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U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Environmental Research Laboratories

Phytoplankton Productivity in the Apex of the New York Bight: September 1973 - August 1974

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Marine EcoSystems
Analysis Program
Office
BOULDER,
COLORADO
April 1976

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
BOULDER, COLORADO 80302

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Thomas C. Malone

Marine EcoSystems Analysis Program Office
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PHYTOPLANKTON PRODUCTIVITY IN THE APEX OF THE NEW YORK BIGHT: SEPTEMBER 1973 - AUGUST 1974

Thomas C. Malone

ABSTRACT

Phytoplankton productivity within a 600-km^2 area within the New York Bight Apex ranged from a December minimum of 0.1 g C m^{-2} d^{-1} to a June maximum of 6 g C m^{-2} d^{-1}. A secondary peak of 2 g C m^{-2} d^{-1} was observed in February. Netplankton productivity peaked in February (1.7 g C m^{-2} d^{-1} at station P1 near the mouth of the estuary) and again in June (2.2 g C m^{-2} d^{-1} at station C3 in the sludge dumping area), while nanoplankton productivity exceeded 1 g C m^{-2} d^{-1} only during the summer with a maximum in July (3.7 g C m^{-2} d^{-1} at station P1). The annual production of 370 g C m^{-2} d^{-1} calculated for the apex reflects the continuous input of nutrient-rich estuarine water which is confined to the photic zone by thermal stratification during the summer months of greatest phytoplankton demand.

Phytoplankton productivity/chlorophyll-*a* in the photic zone was a linear function of mean photic zone light energy, and light-saturated photosynthesis/chlorophyll-*a* was an exponential function of temperature over most of the year. Simulated *in situ* productivity/chlorophyll-*a* was significantly correlated with values calculated by a mathematical model relating productivity/chlorophyll-*a* to light and temperature. This is good evidence that phytoplankton growth in the apex was light limited and a function of light and temperature. Because the attenuation of downwelling light was primarily mediated by nonphotosynthetic particles of estuarine origin, estuarine processes within the geographic limits of the Hudson Estuary play a major regulatory role in phytoplankton growth in the apex.

The dumping of sludge and dredge spoils in the bight apex had no statistical effect on phytoplankton growth or the environmental factors which regulate phytoplankton growth within the dumping areas. Our results indicate that (1) estuarine discharge is the major source of allochthonous-dissolved inorganic nutrients and suspended particulate matter in the apex; (2) an increase in nutrient inputs related to either estuarine discharge or dumping will increase the area over which phytoplankton productivity is high rather than increase productivity within a limited area; (3) an increase in turbidity resulting from estuarine runoff or ocean dumping will reduce phytoplankton productivity within the limited area of study; and (4) an increase in water temperature during

fall-winter-spring months could increase the length of the nanoplankton growing season resulting in a decrease in the relative importance of netplankton in the bight apex.

The winter netplankton bloom was primarily caused by a decrease in copepod grazing pressure rather than to an increase in growth rate. Summer netplankton and nanoplankton blooms were primarily a consequence of high growth rates. Evidence is presented that copepods selectively grazed on the netplankton component of the phytoplankton.

1. INTRODUCTION

The apex of the New York Bight (fig. 1) is a transition region between an estuarine system and a continental-shelf coastal system. Its waters are a varying mixture of three water masses (Ketchum, 1967): (1) estuarine water characterized by low salinity, high nutrient concentrations, and high concentrations of suspended detritus (Panuzio, 1966; Busby and Darmer, 1970; Garside *et al*., in press); (2) surface coastal water characterized by moderate salinity (31°/₀₀) and low nutrient concentrations; and (3) deep ocean water characterized by high salinity (34°/₀₀) and moderate nutrient concentrations. High nutrient concentrations in water of estuarine origin (Hudson and Raritan) are due primarily to the discharge of sewage wastes to the lower Hudson Estuary (Garside *et al*., in press). About 8 x 10^6 m^3 d^{-1} of domestic wastes, or 61 x 10^6 Kg N yr^{-1} and 6 x 10^6 Kg P yr^{-1} (Howells *et al*., 1970), are discharged into the Hudson Estuary south of the George Washington Bridge (Tofflemire and Hetling, 1969). Most of this material is ultimately transported to the New York Bight as a consequence of the two-layered, nontidal circulation pattern characteristic of the lower Hudson Estuary (Abood, 1974; Garside *et al*., in press). At the same time, about 1.2 x 10^4 m^3 d^{-1} of sewage sludge and 2.5 x 10^4 m^3 d^{-1} of dredge spoils are dumped in the apex at two locations (near stations C3 and D3, fig. 1) about 10 nmi from the mouth of the estuary (Buelow, 1968; Gross, 1974; U. S. Environmental Protection Agency, 1974).

Phytoplankton are the most important producers of particulate organic matter in the majority of marine food chains. The environmental factors which regulate phytoplankton productivity fall into two categories: those which directly affect productivity per unit biomass (growth rate) and those which directly affect biomass. In shallow-water marine systems like the apex, the redistribution of phytoplankton biomass as it is produced will result primarily from advection and grazing. Growth rate will be a function of temperature and the availability of light energy and essential nutrients. The effects of estuarine water and ocean dumping should be reflected in spatial and temporal variations in phytoplankton growth rate because of their influence on the concentration of suspended detritus (and, therefore, on light penetration), nutrient supply and temperature, or through the introduction of growth inhibitory materials (e.g., heavy metals, chlorinated hydrocarbons, chlorine, and petroleum products).

