.21	16.437	43.152	
ERROR	1.90	0.75	0.291	5.524	

ZOOPLANKTON DRY WT 63.8 MG/M3
EXTINCTION COEFF 0.133 /M
INCIDENT RADIATION 15.37 Cal $cm^{-2}hr^{-1}$

DATE 24/ 7/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	20.0	28.630	0.50	0.05	-
5	10.0	30.579	0.61	0.05	-
10	4.8	31.186	0.66	0.09	-
15	3.6	31.305	0.69	0.72	-
25	3.5	31.489	0.67	1.62	-
40	2.5	31.642	0.61	1.98	-
53	2.5	31.681	0.58	2.99	-
INTEGRAL		1721.037		78.60	
ERROR		0.118		4.27	

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	2.79	0.13	0.38	0.25	0.222
5	1.86	0.22	0.55	0.33	0.192
10	2.27	0.38	0.60	0.22	0.189
15	2.73	0.44	0.69	0.25	0.140
25	2.85	0.55	0.85	0.30	0.140
40	5.46	0.76	0.94	0.18	0.123
53	9.41	0.88	1.65	0.77	0.130
INTEGRAL	236.20	31.50	48.97	17.47	8.080
ERROR	9.34	1.54	2.26	0.79	0.130

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	1.08	0.00	0.244	10.657	87.0
5	1.15	0.00	0.411	5.329	49.9
10	0.46	0.24	0.254	1.274	24.9
15	0.25	0.14	0.326	0.397	12.4
25	0.96	0.24	0.428	0.152	3.1
40	0.29	0.10	0.324	0.000	0.4
53	0.21	0.00	0.179	0.000	0.1
INTEGRAL	30.55	6.67	17.932	64.530	
ERROR	2.34	0.59	0.326	7.675	

ZOOPLANKTON DRY WT 54.0 MG/M3
EXTINCTION COEFF 0.139 /M
INCIDENT RADIATION 15.35 Cal $cm^{-2} hr^{-1}$

DATE 31/ 7/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	18.0	29.120	0.53	0.05	-
5	11.0	30.035	0.60	0.06	-
10	4.8	31.080	0.68	0.19	-
15	3.7	31.201	0.66	0.61	-
25	2.6	31.355	0.66	1.80	-
40	2.3	31.444	0.60	2.16	-
53	2.4	31.372	0.59	3.12	-
INTEGRAL		1711.270		84.25	
ERROR		0.117		4.61	

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	3.08	0.18	0.50	0.32	0.209
5	2.85	0.26	0.50	0.24	0.198
10	2.50	0.41	0.71	0.30	0.143
15	3.25	0.54	0.77	0.23	0.133
25	5.05	0.64	0.71	0.07	0.091
40	8.48	0.68	1.04	0.36	0.239
53	10.52	0.93	1.31	0.38	0.150
INTEGRAL	328.05	33.02	47.37	14.35	9.072
ERROR	13.24	1.55	2.17	0.67	0.171

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	1.11	0.17	0.273	8.961	87.5
5	0.92	0.05	0.288	5.083	51.2
10	0.38	0.36	0.295	0.633	26.2
15	0.71	0.58	0.283	0.508	13.4
25	0.46	0.26	0.372	0.081	3.5
40	0.38	0.26	0.341	0.013	0.5
53	0.31	0.00	0.225	0.000	0.1
INTEGRAL	28.26	14.00	17.172	56.005	
ERROR	1.83	1.11	0.309	6.851	

ZOOPLANKTON DRY WT 59.8 MG/M3
EXTINCTION COEFF 0.134 /M
INCIDENT RADIATION 8.44 Cal $cm^{-2}hr^{-1}$

DATE 7/ 8/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	17.0	29.028	0.54	0.30	-
5	10.0	31.010	0.66	0.35	-
10	5.6	31.238	0.71	0.80	-
15	4.8	31.338	0.71	0.70	-
25	2.6	31.475	0.63	2.20	-
40	2.3	31.615	0.59	2.64	-
53	2.3	31.676	0.59	3.24	-
INTEGRAL		1724.077		103.15	
ERROR		0.118		5.44	

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	2.61	0.16	0.42	0.26	0.236
5	2.67	0.44	0.75	0.31	0.157
10	2.44	0.35	0.51	0.16	0.175
15	3.08	0.44	0.54	0.10	0.149
25	5.87	0.69	0.84	0.15	0.111
40	10.17	0.94	1.10	0.16	0.107
53	12.26	0.99	1.18	0.19	0.170
INTEGRAL	373.05	37.80	47.25	9.45	7.635
ERROR	15.60	1.86	2.23	0.39	0.121

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	1.08	0.00	0.309	8.571	85.7
5	0.58	0.00	0.261	2.332	46.3
10	1.15	0.32	0.370	1.933	21.4
15	1.69	0.53	0.370	0.913	9.9
25	0.42	0.24	0.203	0.149	2.1
40	0.38	0.03	0.307	0.020	0.2
53	0.42	0.00	0.256	0.000	0.0
INTEGRAL	38.01	9.04	15.765	51.759	
ERROR	2.67	0.84	0.268	5.437	

ZOOPLANKTON DRY WT 72.2 MG/M3
EXTINCTION COEFF 0.154 /M
INCIDENT RADIATION -

DATE 14/ 8/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	17.0	28.226	0.52	0.11	-
5	10.5	30.260	0.60	0.08	-
10	6.1	31.161	0.68	0.15	-
15	4.8	31.264	0.68	0.18	-
25	3.1	31.302	0.63	1.04	-
40	2.2	31.485	0.59	2.81	-
53	2.2	31.695	0.58	3.29	-
INTEGRAL		1713.412		82.60	
ERROR		0.118		5.06	

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	3.93	0.14	0.28	0.14	0.269
5	2.73	0.34	0.61	0.27	0.155
10	3.60	0.39	0.56	0.17	0.171
15	3.43	0.44	0.63	0.19	0.158
25	4.76	0.59	0.78	0.19	0.136
40	9.18	0.80	1.01	0.21	0.098
53	12.90	0.97	1.12	0.15	0.168
INTEGRAL	361.15	33.95	44.57	10.62	7.917
ERROR	14.56	1.64	2.09	0.46	0.125

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.92	0.01	0.295	5.693	86.8
5	0.67	0.15	0.354	1.703	49.2
10	0.58	0.33	0.309	0.442	24.2
15	0.75	0.84	0.314	0.135	11.9
25	0.79	0.39	0.246	0.053	2.9
40	0.42	0.14	0.213	0.000	0.3
53	0.25	0.14	0.349	0.000	0.1
INTEGRAL	32.22	16.69	15.295	26.632	
ERROR	2.25	1.36	0.247	3.355	

ZOOPLANKTON DRY WT 64.3 MG/M3
EXTINCTION COEFF 0.142 /M
INCIDENT RADIATION 6.91 Cal $cm^{-2}hr^{-1}$

DATE 21/ 8/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	16.5	28.273	0.58	0.14	-
5	6.0	31.248	0.70	0.09	-
10	4.7	31.375	0.68	0.17	-
15	3.7	31.421	0.66	0.51	-
25	2.5	31.625	0.62	2.43	-
40	2.4	31.729	0.61	3.20	-
53	2.5	31.788	0.61	3.08	-
INTEGRAL		1729.112		106.95	
ERROR		0.119		6.14	