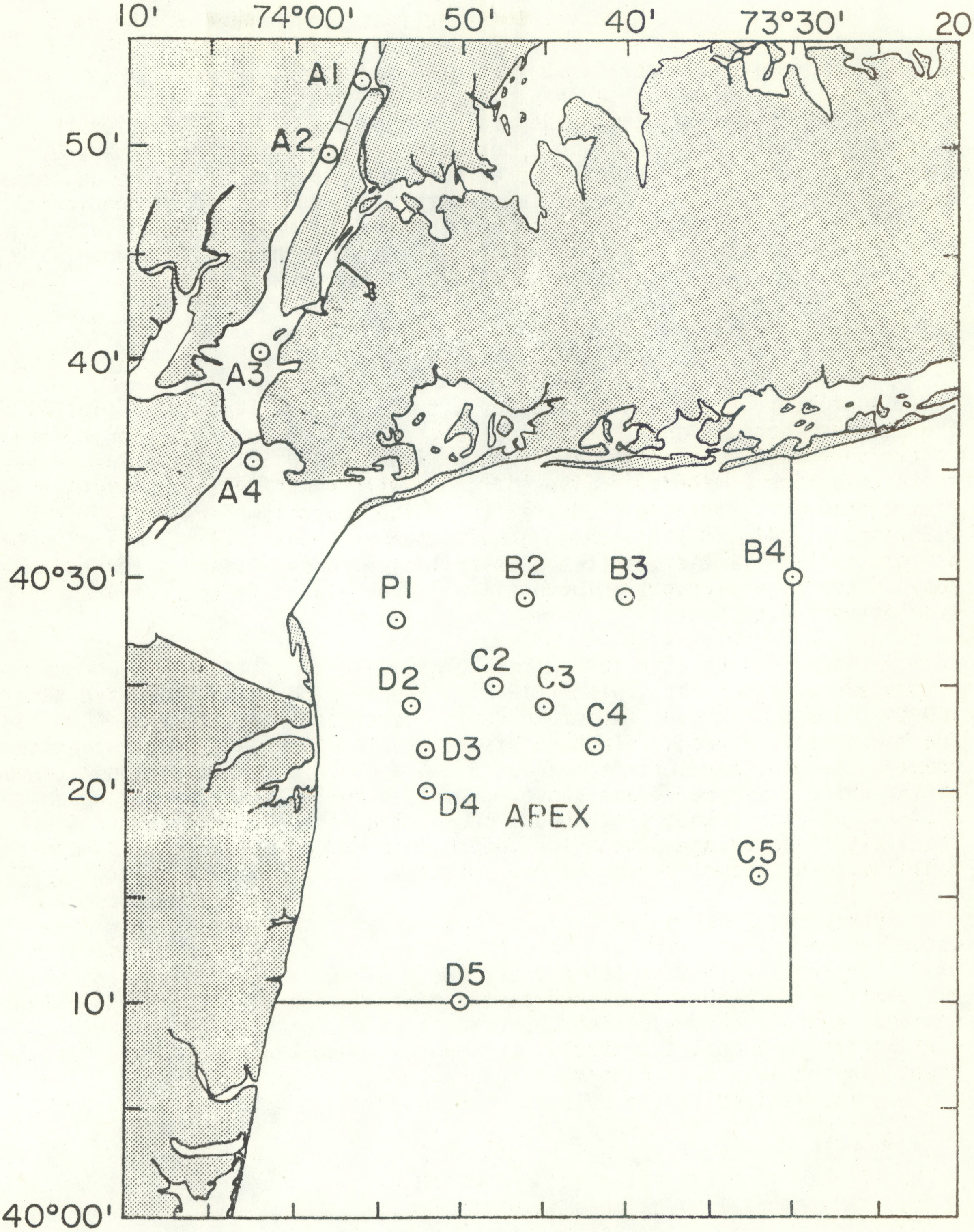

Figure 1. Station locations in the lower Hudson Estuary (A1 through A4) and the New York Bight Apex (B2, B3, B4, C2, C3, C4, C5, D2, D3, D4, D5, and P1).

1.1 Objectives

The objectives of the first year of observations were: (1) to evaluate variations in netplankton and nanoplankton primary productivity as sources of new organic material in the New York Bight Apex; (2) to identify the environmental factors responsible for observed variations in primary productivity; and (3) to evaluate the effects of estuarine discharge and ocean dumping on phytoplankton productivity within the context of environmental regulation. Because the apex receives the bulk of wastes generated by adjacent New York and New Jersey metropolitan areas, emphasis has been placed on the environmental regulation of phytoplankton growth rates.

1.2 Background

Studies of phytoplankton productivity in the apex have been limited to the coast of Long Island (Mandelli *et al.*, 1970). Mean primary productivity at the surface decreased seaward from 0.35 g C m^{-3} d^{-1} in estuarine embayments to 0.16 g C m^{-3} d^{-1} 5 miles offshore with peaks during the summer and fall months. Photic zone productivity in the coastal waters varied from 0.28 to 2.90 g C m^{-2} d^{-1} with an annual mean of about 1.14 g C m^{-2} d^{-1} (420 g C m^{-2} yr^{-1}). Variations in the assimilation number (light-saturated photosynthetic rate per unit chlorophyll-*a*) were related to temperature and species composition.

Primary productivity in New York Bight waters outside the apex has been estimated by Ryther and Yentsch (1958). Annual production decreased from 160 to 100 g C m^{-2} as water column depth increased from less than 50 m near the New Jersey and Long Island coasts to greater than 1000 m near the shelf break. Inshore, productivity exceeded 0.5 g C m^{-2} d^{-1} from December through April, while offshore values above 0.5 only occurred from March through April. The higher levels of annual production inshore presumably reflect the limits imposed by water column depth on vertical mixing and on more rapid nutrient recycling in shallow waters.

Ryther and Dunstan (1971) presented evidence that organically rich water from near the mouth of the estuary extends seaward (east and southeast) for less than 80 km (50 mi) and south along the New Jersey coast for at least 240 km (150 mi). Based on the distribution of dissolved inorganic nitrogen and phosphorus during September 1969 and on bioassay experiments with *Skeletonema costatum*, Ryther and Dunstan concluded that phytoplankton growth in the New York Bight is nitrogen-limited.

2. METHODS

2.1 Sampling Program

Stations were occupied along three transects radiating from the mouth of the Hudson-Raritan Estuary (fig. 1). An additional transect was made down the axis of the Hudson Estuary from Spyten Dyvil (milepoint 15) to the

Lower Bay. Because of the emphasis by MESA on the effects of ocean dumping on biological processes in the apex, this report will focus on transects C and D (fig. 1; table 1). Stations C2, C3, and C4 are located in the sludge dumping area, while stations D2, D3, and D4 are located in the dredge spoil dumping area. Stations P1, C5, and D5 are not directly affected by ocean dumping. Station P1 is most strongly influenced by estuarine runoff, while stations D5 and C5 are affected least by estuarine runoff. The water column of all stations in the apex are of approximately equal depth (20 to 30 m). The area covered by these transects is about 600 km^2.

The stations were occupied at approximately monthly intervals from September 1973 through August 1974. Samples were collected from three to five discrete depths, depending on water depth and the rate of light attenuation as estimated from Secchi disc measurements. Monthly observations of phytoplankton productivity and biomass along environmental gradients should allow identification of where and when more frequent sampling is required to understand the time-course of phytoplankton responses to specific environmental perturbations, both natural and man-induced. This type of sampling program is necessary to determine what environmental factors cause and dissipate phytoplankton blooms.

The environmental and biological variables measured are summarized in table 2. Of the biological variables, only chlorophyll-a was measured at all stations and depths sampled. Surface photosynthetic capacity was measured at stations A3, P1, B4, C3, C5, D3, and D5, and photic zone primary productivity was measured at stations A3, C3, and C5. The concentrations of dissolved and particulate matter were measured at all depths only at stations where photosynthetic capacity was measured. Otherwise, measurements were made on surface and near-bottom samples only. Zooplankton abundance in the photic zone was estimated from samples collected at stations A1, A3, P1, B4, C3, C5, D3, and D5. All sampling was conducted during the day between 2 hours after sunrise and 2 hours before sunset over a 3-day period in an effort to minimize the effects of diel periodicity.

2.2 Environmental Factors

Salinity, temperature, and dissolved oxygen were measured with an induction salinometer, protected reversing thermometers, and YSI oxygen electrodes, respectively. Dissolved inorganic nutrient analyses were performed by Dr. C. Garside, using a Technicon AAII three-channel autoanalyzer. Standard manifolds were used for nitrate, nitrite, ammonia, phosphate, and silicate determinations (Strickland and Parsons, 1968). Each method was calibrated and checked for linear response using a series of replicate standards before samples were analyzed, and replicate standards were run every 30 samples during the analyses. Precision was ± 0.25 μg-at l^{-1} or better for all methods. Continuous recordings of incident solar radiation were obtained with an Eppley pyranometer. Daily integrals of photosynthetically active radiation in langleys (1 ly = 1 gcal cm^{-2}) were estimated by measuring the area under the curve with a planimeter and by applying a correction factor of 0.5 during cloudless periods (Jerlov, 1968). Light percent depths were estimated from Secchi disc readings, and mean photic zone light energy was calculated from

Table 1. Position, MESA-Area Identification, and Location of Stations in the Lower Hudson Estuary and New York Bight Apex

Station	Position	Mesa area	Location
A1 (M1)	40°52'53''N, midchannel		Spyten Dyvil
A2 (M2)	40°49'31''N, midchannel		Manhattan
A3 (M3)	40°40'18''N, 74°02'18''W	40407402	Upper Bay
(M4)*	40°38'30''N, 74°02'18''W	40387402	Upper Bay
A4 (M5)	40°35'18''N, 74°02'39''W	40357402	Lower Bay
P1 (M6)	40°28.6' N, 73°54.0' W	40287354	Sandy Hook
B2**	40°29.1' N, 73°46.8' W	40297346	Long Island transect
B3**	40°29.4' N, 73°40.5' W	40297340	do.
B4 (M16)	40°30.0' N, 73°30.0' W	40307330	do.
C2 (M7)	40°25.4' N, 73°48.0' W	40257348	Sludge transect
C3 (M8)	40°24.0' N, 73°45.5' W	40247345	do.
C4 (M9)	40°22.4' N, 73°42.0' W	40227342	do.
C5 (M10)	40°16.7' N, 73°32.4' W	40167332	do.
D2 (M11)	40°24.0' N, 73°53.0' W	40247353	Dredge spoil transect
D3 (M12)	40°22.0' N, 73°52.5' W	40227352	do.
D4 (M13)	40°20.0' N, 73°52.1' W	40207352	do.
D5 (M14)	40°10.0' N, 73°50.0' W	40107350	do.
(M15)*	40°23.0' N, 73°49.0' W	40237349	do.

* Occupied during Sept.-Dec., 1973, and Jan. 1974 only.

** Occupied from Feb. 1974 on.

Table 2. Summary of Observations in the Lower Hudson Estuary and New York Bight Apex

ENVIRONMENTAL FACTORS
Nutrients (NO_3, NO_2, NH_3, PO_4, SiO_4)
Temperature
Salinity
Dissolved Oxygen
Light -incident light energy -light attenuation -turbidity/microseston/particulate organic carbon
Zooplankton Biomass -taxonomic composition -numerical abundance -dry weight
PHYTOPLANKTON PRODUCTIVITY
Biomass -netplankton and nanoplankton chlorophyll-a -numerical abundance -taxonomic composition
Primary Productivity -netplankton and nanoplankton -productivity per unit biomass
Photosynthetic Capacity -netplankton and nanoplankton -assimilation number

the expression:

$$I' = \frac{I_o\,(1-e^{-kd'})}{kd'}$$

where I' = mean photic zone light energy (ly d^{-1}),
I_o = photosynthetically active radiation incident at the sea surface (ly d^{-1}),
k = mean extinction coefficient (1.7/Secci disc reading), and
d' = 1-percent light depth.
The 1-percent light depth was used in this expression rather than mixed layer depth because of limited water column depths in the study area and mean mixed layer light values underestimated the amount of light available for photosynthesis during periods of stratification.

Measurements of suspended particulate matter (microseston) were made to evaluate the factors responsible for light attenuation in the water column and to estimate levels of organic detritus relative to phytoplankton biomass. Suspended organic and inorganic matter were measured gravimetrically, and the concentration of particulate organic carbon was analyzed by the wet oxidation technique (Strickland and Parsons, 1968).

2.3 Phytoplankton Standing Crop and Productivity

Nanoplankton and netplankton chlorophyll-a concentrations were measured by fluorometry (Strickland and Parsons, 1968) following serial fractionation through a 22-μ mesh Nitex net-disc and a Gelman type-A glass fiber filter (Malone, 1971). Total chlorophyll-a concentration was estimated from the sum of the nanoplankton and netplankton fractions. Comparison of calculated concentrations with chlorophyll-a measurements of unfractionated samples gave a mean error of 10.5 ±3.2 percent (95-percent confidence limits). Based on the Wilcoxon signed rank test of differences between the sum of fractionated and unfractionated samples, fractionation did not have a significant ($P<0.01$) effect on estimates of total chlorophyll-a.

The photosynthetic production of particulate organic carbon by nanoplankton and netplankton fractions was estimated from ^{14}C-uptake measurements (Malone, 1971). Light-saturated photosynthetic rates (photosynthetic capacity) were derived from photosynthesis-light experiments using fluorescent light incubators. Surface water samples (2 m below the surface) were incubated for 2 hours at surface water temperature under light intensities of 0.10, 0.06, 0.03, 0.015, and 0.005 ly min^{-1}. *In situ* primary productivity was estimated using sunlight incubators in combination with neutral density filters that simulated the percent light depths from which the samples were collected (100, 60, 30, 15, and 5 percent). Samples were incubated for 24 hours at surface water temperature. Following both artificial light and sunlight incubations, the samples were fractionated by serial filtration through a 22-μ mesh Nitex net-disc and an HA Millipore filter. The filter discs were washed with particle-free sea water, placed over fuming HCl for 30 seconds, dried, and their activity measured using a liquid scintillation counter.

Mean coefficients of variations between duplicate light bottles were 16 ± 5 percent and 8 ± 4 percent (95-percent confidence limits) for the netplankton and nanoplankton fractions, respectively.

Primary productivity at stations in the apex other than C3 and C5 (where measurements were made) was calculated from the photic zone productivity/chlorophyll-a ratios observed at these two stations. Annual phytoplankton production (g C m^{-2} yr^{-1}) was calculated by weighting daily productivity at each station according to the area each was assumed to represent. Boundaries were located at one-half the distance between stations and at 2 nmi from the New Jersey and Long Island coasts within the defined area of the apex. Netplankton/nanoplankton productivity ratios were calculated for stations P1, D3, and D5 from the netplankton/nanoplankton ratios of photosynthetic capacity (R_{pc}) which were significantly correlated ($r = 0.993$; $P < 0.01$) with the corresponding primary productivity ratios at stations A3, C3, and C5 ($R_{pc} = 0.94 R_{pp} - 0.015$).

2.4 Zooplankton Abundance

Macrozooplankton samples were collected with a ½-m, 202-μ mesh net equipped with paired TSK flow meters. An oblique tow was made over the photic zone. One-half of the catch was washed with distilled water and frozen for dry weight analysis and one-half was preserved in 10-percent buffered formalin for enumeration and identification (major taxonomic groups). After thawing, the dry weight samples were split into two subsamples. One subsample was homogenized for total dry weight and the second was used for measurements of copepod dry weight. The samples were dried at 60°C for 24 hours and weighed on a semi-microbalance after cooling in a desiccator.