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	6.22	0.07	0.20	0.13	0.319
5	3.25	0.37	0.52	0.15	0.153
10	3.72	0.46	0.66	0.20	0.176
15	3.93	0.52	0.67	0.15	0.123
25	9.30	0.82	1.03	0.21	0.079
40	10.75	0.77	1.06	0.29	0.192
53	11.39	0.84	1.11	0.27	0.154
INTEGRAL	442.80	36.32	48.52	12.20	8.387
ERROR	17.62	1.74	2.30	0.57	0.147

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	1.31	0.31	0.324	17.671	88.4
5	0.63	0.17	0.271	2.792	54.1
10	0.58	0.54	0.373	0.914	29.2
15	0.63	0.36	0.309	0.678	15.8
25	0.29	0.27	0.227	0.095	4.6
40	0.17	0.22	0.275	0.144	0.7
53	0.25	0.10	0.314	0.000	0.1
INTEGRAL	22.05	14.37	15.665	71.140	
ERROR	1.38	0.99	0.259	9.379	

ZOOPLANKTON DRY WT 72.3 MG/M3
EXTINCTION COEFF 0.123 /M
INCIDENT RADIATION 28.61 Cal $cm^{-2} hr^{-1}$

DATE 28/ 8/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	15.6	29.360	0.57	0.13	-
5	10.6	30.890	0.69	0.09	-
10	6.0	31.316	0.73	0.23	-
15	4.0	31.397	0.79	0.89	-
25	2.9	31.661	0.75	3.01	-
40	2.8	31.880	0.81	2.77	-
53	2.8	32.046	0.81	3.14	-
INTEGRAL		1734.215		111.32	
ERROR		0.119		6.12	

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	2.67	0.02	0.08	0.06	0.432
5	2.44	0.10	0.11	0.01	0.412
10	4.18	0.40	0.37	0.00	0.180
15	9.12	0.43	0.56	0.13	0.158
25	4.47	0.75	0.67	0.00	0.102
40	9.24	0.72	0.71	0.00	0.098
53	7.49	0.80	0.81	0.01	0.136
INTEGRAL	358.82	31.95	31.90	1.25	8.990
ERROR	14.04	1.60	1.56	0.10	0.141

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	1.19	0.60	0.426	19.438	88.8
5	0.46	0.37	0.299	7.248	55.2
10	0.50	1.03	0.583	1.359	30.4
15	0.63	0.15	0.309	0.521	16.8
25	0.33	0.17	0.346	0.095	5.1
40	0.42	0.20	0.390	0.079	0.9
53	0.25	0.14	0.593	0.000	0.2
INTEGRAL	24.76	15.81	22.415	97.910	
ERROR	1.62	1.11	0.379	12.230	

ZOOPLANKTON DRY WT 75.8 MG/M3
EXTINCTION COEFF 0.119 /M
INCIDENT RADIATION 16.58 Cal $cm^{-2}hr^{-1}$

DATE 5/ 9/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	6.9	31.260	0.62	0.65	-
5	6.9	31.283	0.62	0.73	-
10	5.0	31.343	0.63	1.54	-
15	4.6	31.402	0.62	1.60	-
25	3.0	31.739	0.59	2.74	-
40	2.9	31.890	0.63	3.11	-
53	2.9	32.097	0.58	3.83	-
INTEGRAL		1742.610		134.60	
ERROR		0.119		6.63	

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	4.30	0.41	0.48	0.07	0.200
5	3.37	0.43	0.35	0.00	0.207
10	5.64	0.56	0.64	0.08	0.182
15	6.22	0.62	0.66	0.04	0.174
25	9.30	0.82	0.77	0.00	0.108
40	6.74	0.66	0.71	0.05	0.108
53	9.18	0.82	0.88	0.06	0.194
INTEGRAL	388.65	36.92	37.97	2.08	8.175
ERROR	14.28	1.66	1.70	0.10	0.129

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.21	0.31	0.443	3.422	89.4
5	0.67	0.15	0.380	3.512	57.1
10	0.58	0.35	0.503	1.589	32.6
15	0.42	0.43	0.341	1.355	18.6
25	0.38	0.15	0.443	0.134	6.1
40	0.17	0.14	0.699	0.013	1.1
53	0.25	0.22	0.462	0.000	0.3
INTEGRAL	18.98	12.04	27.567	46.092	
ERROR	1.25	0.80	0.522	4.694	

ZOOPLANKTON DRY WT 59.1 MG/M3
EXTINCTION COEFF 0.112 /M
INCIDENT RADIATION 9.99 Cal $cm^{-2} hr^{-1}$

DATE 11/ 9/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	7.8	30.598	0.62	0.57	-
5	7.7	30.809	0.63	0.63	-
10	6.0	31.520	0.62	1.85	-
15	3.0	31.762	0.63	2.63	-
25	3.0	31.938	0.62	2.55	-
40	2.4	32.019	0.59	2.86	-
53	2.4	31.972	0.57	2.68	-
INTEGRAL		1745.655		128.42	
ERROR		0.120		6.12	

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	4.94	0.44	0.63	0.19	0.156
5	4.59	0.45	0.79	0.34	0.162
10	6.10	0.66	0.62	0.00	0.125
15	7.44	0.63	0.74	0.11	0.106
25	5.87	0.66	0.71	0.05	0.109
40	6.27	0.64	0.90	0.26	0.074
53	6.10	0.83	0.90	0.07	0.143
INTEGRAL	334.77	35.45	43.30	8.05	6.165
ERROR	11.61	1.54	1.91	0.44	0.099

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	1.36	0.00	0.288	8.216	89.7
5	1.73	0.00	0.324	7.567	58.0
10	1.06	0.00	0.135	1.789	33.6
15	0.67	0.30	0.286	0.555	19.5
25	0.29	0.31	0.307	0.000	6.6
40	0.21	0.16	0.300	0.000	1.3
53	0.25	0.18	0.273	0.000	0.3
INTEGRAL	31.02	9.77	15.545	71.482	
ERROR	2.06	0.83	0.275	8.833	

ZOOPLANKTON DRY WT 34.8 MG/M3
EXTINCTION COEFF 0.109 /M
INCIDENT RADIATION 27.88 $Cal \cdot cm^{-2} hr^{-1}$

DATE 18/ 9/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	12.4	30.517	0.61	0.24	0.22
5	10.3	31.059	0.64	0.25	0.33
10	10.8	31.360	0.61	0.19	0.41
15	10.2	31.435	0.62	0.31	0.30
25	9.2	31.509	0.63	0.25	0.63
40	3.0	31.942	0.62	2.87	0.46
53	2.9	32.031	0.60	3.80	0.46
INTEGRAL		1737.375		79.80	24.72
ERROR		0.119		5.18	1.04

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	3.08	0.32	0.49	0.17	0.227
5	2.27	0.33	0.62	0.29	0.285
10	2.27	0.33	0.57	0.24	0.254
15	2.03	0.33	0.56	0.23	0.193
25	2.03	0.33	0.52	0.19	0.235
40	6.97	0.79	0.98	0.19	0.156
53	9.01	0.87	1.04	0.17	0.206
INTEGRAL	243.12	29.07	40.37	11.30	11.532
ERROR	10.34	1.46	1.89	0.47	0.190