3. HYDROGRAPHY

3.1 Temperature and Salinity

Spatial and temporal variations in water temperature and salinity reflect changes in vertical stability and the proportions of estuarine, coastal, and oceanic water; in addition, such variations directly affect plankton metabolism. Geographic ranges of surface temperature in the apex were less than 2°C throughout the year, while ranges of surface salinity varied from 0.6 in November to 6.2 ‰ in late April. Surface salinity generally increased with distance from the mouth of the estuary and tended to be lowest along the New Jersey coast (D transect), especially during the spring and early summer.

The seasonal cycle of surface temperature was characterized by a February minimum of 3° and a July maximum of 25°C (fig. 2). Vertical distributions showed little stratification from October to April and marked stratification May through August. Surface salinity ranged from 27 in June to 32 ‰ from October through December. Vertical salinity stratification was best developed from April through June (fig. 3).

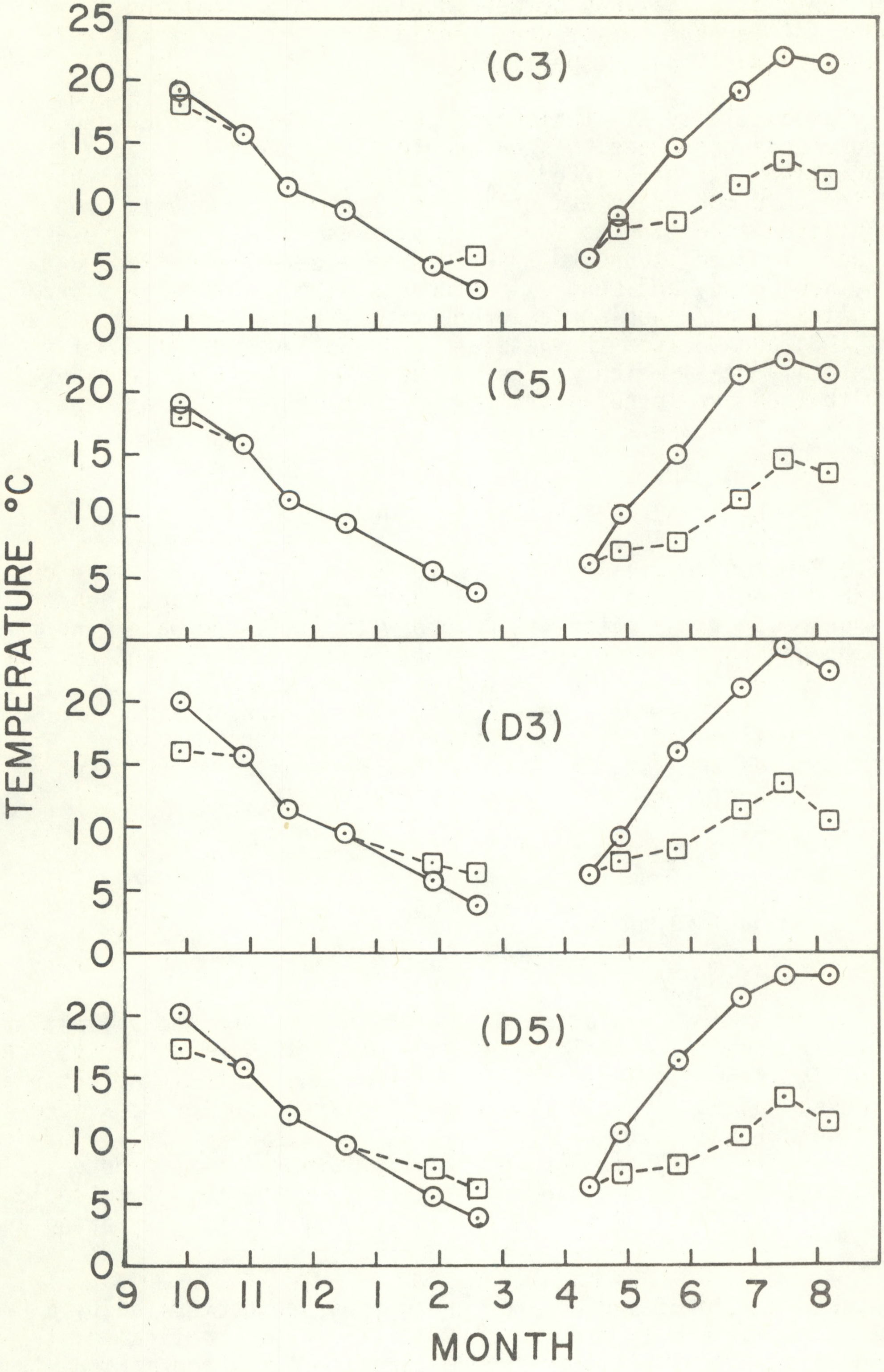

Figure 2. Monthly variations in surface (○) and near-bottom (□) temperature at stations C3, C5, D3, and D5.

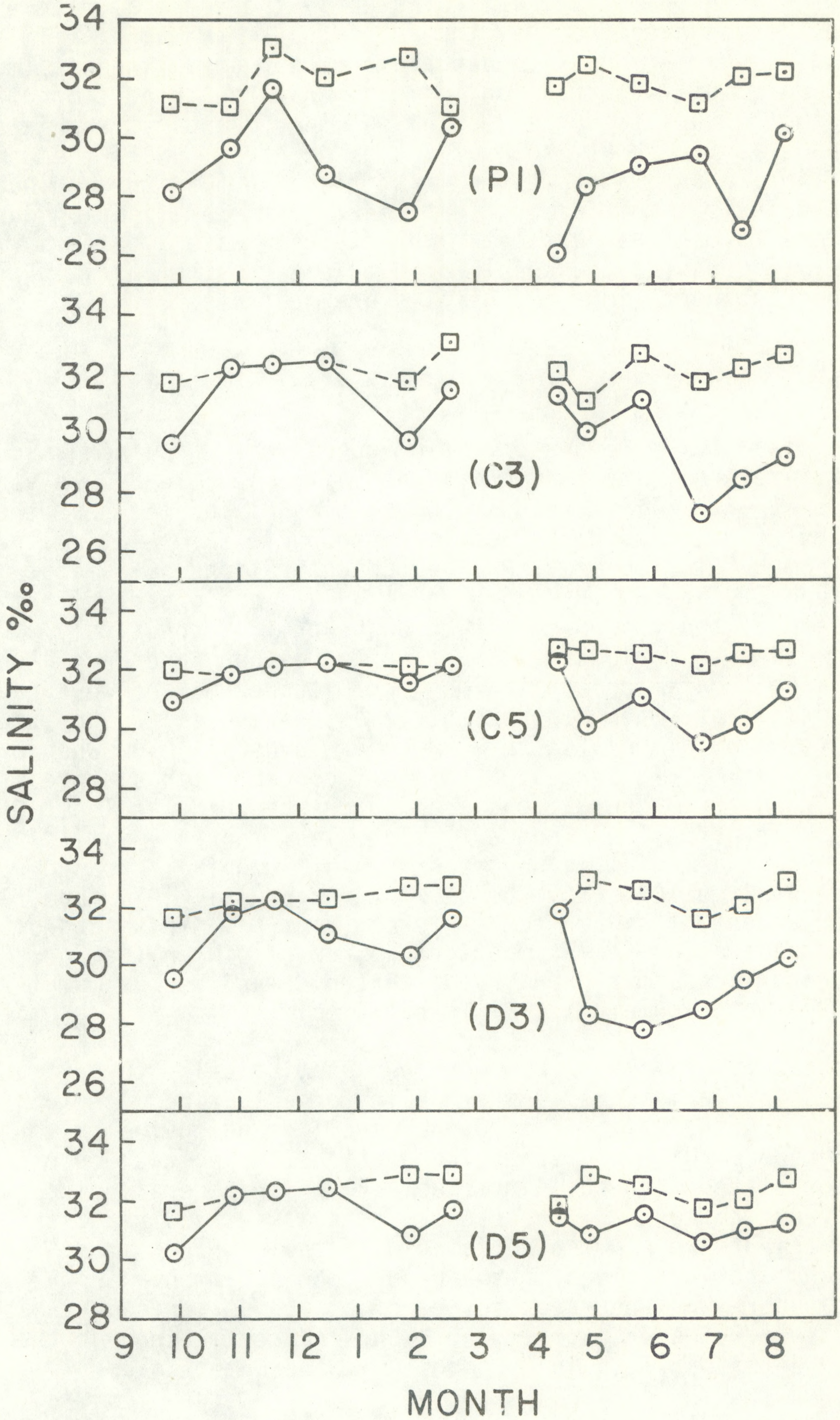

Figure 3. Monthly variations in surface (○) and near-bottom (□) salinity at stations P1, C3, C5, D3, and D5.

Water column stability, as indicated by the vertical gradient in sigma-t, was most pronounced from May through August (maximum stability in June and July) with a secondary peak in January and February. These patterns of salinity and stability variation indicate that the proportion of estuarine water in the surface layer peaked in September, January, and late April through June as the result both of increased river runoff (September, January, and April) and water column stratification (May through August). Thus rather than inhibit photic zone fertilization, stratification during the summer tends to confine nutrient-rich estuarine water to the surface layer, effectively increasing the supply of nutrients to the photic zone during the period when incident light intensities are greatest.

3.2 Inorganic Nutrients

Mean mixed layer levels of dissolved silicate and inorganic nitrogen (DIN = nitrate + nitrite + ammonia) ranged from 0.5 to 3.0 μg-at Si l^{-1} and 1 to 14 μg-at N l^{-1}, exclusive of station P1 located near the mouth of the estuary (fig. 4 and 5). Dissolved phosphate was relatively constant, ranging from 0.5 to 1.5 μg-at P l^{-1}. Concentrations of silicate and DIN greater than 1 μg-at Si l^{-1} and 5 μg-at N l^{-1} were observed from September through January and from December through April, respectively. Peaks in DIN coincided with periods of low salinity (January and June along the C transect and January and April along the D transect) and were caused by influxes of nitrate when DIN concentrations were greater than 5 μg-at l^{-1}. The proportion of ammonia in the DIN pool was usually low when DIN exceeded 6 μg-at l^{-1} (78 percent of all DIN concentrations above 6 μg-at l^{-1} were less than 50-percent ammonia) and high when DIN was less than 5 μg-at l^{-1} (71-percent of all DIN concentrations less than 5 μg-at l^{-1} were more than 80-percent ammonia). The proportion of ammonia increased with temperature from 2 to 12°C (November 1973 through April 1974) and fluctuated around 80 percent at higher temperatures (fig. 6). This suggests that nitrogen regeneration is an important source of DIN in the apex, especially during the summer when phytoplankton demand is maximum (see section 4.2) and the water column is well stratified.

Temporal variations in DIN were not statistically correlated with salinity because of variations in the quality of estuarine water discharged into the apex and the rate of nitrogen recycling and phytoplankton uptake within the apex. However, spatial variations during each cruise were inversely correlated with salinity (table 3) which generally increased with distance from the mouth of the estuary. Anomalies in the distribution of surface nutrients were not associated with the dumping sites. Based on these observations and variations in the proportion of ammonia in the DIN pool, estuarine runoff was the major source of plant nutrients in the apex, both directly through the transport of DIN and indirectly through the transport of organic detritus which is decomposed in the water column.

Near-bottom DIN ranged from 2 to 24 μg-at l^{-1} with all concentrations but one less than 15 μg-at N l^{-1}. Bottom concentrations were lowest (less than 8 μg-at N l^{-1}) from May through July when the water column was well stratified. High concentrations were not observed in the dumping areas except in late April at station C3 (sludge dumping site) when the bottom