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.63	0.09	0.385	5.277	86.3
5	0.90	0.20	0.501	2.576	48.0
10	1.11	0.03	0.411	5.899	23.0
15	1.11	0.25	0.350	1.845	11.0
25	1.48	0.02	0.445	0.343	2.5
40	0.67	0.28	0.365	0.040	0.3
53	0.21	0.39	0.460	0.000	0.0
INTEGRAL	49.94	10.71	22.635	74.292	
ERROR	3.81	0.89	0.382	7.537	

ZOOPLANKTON DRY WT 41.8 MG/M3
EXTINCTION COEFF 0.147 /M
INCIDENT RADIATION 27.78 Cal $cm^{-2}hr^{-1}$

DATE 25/ 9/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	14.6	30.939	0.54	0.33	0.46
5	14.6	30.956	0.54	0.17	0.20
10	14.7	31.069	0.54	0.19	0.76
15	14.5	31.076	0.54	0.48	0.30
25	14.2	31.128	0.54	0.54	0.30
40	10.0	31.151	0.55	0.22	1.11
53	2.5	31.539	0.63	0.59	0.30
INTEGRAL		1713.450		20.70	30.85
ERROR		0.117		0.96	1.61

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	2.50	0.31	0.50	0.19	0.274
5	2.79	0.30	0.61	0.31	0.259
10	2.09	0.28	0.52	0.24	0.334
15	1.86	0.28	0.51	0.23	0.227
25	2.56	0.28	0.56	0.28	0.190
40	2.56	0.30	0.52	0.22	0.142
53	3.66	0.56	0.79	0.23	0.175
INTEGRAL	142.45	17.97	31.45	13.47	11.170
ERROR	4.92	0.77	1.33	0.58	0.178

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	1.23	0.51	0.484	9.346	83.5
5	1.27	0.29	0.522	9.294	40.7
10	1.31	0.04	0.390	4.819	16.5
15	1.23	0.12	0.295	3.403	6.7
25	0.98	0.35	0.322	0.099	1.1
40	0.81	0.19	0.402	0.000	0.1
53	0.38	0.22	0.431	0.000	0.0
INTEGRAL	52.50	12.65	21.270	120.690	
ERROR	3.52	0.93	0.358	12.552	

ZOOPLANKTON DRY WT -
EXTINCTION COEFF 0.180 7M
INCIDENT RADIATION 17.64 Cal $cm^{-2}hr^{-1}$

DATE 2/10/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	14.5	30.837	0.55	0.14	0.18
5	14.6	30.786	0.55	0.18	0.18
10	14.2	30.750	0.53	0.18	0.18
15	10.0	31.323	0.56	1.01	0.20
25	4.5	31.656	0.63	2.76	0.59
40	4.5	32.042	0.56	4.39	0.46
53	3.6	32.176	0.57	4.85	0.35
INTEGRAL		1737.345		146.45	20.65
ERROR		0.119		8.31	0.96

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	2.85	0.28	0.55	0.27	0.168
5	2.85	0.28	0.52	0.24	0.136
10	2.91	C.31	0.52	0.21	0.141
15	4.36	0.54	0.63	0.09	0.132
25	8.25	0.84	1.03	0.19	0.122
40	9.12	0.86	1.07	0.21	0.105
53	9.76	0.91	1.11	0.20	0.150
INTEGRAL	381.75	37.92	48.55	10.63	7.020
ERROR	15.23	1.86	2.30	0.46	0.114

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.88	0.31	0.256	6.017	87.5
5	0.96	0.22	0.336	2.216	51.4
10	1.23	0.10	0.304	1.468	26.4
15	0.63	0.13	0.203	0.928	13.6
25	0.25	0.22	0.310	0.229	3.6
40	0.13	0.16	0.542	0.060	0.5
53	0.17	0.24	0.307	0.000	0.1
INTEGRAL	24.09	10.30	19.670	44.185	
ERROR	1.62	0.71	0.388	4.291	

ZOOPLANKTON DRY WT 24.9 MG/M3
EXTINCTION COEFF 0.133 /M
INCIDENT RADIATION 12.48 Cal $cm^{-2} hr^{-1}$

DATE 10/10/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	11.0	30.417	0.57	0.21	0.78
5	11.0	30.884	0.58	0.09	0.22
10	10.2	31.072	0.59	0.18	0.96
15	9.2	31.300	0.59	1.23	0.40
25	5.4	31.610	0.57	3.92	1.15
40	3.8	32.104	0.56	6.98	0.76
53	3.2	32.127	0.56	7.73	0.24
INTEGRAL		1738.210		222.77	38.42
ERROR		0.119		12.97	1.75

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	3.14	0.35	0.42	0.07	0.195
5	3.31	0.34	0.72	0.38	0.276
10	3.83	0.37	0.51	0.14	0.202
15	4.59	0.46	0.60	0.14	0.188
25	5.69	0.72	1.01	0.29	0.169
40	7.32	0.88	1.10	0.22	0.182
53	7.20	0.93	1.05	0.12	0.172
INTEGRAL	312.90	37.05	48.70	11.65	10.420
ERROR	11.84	1.80	2.31	0.55	0.173

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	2.17	0.09	0.123	4.782	81.1
5	4.55	0.00	0.278	1.622	35.0
10	2.23	0.03	0.218	1.279	12.2
15	1.77	0.18	0.256	0.349	4.3
25	0.75	0.16	0.184	0.086	0.5
40	0.17	0.12	0.186	0.080	0.0
53	0.17	0.28	0.201	0.000	0.0
INTEGRAL	65.74	7.65	11.305	31.352	
ERROR	4.91	0.59	0.189	3.219	

ZOOPLANKTON DRY WT 36.1 MG/M3
EXTINCTION COEFF 0.210 /M
INCIDENT RADIATION -

DATE 16/10/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	9.0	29.799	0.58	0.06	0.06
5	8.9	30.309	0.58	0.18	0.43
10	8.7	30.818	0.57	0.46	0.56
15	8.2	30.856	0.56	1.02	0.93
25	5.6	31.335	0.56	2.92	0.55
40	3.5	31.820	0.56	4.83	0.56
53	1.6	32.230	0.54	8.78	0.76
INTEGRAL		1722.265		185.80	33.05
ERROR		0.118		10.48	1.31

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	4.47	0.32	0.47	0.15	0.262
5	4.07	0.37	0.48	0.11	0.245
10	3.49	0.42	0.51	0.09	0.212
15	4.59	0.45	0.62	0.17	0.186
25	5.28	0.62	0.77	0.15	0.164
40	6.04	0.79	0.92	0.13	0.132
53	8.77	1.05	1.12	0.07	0.204
INTEGRAL	305.77	35.60	42.60	7.00	9.895
ERROR	11.00	1.68	1.97	0.31	0.157