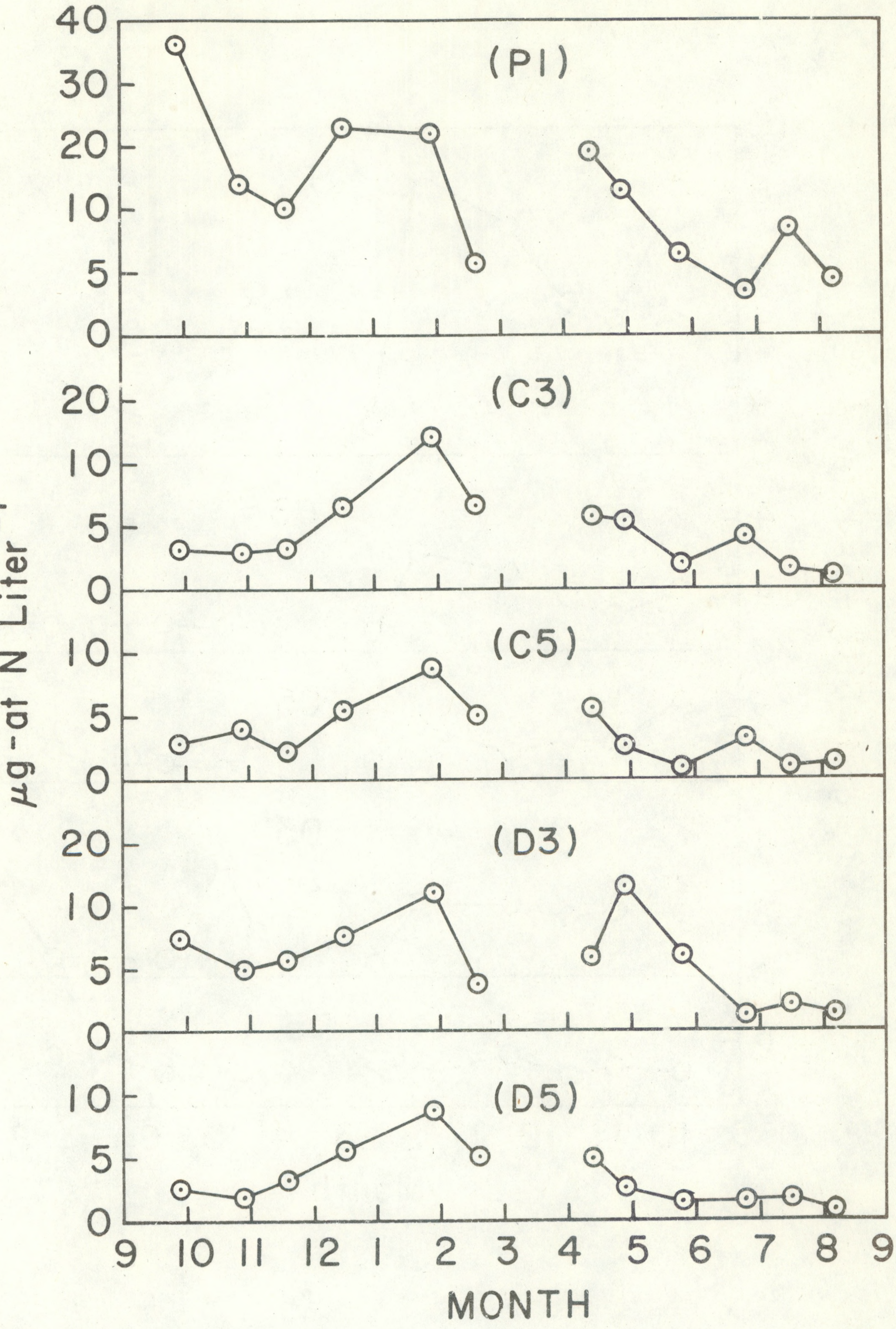

Figure 4. Monthly variations in mean mixed layer silicate concentration at stations P1, C3, C5, D3, and D5.

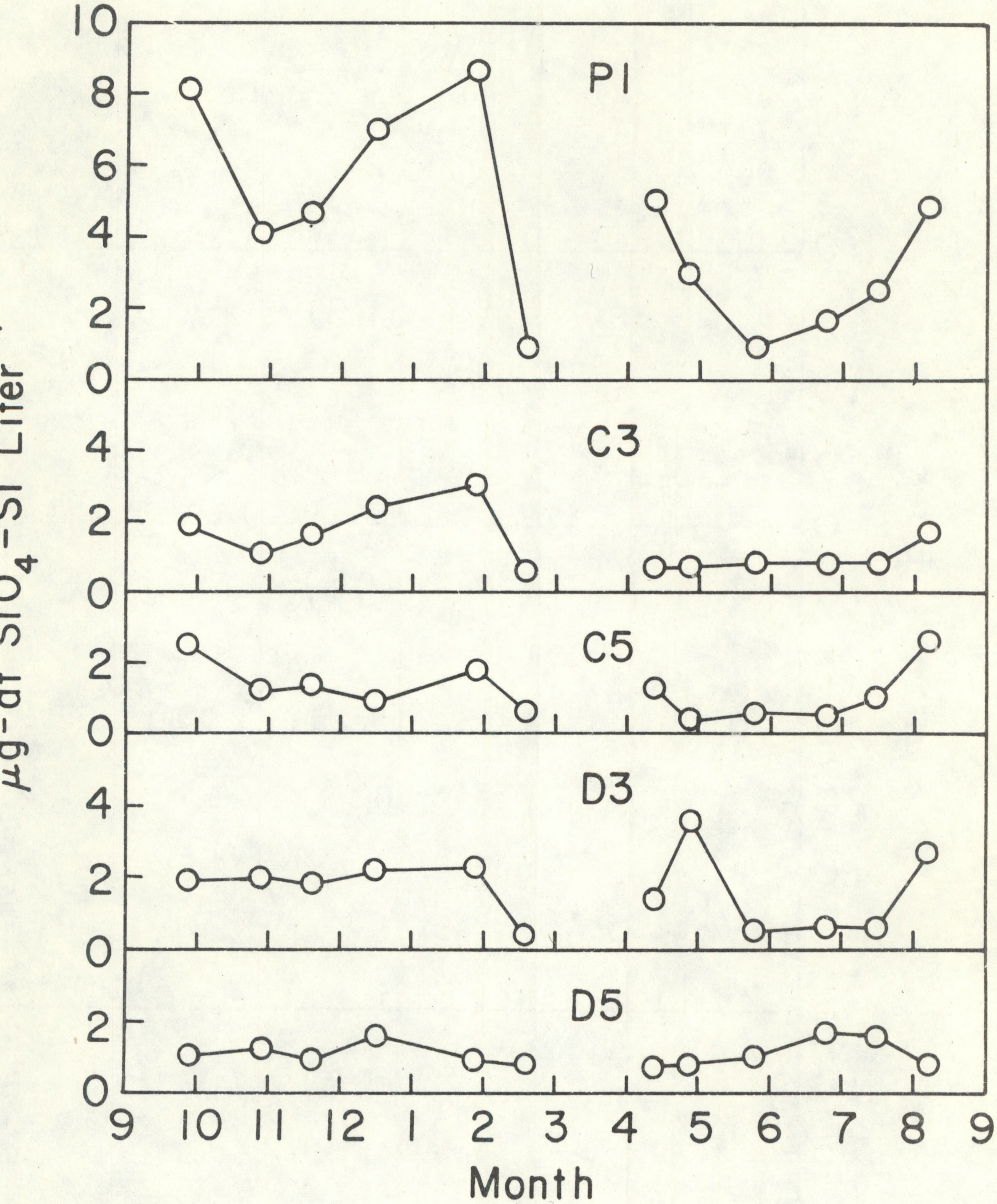

Figure 5. Monthly variations in mean mixed layer dissolved inorganic nitrogen (nitrate + nitrite + ammonia) concentration at stations P1, C3, C5, D3, and D5.

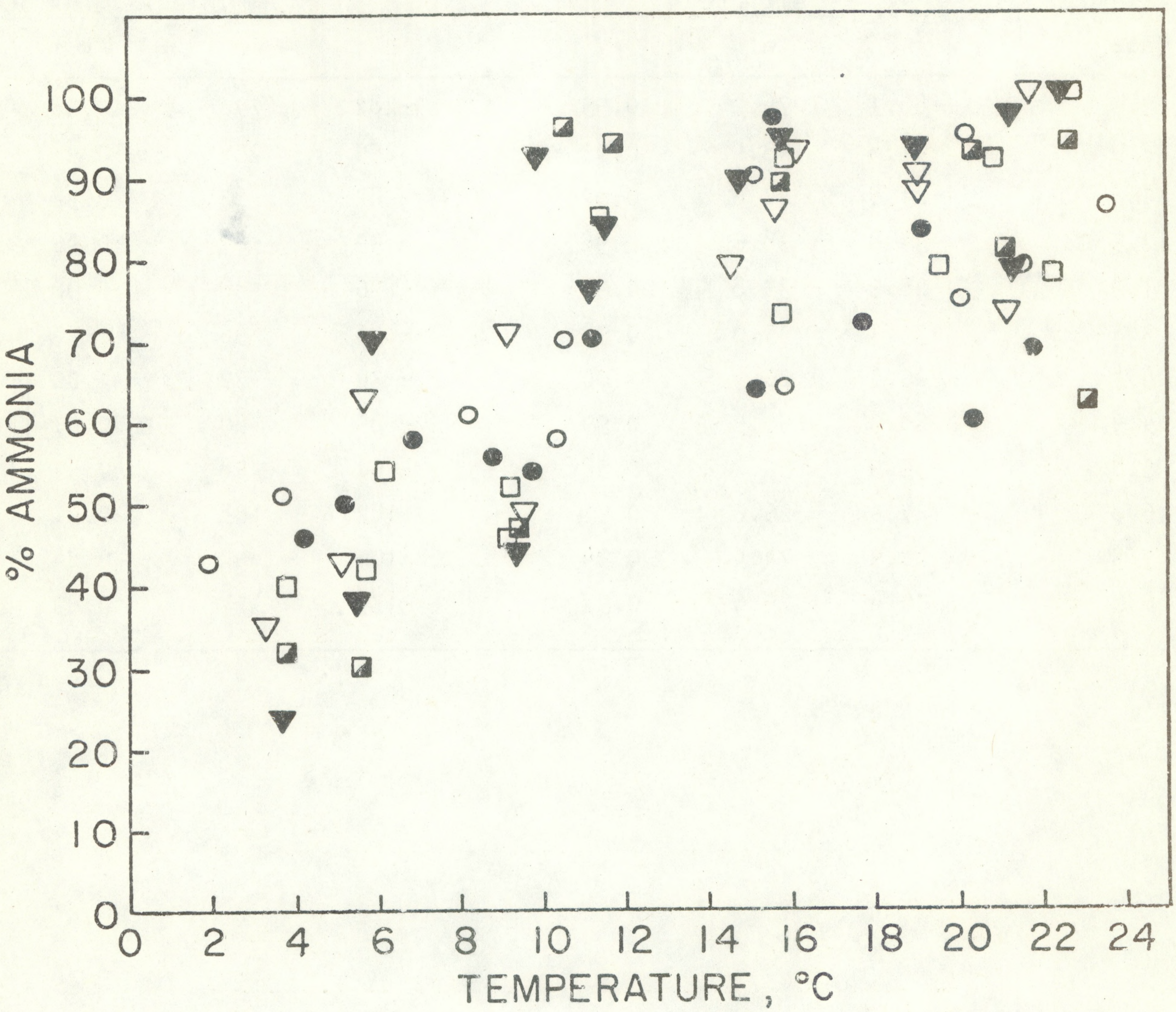

Figure 6. The proportion of ammonia in the dissolved inorganic nitrogen pool (percent of DIN) as a function of temperature in the surface mixed layer (○ - A3, ● - P1, ▽ - C3, ▼ - C5, □ - D3, and ◪ - D5).

Table 3. Linear Regression Analyses of Mean Mixed Layer Nitrate Plus Nitrate and Ammonia (μg-at l^{-1}) on Relative Salinity (Surface Salinity/Bottom Salinity at Station C5). All Correlation Coefficients (r) Significant ($P \leq 0.05$); b = Slope and a = Intercept

	Nitrate			Ammonia		
Date	b	a	r	b	a	r
9.9	-80.1	76.2	0.99	-282	271	0.98
10.9	-41.4	43.4	0.93	-255	256	0.98
11.6	-21.8	22.6	0.92	- 82	83	0.97
12.5	-34.8	38.6	0.98	- 59	63	0.96
1.9	-28.9	33.8	0.96	- 36	38	0.98
2.6	-33.3	35.0	0.98	- 36	36	0.97
4.4	-25.6	26.4	1.00	- 30	32	1.00
4.9	-50.9	50.5	0.99	- 85	80	0.97
5.8	-35.9	33.2	0.98	- 61	58	0.97
6.8	-27.5	26.6	0.91	-182	168	0.91
7.5	-26.9	24.5	0.94	-101	92	0.84
8.2	-30.4	29.6	0.97	-133	127	0.99

concentration of ammonia was 21.9 µg-at N l^{-1}. This suggests that the effects of dumping on local DIN concentrations are short-term because of dilution by estuarine and coastal waters. Decomposition of resuspended organic detritus originally introduced by dumping may represent an important input of DIN which is not localized in the dump sites themselves, but contributes to the general background of ammonia in the apex (except for short periods immediately following a dump). Assuming that most solids introduced by dumping sink to the bottom or into bottom water during periods of thermal stratification (May through August) and that regeneration rates are low during cold months (December through February) as our data indicate, the influx of low salinity estuarine water is probably the major source of nutrients over most of the year.

Atomic ratios of nitrogen:phosphorus (N:P) were generally (80 percent of the values) less than 10, especially during July, August, and September when ratios below 5 characterized the apex.[1] Ratios above 10 were observed most frequently in January and April which coincide with peaks in the proportion of estuarine water in the apex. The low N:P ratios characteristic of the mixed layer in the apex most of the year support Ryther and Dunstan's (1971) conclusion that phytoplankton productivity in the bight is not phosphorus limited. The data also indicate that DIN could limit phytoplankton growth, especially during the summer when DIN and N:P were lowest. However, these data must be interpreted with caution given the continuous input of nutrient-rich estuarine water, the increased proportion of estuarine water in the photic zone caused by thermal stratification, high rates of nitrogen regeneration during the summer, and that DIN remained at or above 1 µg-at N l^{-1}.

3.3 Solar Radiation and Light Extinction

Mean photic zone light energy ranged from 6 ly d^{-1} in December to 105 ly d^{-1} in July (fig. 7) as the result of variations in incident radiation and extinction of downwelling radiation. Extinction coefficients varied from 0.2 to 1.7 m^{-1}, with low coefficients characteristic of the apex in November and high coefficients characteristic in June. Light extinction was significantly correlated ($P < 0.01$) with surface microseston concentrations (fig. 8). Mean water column concentrations of microseston (TMS) in the apex ranged from 4 to 12 mg l^{-1}, of which 7 to 49 percent was oxidizable organic matter. Assuming a C:Chl ratio of 35 (cf. Eppley, 1972), phytoplankton averaged 2.8 ± 1.5 percent (1 s) of the TMS except during February and June when phytoplankton averaged 5.8 ± 2.1 percent (1 s). Thus, with the possible exception of February and June, light attenuation in the apex resulting from absorption and scattering by TMS was primarily a function of the concentration of nonphotosynthetic particles.

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[1] Phytoplankton N:P ratios are usually between 10 and 15 when growing under nutrient-rich conditions. Therefore, N:P ratios (DIN:P) of less than 10 in the photic zone indicate that the nitrogen pool will be exhausted before the phosphorus pool.