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	2.15	0.00	0.462	8.599	82.1
5	2.40	0.00	0.475	7.559	37.3
10	1.65	0.24	0.464	2.437	13.9
15	1.36	0.07	0.394	0.672	5.2
25	0.88	0.09	0.370	0.120	0.7
40	0.46	0.07	0.342	0.046	0.0
53	0.50	0.10	0.402	0.000	0.0
INTEGRAL	57.35	4.58	21.575	78.707	
ERROR	3.67	0.34	0.353	9.093	

ZOOPLANKTON DRY WT 30.3 MG/M3
EXTINCTION COEFF 0.197 /M
INCIDENT RADIATION -

DATE 23/10/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	11.4	30.432	0.68	0.33	1.02
5	11.4	30.431	0.59	0.29	0.56
10	9.0	31.154	0.56	2.06	0.91
15	7.7	31.719	0.64	3.20	0.85
25	6.1	31.699	0.60	5.11	0.74
40	4.9	31.946	0.58	5.68	0.37
53	3.8	32.050	0.58	5.84	0.41
INTEGRAL		1737.700		229.45	34.15
ERROR		0.119		11.81	1.28

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	4.42	0.35	0.51	0.16	0.157
5	4.13	0.34	0.51	0.17	0.141
10	4.36	0.54	0.66	0.12	0.160
15	4.24	0.56	0.79	0.23	0.133
25	5.46	0.73	0.90	0.17	0.148
40	4.65	0.80	0.87	0.07	0.129
53	7.67	1.05	1.09	0.04	0.208
INTEGRAL	280.82	38.47	45.52	7.05	8.240
ERROR	9.75	1.78	2.04	0.32	0.138

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	0.96	0.00	0.334	5.442	85.6
5	0.83	0.00	0.316	2.715	45.8
10	0.63	0.05	0.376	1.125	21.0
15	0.54	0.06	0.321	0.417	9.6
25	0.29	0.00	0.308	0.015	2.0
40	0.33	0.01	0.316	0.049	0.2
53	0.38	0.03	0.365	0.000	0.0
INTEGRAL	25.23	1.12	18.030	36.855	
ERROR	1.57	0.09	0.303	4.056	

ZOOPLANKTON DRY WT 26.5 MG/M3
EXTINCTION COEFF 0.156 /M
INCIDENT RADIATION –

DATE 30/10/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	10.6	30.280	0.61	0.36	0.54
5	10.5	30.238	0.64	0.36	0.54
10	10.5	30.208	0.70	0.41	0.85
15	10.2	30.352	0.68	0.61	0.52
25	7.0	31.547	0.60	3.90	1.02
40	5.4	31.976	0.60	6.28	0.67
53	4.5	32.054	0.59	6.34	0.48
INTEGRAL		1719.952		199.82	38.60
ERROR		0.118		11.64	1.61

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	5.34	0.35	0.49	0.14	0.248
5	5.29	0.33	0.63	0.30	0.236
10	4.88	0.35	0.58	0.23	0.241
15	5.29	0.35	0.57	0.22	0.222
25	8.83	0.74	0.99	0.25	0.125
40	12.14	0.88	1.33	0.45	0.192
53	13.60	1.01	1.39	0.38	0.244
INTEGRAL	498.35	36.92	54.30	17.37	10.942
ERROR	19.40	1.82	2.64	0.84	0.179

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	4.55	0.00	0.498	15.674	76.6
5	4.94	0.00	0.545	4.756	26.3
10	4.13	0.00	0.425	0.970	6.9
15	4.13	0.00	0.472	0.275	1.8
25	0.50	0.18	0.321	0.100	0.1
40	0.17	0.20	0.397	0.045	0.0
53	0.25	0.22	0.386	0.000	0.0
INTEGRAL	98.32	6.82	22.497	71.802	
ERROR	7.46	0.65	0.371	9.232	

ZOOPLANKTON DRY WT 18.5 MG/M3
EXTINCTION COEFF 0.267 /M
INCIDENT RADIATION -

DATE 6/11/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	11.5	30.696	0.61	0.08	0.43
5	11.2	30.657	0.60	0.09	0.59
10	11.6	30.985	0.64	0.24	0.74
15	11.6	31.149	0.61	0.31	0.67
25	11.1	31.124	0.57	0.31	0.76
40	8.1	31.430	0.58	3.49	0.98
53	5.1	32.110	0.58	7.10	0.37
INTEGRAL		1719.892		113.65	39.72
ERROR		0.118		7.48	1.71

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	3.25	0.29	0.52	0.23	0.302
5	2.90	0.26	0.55	0.29	0.265
10	3.37	0.29	0.52	0.23	0.156
15	2.50	0.23	0.38	0.15	0.140
25	2.90	0.28	0.44	0.16	0.143
40	8.31	0.70	0.93	0.23	0.146
53	12.90	1.03	1.20	0.17	0.248
INTEGRAL	315.87	26.92	37.95	11.02	9.747
ERROR	13.18	1.38	1.82	0.47	0.157

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	2.09	0.12	0.483	13.567	83.4
5	2.36	0.16	0.436	10.176	40.3
10	1.36	0.32	0.337	3.059	16.2
15	1.06	0.30	0.378	1.532	6.5
25	0.83	0.41	0.329	0.267	1.1
40	0.54	0.23	0.329	0.058	0.1
53	0.33	0.19	0.373	0.000	0.0
INTEGRAL	52.81	14.93	19.752	115.790	
ERROR	3.42	1.11	0.325	12.833	

ZOOPLANKTON DRY WT 22.8 MG/M3
EXTINCTION COEFF 0.182 /M
INCIDENT RADIATION 22.32 Cal $cm^{-2}hr^{-1}$

DATE 8/12/67

DEPTH METRES	TEMP. DEG.C	SALINITY 0/00	OXYGEN G-AT/M3	NITRATE MG-AT/M3	AMMONIA MG-AT/M3
1	4.4	30.305	0.65	3.79	0.48
5	4.5	30.443	0.64	3.86	0.52
10	4.6	30.885	0.64	3.36	0.89
15	5.1	30.894	0.64	4.04	0.63
25	5.1	31.218	0.61	5.16	0.76
40	5.1	31.533	0.60	5.73	0.83
53	5.0	31.817	0.57	6.52	0.76
INTEGRAL		1715.955		275.22	40.62
ERROR		0.118		12.49	1.63

DEPTH METRES	SILICATE MG-AT/M3	INORG.PHOS MG-AT/M3	TOTAL PHOS MG-AT/M3	DIS.ORG.PHOS MG-AT/M3	PART.PHOS MG-AT/M3
1	8.13	0.57	0.81	0.24	0.168
5	7.67	0.54	0.76	0.22	0.189
10	7.09	0.56	0.70	0.14	0.131
15	6.39	0.54	0.74	0.20	0.134
25	7.03	0.65	0.88	0.23	0.201
40	8.13	0.69	1.00	0.31	0.113
53	10.34	0.95	1.42	0.47	0.125
INTEGRAL	429.42	36.57	51.52	14.95	8.170
ERROR	14.76	1.60	2.28	0.68	0.142

DEPTH METRES	CHLOROPHYLL MG/M3	PHAEOPHYTIN MG/M3	PART.CARBON GC/M3	PRODUCTION MGC/M3/HR	SURF.RADN 0/0
1	2.11	0.00	0.300	8.982	83.4
5	2.11	0.02	0.360	6.541	40.3
10	0.83	0.10	0.310	0.323	16.2
15	0.71	0.22	0.347	0.054	6.5
25	0.50	0.10	0.355	0.031	1.1
40	0.38	0.13	0.269	0.000	0.1
53	0.33	0.17	0.347	0.000	0.0
INTEGRAL	39.67	6.70	17.777	57.567	
ERROR	2.59	0.50	0.299	7.942	

ZOOPLANKTON DRY WT 19.8 MG/M3
EXTINCTION COEFF 0.182 /M
INCIDENT RADIATION -

APPENDIX II Species list and periods of occurrence of zooplankton organisms in St. Margaret's Bay 1967.

This list was compiled by the Canadian Oceanographic Identification Centre after examination of samples collected at Station A. As emphasised elsewhere, the list refers to only organisms vulnerable to vertical tows made by a 366µ mesh net, diamter 0.5m.

Species List and Limits of Periods of Occurrence of Zooplankton Organisms in St. Margaret's Bay, January 7th to December 8th, 1967

Species	J	F	M	A	M	J	J	A	S	O	N	D
HYDROMEDUSAE												
Aglantha digitale (O.F. Muller)	-	r	-	r	r	+	+	+	r	+	+	r
Euphysa aurata Forbes	r	r	r	r	r	-	r	r	r	r	r	r
Euphysa flammea (Linko)	-	-	r	r	r	-	-	r	-	r	-	-
Euphysa tentaculata Linko	-	-	-	-	-	-	-	r	-	-	-	-
Hybacodon prolifer L. Agassiz	-	-	-	r	r	-	r	-	r	-	-	-
Obelia spp.	-	-	-	-	r	+	a	+	a	a	r	r
Sarsia sp. (damaged)	-	-	-	-	-	r	-	-	-	-	-	-
Tiaropsis multicirrata (M. Sars)	-	-	-	r	r	r	-	-	-	-	-	-
SIPHONOPHORA												
Nanomia sp.	-	-	-	-	-	-	-	-	-	r	-	-
CTENOPHORA												
Beroe cucumis Fabricius?(jun)	+	a	+	+	+	r	r	+	+	r	-	-
Pleurobrachia pileus Vanhoffen	a	r	+	+	+	r	a	a	+	+	r	r
POLYCHAETA												
Autolytus sp. (jun)	-	-	-	-	+	+	-	-	-	-	-	-
Nereis sp. (jun)	-	-	-	-	-	r	r	-	-	-	-	-
Tomopteris helgolandica Greeff	r	r	-	r	-	-	-	-	-	r	-	-
CLADOCERA												
Evadne nordmanni Loven	-	-	-	-	r	+	s	s	s	s	s	+
Podon leuckarti G. O. Sars	r	-	-	-	-	-	+	+	a	a	a	-
Podon polyphemoides Leuckart	-	-	-	-	-	-	+	a	a	r	-	-
OSTRACODA												
Conchoecia haddoni Brady & Norman	-	r	-	-	-	-	-	-	-	-	-	-
Philamedes globosus (Lilljeborg)	-	-	-	r	-	-	-	-	-	-	-	-
COPEPODA												
nauplii (unidentified)	-	-	-	r	r	-	-	-	-	-	-	-
Harpacticus chelifer (Muller)	-	-	-	r	-	-	r	r	-	r	-	-
Microstella norvegica (Boeck)	-	-	-	r	-	-	-	-	-	-	-	-
Zaus sp.	-	-	-	r	r	+	-	-	-	r	-	-
Oithona similis Claus	-	-	-	+	r	+	-	-	+	+	-	+
Oithona spinirostris Claus	r	-	-	r	+	r	r	-	+	-	-	s
Acartia longiremis (Lilljeborg)	s	s	a	a	a	a	a	a	s	s	s	s
Anomalocera patersoni Templeton	-	-	-	-	-	-	r	-	-	-	-	-
Calanus finmarchicus (Gunner)	+	-	+	+	s	s	s	+	a	a	+	-
Calanus hyperboreus Krøyer	-	-	r	+	a	a	-	-	-	-	-	-
Candacia armata (Boeck)	r	-	-	-	-	-	-	-	-	-	-	-
Candacia bipinnata Giesbrecht	-	-	-	-	-	-	-	-	-	r	-	-
Centropages hamatus (Lilljeborg)	r	-	+	r	+	+	+	+	s	-	-	-
Centropages typicus Krøyer	-	-	-	-	-	-	-	-	-	s	s	s
Eurytemora herdmani Thompson & Scott	-	-	-	r	-	-	-	-	+	r	-	-
Metridia longa (Lubbock)	-	+	-	r	-	-	-	-	-	-	-	-
Metridia lucens Boeck	+	r	-	-	-	-	r	-	a	+	-	-
Metridia sp. jun.	-	-	+	r	+	a	+	-	-	-	-	-
Pseudocalanus minutus (Krøyer)	s	s	s	a	s	s	s	s	s	s	s	s
Scolecithricella minor G. O. Sars	-	-	-	r	-	-	-	-	-	-	-	-

Species	J	F	M	A	M	J	J	A	S	O	N	D
Temora longicornis Muller	s	s	s	+	s	s	s	s	s	s	s	s
Tortanus discaudatus (Thompson & Scott)	r	+	+	+	+	+	a	+	a	-	s	-
CIRRIPEDIA												
nauplii (unidentified)	-	-	-	+	+	-	-	-	-	-	-	-
cypris (unidentified)	-	-	-	-	+	+	r	-	-	-	-	-
ISOPODA												
microniscid epicarids (unidentified)	-	r	r	r	r	r	r	-	-	r	+	r
HYPERIID AMPHIPODA												
Hyperoche medusarum (Krøyer)	-	-	r	r	r	+	r	r	r	-	-	-
Parathemisto sp. (juv.)	r	-	-	r	-	-	-	-	-	-	-	-
EUPHAUSIACEA												
nauplii (unidentified)	-	-	-	r	a	-	-	-	r	r	r	-
calytopis (unidentified)	r	-	-	-	a	a	+	-	+	r	-	r
furcilia (unidentified)	r	-	-	-	r	+	r	r	r	r	-	-
Thysanoessa inermis (Krøyer)	-	-	-	-	r	-	-	-	-	-	-	-
Thysanoessa raschii (M. Sars)	-	-	r	r	-	-	-	-	-	-	-	-
DECAPODA												
caridean zoea (unidentified)	-	-	-	r	r	r	r	r	r	r	+	-
pagurid zoea (unidentified)	-	-	-	r	r	r	r	-	-	-	r	-
anomuran larvae	-	-	-	-	-	-	-	-	-	r	-	-
brachyuran zoea	-	-	-	-	r	+	r	-	r	r	r	-
MOLLUSCA												
bivalve larvae or juv.	-	-	+	r	r	r	+	+	r	a	-	a
Littorina floating capsule	-	-	-	r	-	-	-	-	-	r	-	-
veliger	-	-	-	+	r	r	-	-	-	r	-	-
*Spiratella helicina (Phipps)?	+	+	+	+	+	-	+	+	-	a	s	-
*Spiratella retroversa (Fleming)?	-	-	-	-	-	-	-	-	-	+	-	-
Clione limacina (Phipps)	-	r	r	r	r	r	-	-	-	-	-	-
gymnosome juv. (unidentified)	r	-	r	r	r	-	-	-	-	-	r	r
CHAETOGNATHA												
Sagitta elegans Verrill	-	a	a	a	a	+	a	+	a	a	a	+
APPENDICULARIA												
Fritillaria borealis Lohmann	r	r	r	+	+	-	+	-	a	r	-	-
Oikopleura dioica Fol	-	-	-	-	-	-	-	-	-	+	-	-
Oikopleura labradoriensis Lohmann	a	a	+	r	+	r	r	+	+	r	-	-
Oikopleura sp. (dmg, unidentified)	+	r	r	r	r	r	r	+	+	r	a	+
ECHINODERMATA (unidentified)												
ophiopluteus	-	-	-	-	r	-	-	-	-	r	-	-
echinopluteus	-	-	-	-	r	+	r	-	-	-	-	-
bipinnaria	-	-	-	-	-	-	r	-	-	a	-	-
brachiolarian	-	-	-	-	-	-	-	-	-	a	-	-
asteriod juv.	-	-	-	-	-	-	-	-	-	r	-	-
PISCES (unidentified)												
eggs	-	-	-	r	r	r	+	r	r	r	+	-
larvae	-	-	-	r	-	-	r	r	-	r	r	-

"-" not present in the sample
"r" number of specimens present in the sample, 1-5
"+ " number of specimens present in the sample, 6-50
"a" number of specimens present in the sample, 51-200
"s" number of specimens present in the sample, over 200
* specimens decalcified, identification uncertain

APPENDIX III Data collected at nine stations in St. Margaret's Bay during the autumn bloom 1967.

The locations of the stations are shown in Fig. 15. The error of the integral is twice the standard deviation evaluated as described on page 10.

WEEK 1

CHLOROPHYLL MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
0.563	0.834	0.313	1.230	0.667	0.834	1.230	0.834	0.876
0.813	0.834	0.918	5.818	0.563	0.417	1.230	0.667	0.959
1.481	0.500	0.730	0.313	1.064	0.417	0.563	0.563	1.230
0.396	0.334	0.730	0.167	0.563	1.147	0.250	0.417	0.626
	0.250	0.563	0.167	0.334	0.250		0.334	0.250
				0.167	0.083		0.167	0.125
				0.250			0.250	0.167
INTEGRALS								
19.811	16.015	34.199	37.484	24.325	19.613	18.924	26.171	24.086
ERRORS								
3.322	3.596	4.697	4.122	3.945	3.834	3.441	4.110	3.924

WEEK 1

INORG.PHOSPHATE MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
0.170	0.150	0.150	0.100	0.220	0.200	0.180	0.190	0.280
0.230	0.160	0.330	0.180	0.200	0.210	0.540	0.330	0.280
0.340	0.280	0.280	0.250	0.180	0.790	0.490	0.620	0.310
0.540	0.500	0.320	0.490	0.560	0.860	0.770	0.630	0.540
	0.550	0.330	0.600	0.680	0.630		0.630	0.840
				0.670	0.890		0.900	0.860
				0.740			0.650	0.910
INTEGRALS								
12.725	16.775	17.375	15.075	35.930	37.180	26.775	52.450	37.925
ERRORS								
2.484	3.196	3.244	3.087	4.004	3.994	3.200	4.446	3.990

WEEK 1

NITRATE MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
0.026	0.051	0.032	0.040	0.003	0.046	0.065	0.240	0.140
0.003	0.021	0.490	0.064	0.050	0.101	0.226	0.188	0.140
0.889	0.296	0.072	0.226	0.024	1.598	3.167	3.012	0.180
2.109	1.689	0.750	1.823	1.545	2.616	5.869	3.564	1.010
	3.519	0.984	3.210	4.117	3.645		5.198	2.760
				4.992	3.919		5.190	4.390
				5.146			5.853	4.850
INTEGRALS								
41.432	81.241	42.955	63.372	212.924	150.213	178.525	376.377	146.250
ERRORS								
4.159	7.352	4.534	5.706	9.555	9.014	16.374	20.000	6.68[illegible]

WEEK 2
CHLOROPHYLL MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
2.148	3.608	1.481	1.814	1.564	1.981	1.564	1.314	2.169
2.148	3.295	2.377	2.231	3.795	1.814	1.898	3.003	4.546
1.564	3.045	1.981	2.315	3.003	1.397	1.564	1.147	2.231
1.981	1.814	1.647	2.315	1.230	0.980	0.980	1.481	1.773
	0.667	0.334	1.564	0.563	0.667		0.313	0.751
				0.167	0.667		0.167	0.167
				0.250			0.083	0.167

INTEGRALS

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
58.598	67.002	49.527	68.086	60.297	49.714	48.171	44.261	65.740

ERRORS

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
6.666	4.815	4.520	5.743	4.139	4.559	5.609	4.061	4.155

WEEK 2
INORG.PHOSPHATE MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
0.270	0.270	0.240	0.290	0.430	0.350	0.400	0.390	0.350
0.330	0.310	0.300	0.290	0.450	0.290	0.430	0.340	0.340
0.360	0.290	0.300	0.380	0.370	0.260	0.390	0.340	0.370
0.580	0.240	0.310	0.360	0.430	0.420	0.580	0.360	0.460
	0.590	0.800	0.310	0.720	0.800		0.750	0.720
				0.820	0.800		0.840	0.880
				0.860			0.900	0.930

INTEGRALS

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
14.275	16.685	33.925	11.425	42.170	32.375	21.050	58.300	37.050

ERRORS

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
2.642	3.319	4.181	3.177	4.124	3.969	3.021	4.900	3.996

WEEK 2
NITRATE MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
0.030	0.218	0.228	0.243	0.195	0.018	0.407	0.066	0.210
0.339	0.079	0.177	0.202	0.231	0.030	0.002	0.023	0.090
0.210	0.018	0.095	0.224	0.028	0.170	0.325	0.089	0.180
1.566	0.170	0.201	0.247	0.192	1.727	1.587	0.469	1.230
	2.157	5.526	0.542	3.373	3.814		3.613	3.920
				5.976	3.938		5.596	6.980
				6.312			5.810	7.730

INTEGRALS

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
30.225	43.288	196.847	12.720	226.549	138.463	46.295	322.170	222.775

ERRORS

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
3.387	5.116	19.584	3.199	11.136	9.020	5.047	19.872	8.929

WEEK 3
CHLOROPHYLL MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
0.730	0.667	0.834	1.147	0.834	0.500	0.834	1.314	0.959
0.730	0.834	0.667	0.667	0.667	0.834	0.834	0.730	0.834
0.417	0.250	0.500	0.563	0.563	0.417	0.500	0.417	0.626
0.334	0.417	0.417	0.334	0.250	0.334	0.334	0.417	0.542
	0.250	0.334	0.334	0.417	0.083		0.083	0.292
				0.167	0.250		0.167	0.334
				0.417			0.167	0.375

INTEGRALS

13.398	14.973	22.730	16.526	23.877	15.932	17.934	21.114	25.233

ERRORS

3.137	3.562	3.971	3.644	4.022	3.791	3.396	3.999	3.968

WEEK 3
INORG.PHOSPHATE MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
0.320	0.290	0.330	0.360	0.260	0.330	0.220	0.370	0.350
0.320	0.320	0.350	0.320	0.350	0.320	0.340	0.190	0.340
0.540	0.530	0.520	0.610	0.490	0.470	0.440	0.500	0.540
0.540	0.660	0.660	0.510	0.440	0.510	0.480	0.410	0.560
	0.560	0.510	0.580	0.600	0.740		0.690	0.730
				0.670	0.560		0.720	0.800
				1.080			0.750	1.050

INTEGRALS

14.550	20.565	27.975	18.075	41.360	28.770	17.650	51.250	38.475

ERRORS

2.669	3.347	3.662	3.318	4.168	3.800	2.732	4.594	3.998

WEEK 3
NITRATE MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
0.210	0.251	0.328	0.257	0.210	0.208	0.088	0.106	0.330
1.271	0.837	0.036	0.115	0.318	0.356	0.193	0.328	0.290
2.798	1.905	1.417	2.983	0.912	3.004	1.905	2.066	2.060
2.648	4.099	3.836	1.996	2.713	3.858	1.416	3.820	3.200
	4.337	3.916	2.820	3.712	5.262		4.716	5.110
				3.315	5.140		3.414	5.680
				3.485			5.358	5.840

INTEGRALS

67.210	127.483	173.915	73.402	173.680	212.260	49.650	325.180	229.450

ERRORS

5.523	9.185	14.259	5.555	7.299	11.460	4.586	18.242	7.723

WEEK 4

CHLOROPHYLL MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
2.794	4.692	3.295	2.377	2.461	1.814	2.878	2.085	4.546
2.961	3.045	2.628	1.814	2.628	1.314	2.794	2.085	4.942
1.481	2.711	1.314	2.127	2.315	1.564	2.127	1.898	4.129
1.731	1.397	1.481	2.210	1.898	1.564	1.981	2.377	4.129
	0.813	0.730	0.980	1.397	0.417		0.250	0.500
				0.250	0.250		0.083	0.167
				0.417			0.250	0.250

INTEGRALS

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
59.484	66.439	64.593	56.930	72.361	40.747	86.281	55.470	98.323

ERRORS

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
6.206	4.918	5.798	4.896	4.377	4.114	9.572	4.293	4.314

WEEK 4

INORG.PHOSPHATE MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
0.280	0.270	0.360	0.380	0.230	0.280	0.370	0.320	0.350
0.190	0.250	0.410	0.280	0.280	0.290	0.290	0.340	0.330
0.320	0.280	0.470	0.280	0.250	0.260	0.330	0.260	0.350
0.320	0.350	0.490	0.210	0.330	0.350	0.330	0.240	0.350
	0.330	1.100	0.360	0.470	0.630		0.680	0.740
				0.770	0.800		0.810	0.880
				0.910			0.860	1.010

INTEGRALS

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
8.850	12.220	47.475	10.725	36.320	29.550	13.100	54.200	36.925

ERRORS

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
2.493	3.185	5.008	3.228	4.083	3.918	2.680	4.803	4.007

WEEK 4

NITRATE MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
0.348	0.087	0.595	0.096	0.344	0.795	0.130	0.464	0.360
0.025	0.002	0.423	0.038	0.287	0.513	0.385	0.388	0.360
0.880	0.615	1.195	0.075	0.882	0.818	0.682	0.800	0.410
0.818	0.945	0.726	0.043	0.832	1.101	1.216	0.743	0.610
	1.809	2.292	0.643	1.244	3.808		2.762	3.900
				5.046	5.391		4.459	6.280
				5.573			5.925	6.340

INTEGRALS

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
19.710	44.761	95.242	10.772	184.993	169.624	39.100	306.645	199.825

ERRORS

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
2.905	4.558	8.692	3.062	9.958	11.574	4.059	20.069	8.060

WEEK 5
CHLOROPHYLL MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
2.294	1.731	1.481	1.981	1.230	1.564	1.981	1.481	2.085
2.127	1.564	1.731	1.397	1.481	1.314	1.898	1.731	2.356
1.481	1.314	1.731	1.564	1.397	1.543	2.044	2.044	1.355
1.647	0.667	1.981	1.314	2.127	0.897	1.898	2.044	1.064
	0.500	0.897	0.584	0.334	0.667		1.481	0.834
				0.250	0.730		0.250	0.542
				0.250			0.167	0.334

INTEGRALS

52.603	33.230	67.252	38.370	44.970	47.493	76.845	65.584	52.811

ERRORS

5.910	4.086	6.510	4.185	4.109	4.621	9.143	4.362	4.187

WEEK 5
INORG.PHOSPHATE MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
0.210	0.310	0.190	0.210	0.210	0.200	0.380	0.260	0.290
0.220	0.310	0.210	0.240	0.200	0.160	0.410	0.240	0.260
0.250	0.340	0.200	0.220	0.240	0.200	0.360	0.240	0.290
0.300	0.250	0.250	0.270	0.280	0.240	0.350	0.250	0.230
	0.540	0.320	0.330	0.470	0.350		0.270	0.280
				0.570	0.300		0.680	0.700
				0.980			0.960	1.030

INTEGRALS

8.125	16.160	15.600	9.800	33.460	14.325	14.425	49.700	26.925

ERRORS

2.406	3.313	3.249	3.111	4.070	3.562	2.723	4.946	3.925

WEEK 5
NITRATE MMG-AT/L

STN1	STN2	STN3	STN4	STN5	STN6	STN7	STN8	STN9
0.077	0.072	0.002	0.017	0.338	0.002	0.116	0.072	0.080
0.023	0.111	0.005	0.005	0.002	0.016	0.082	0.042	0.090
0.179	0.053	0.002	0.055	0.065	0.003	0.086	0.042	0.240
0.186	0.311	0.002	0.005	0.206	0.132	0.097	0.051	0.310
	1.278	0.731	1.533	2.338	0.624		0.236	0.310
				3.343	0.761		2.031	3.490
				5.651			6.369	7.100

INTEGRALS

4.457	27.614	25.640	23.375	164.034	23.729	3.797	241.390	113.650

ERRORS

2.083	3.760	3.428	3.477	9.652	3.446	2.182	21.135	7.305

APPENDIX IV Scotian Shelf data

Station: L7

Date: 2 May 1967

Time: 1700 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	1.043	3.08	0.38	0.45	0.69	
10	1.043	2.44	0.30	0.39	0.53	
25	0.667	2.73	0.42	0.39	0.59	
40	1.084	2.21	0.40	0.33	0.52	
60	1.481	2.03	0.94	0.50	0.68	

Station: L6

Date: 2 May 1967

Time: 2000 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.167	1.39	0.23	0.30	0.53	
10	0.334	1.39	0.22	0.29	0.48	
25	0.334	1.22	0.22	0.27	0.44	
50	0.542	2.27	1.14	0.44	0.68	

Station: L5

Date: 2 May 1967

Time: 2200 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	---	1.45	0.26	0.59	0.81	
10	0.250	0.99	0.26	0.36	0.57	
25	---	1.28	0.24	0.86	1.01	
50	1.48	2.32	0.56	0.42	0.58	

Station: L4

Date: 3 May 1967

Time: 0800 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.167	0.70	0.24	1.57	1.88	
10	1.001	1.22	0.21	0.38	0.56	
25	0.083	1.28	0.22	0.34	0.47	
50	3.712	1.51	0.40	0.35	0.49	
90	1.272	2.27	1.92	0.53	0.73	

Station: L3

Date: 3 May 1967

Time: 1100 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
10	1.272	0.23	0.27	0.44	0.69	
25	1.355	1.16	0.24	0.30	0.43	
50	2.440	1.51	1.19	0.44	0.54	
75	2.842	0.81	1.56	0.51	0.60	
120	2.356	2.09	2.51	0.47	0.63	

Station: L2

Date: 3 May 1967

Time: 1200 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
10	3.900	0.93	1.04	0.44	0.69	
25	3.900	2.09	1.35	0.42	0.62	
50	5.213	1.16	1.33	0.43	0.62	
75	1.293	0.58	2.01	0.57	0.70	
130	0.918	0.87	7.20	0.87	0.95	

Station: L1

Date: 3 May 1967

Time: 1400 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
10	1.835	0.23	0.37	0.34	0:59	
25	1.960	1.22	0.44	0.37	0.70	
50	2.210	2.50	1.52	0.48	0.76	
75	1.689	3.66	2.64	0.66	0.78	
130	1.168	7.96	7.98	0.88	1.04	
170	0.521	12.78	12.99	1.24	1.46	

Station: D1

Date: 10 May 1967

Time: 1830 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.209	1.57	0.33	0.41	0.54	0.745
5	0.334	1.39	0.43	0.39	0.63	0.740
10	0.417	1.10	0.51	0.37	0.57	0.751
20	0.375	1.10	0.76	0.42	0.58	0.748
50	0.626	2.09	2.20	0.53	0.79	0.723
85	0.834	3.08	1.99	0.57	0.78	0.710

Station: D2

Date: 11 May 1967

Time: 1830 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.125	2.09	0.34	0.35	0.54	0.746
5	0.271	1.51	0.36	0.39	0.61	0.740
10	0.083	1.92	0.36	0.37	0.51	0.746
20	0.083	1.98	0.47	0.40	0.52	0.745
50	0.125	1.51	0.50	0.37	0.55	0.760

Station: D4

Date: 13 May 1967

Time: 1930 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.209	1.74	0.30	0.39	0.39	
5	0.167	1.74	0.33	0.37	0.60	
10	0.083	1.74	0.34	0.34	0.58	
20	0.083	1.92	0.35	0.43	0.49	
50	0.334	2.50	1.28	0.46	0.57	
75	0.459	2.38	1.39	0.69	0.76	

Station: D5

Date: 14 May 1967

Time: 2000 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.042	1.86	0.40	0.50	0.60	0.730
5	0.083	2.09	0.49	0.56	0.60	0.731
10	0.167	1.63	0.47	0.38	0.50	0.731
20	0.042	1.86	0.39	0.42	0.67	0.739
50	0.125	2.27	1.35	0.69	0.91	0.728
120	0.167	12.78	9.51	1.13	1.30	0.477

Station: D6

Date: 15 May 1967

Time: 1830 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.042	1.68	0.43	0.39	0.56	0.730
5	0.083	1.63	0.47	0.41	0.61	0.729
10	0.167	1.63	0.45	0.37	0.58	0.731
20	0.083	1.74	0.44	0.35	0.63	0.733
50	0.167	2.27	2.18	0.54	0.70	0.721
120	0.125	11.16	10.90	1.09	1.28	0.503

Station: D7

Date: 16 May 1967

Time: 1900 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.125	1.74	0.29	0.32	0.59	0.740
5	0.083	1.68	0.26	0.35	0.77	0.736
10	0.104	1.68	0.24	0.42	0.59	0.736
20	0.083	1.63	0.37	0.32	0.55	0.736
50	0.125	2.44	1.61	0.54	0.52	0.720
120	0.125	9.88	9.11	1.01	1.26	0.532

Station: D8

Date: 17 May 1967

Time: 2000 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.042	2.15	0.38	0.38	0.58	0.732
5	0.125	2.44	0.34	0.39	0.55	0.723
10	0.063	2.21	0.43	0.40	0.42	0.700
20	0.209	2.03	2.84	0.40	0.58	0.746
50	0.083	3.05	7.04	0.51	0.77	0.702
120	0.083	12.72	12.48	1.17	1.36	0.460

Station: L7

Date: 7 September 1967

Time: 1500 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	1.001	5.34	0.46	0.42	0.56	
10	0.834	5.23	1.08	0.52	0.64	
25	0.334	6.27	2.83	0.67	1.20	
40	0.209	6.97	3.41	0.68	0.85	
60	0.250	10.05	4.97	0.85	0.99	

Station: L6

Date: 7 September 1967

Time: 1700 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	1.064	5.46	0.50	0.44	0.56	
10	0.626	5.69	1.46	0.58	0.79	
25	0.417	5.46	3.53	0.67	0.74	
45	0.271	8.46	4.90	0.78	0.90	

Station: L5

Date: 7 September 1967

Time: 1930 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.834	3.14	0.32	0.25	0.39	
10	0.792	2.85	1.26	0.22	0.29	
25	0.459	5.75	3.46	0.61	0.53	
45	0.292	6.33	4.84	0.71	0.82	

Station: L4

Date: 7 September 1967

Time: 2230 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.459	2.21	0.09	0.13	0.20	
10	0.751	2.61	0.11	0.20	0.27	
25	1.064	3.72	1.47	0.57	0.63	
50	0.250	7.03	5.22	0.77	0.79	
75	0.500	8.02	6.44	0.86	0.85	

Station: L3

Date: 8 September 1967

Time: 0100 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.834	2.03	0.08	0.20	0.23	
10	0.250	1.86	0.06	0.19	0.27	
25	0.500	4.59	0.34	0.56	0.60	
50	0.250	7.32	5.56	0.81	0.92	
75	0.083	10.17	8.20	0.89	0.94	
125	0.125	14.76	10.39	1.15	1.16	

Station: L2

Date: 8 September 1967

Time: 0300 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.334	2.15	0.08	0.18	0.26	
10	0.250	1.74	0.18	0.18	0.32	
25	0.834	2.96	7.82	0.39	0.48	
50	0.250	7.44	5.40	0.71	0.62	
75	0.083	12.14	13.14	0.96	1.06	
140	0.083	14.76	13.00	1.11	1.28	

Station: L1

Date: 8 September 1967

Time: 0500 ADT

Depth (Meters)	Chlorophyll (mg/m^3)	Silicate $mg\text{-}at/m^3$	Nitrate $mg\text{-}at/m^3$	Inorg. Phosphate $mg\text{-}at/m^3$	Total Phosphate $mg\text{-}at/m^3$	Oxygen $g\text{-}at/m^3$
1	0.209	1.80	0.06	0.20	0.40	
10	0.250	1.51	0.09	0.19	0.38	
25	0.334	2.03	2.76	0.34	0.66	
50	0.167	5.29	6.56	0.74	0.73	
75	0.083	10.92	11.17	0.96	0.93	
175	0.021	11.10	13.66	1.10	1.23	