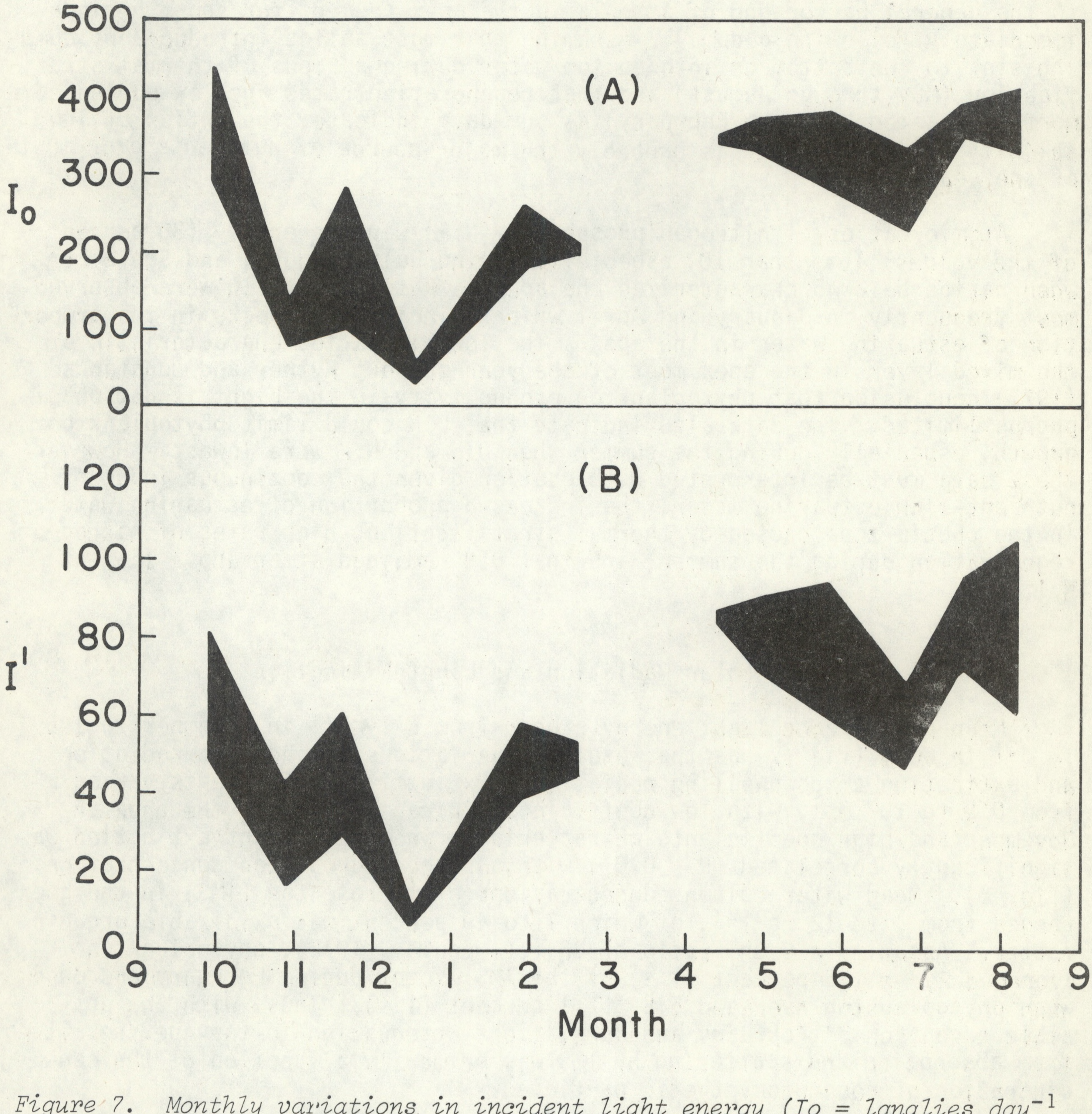

Figure 7. Monthly variations in incident light energy (Io = langlies day^{-1} (ly d^{-1}) = gcal cm^{-2} d^{-1}) and mean photic zone light energy (I' = ly d^{-1}), showing the range of values observed during each cruise.

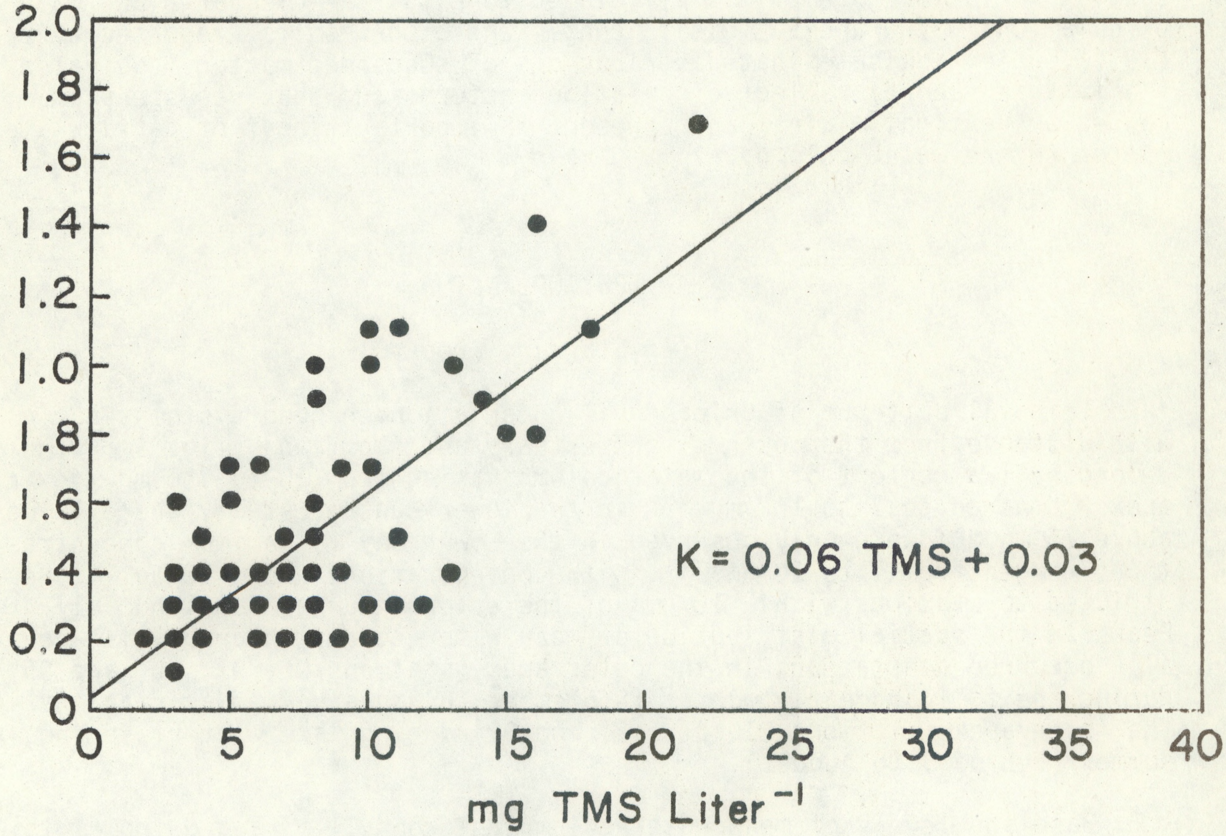

Figure 8. Mean extinction coefficient (Secchi disc) as a function of surface microseston concentration ($r = 0.72$, $P < 0.01$).

Three processes potentially contributed to the suspended load in the apex: estuarine discharge, dumping, and vertical mixing. While it is clear that ocean dumping is a major, highly localized input of solids (see section 1.0), dumping *per se* does not appear to affect ambient levels of microseston except over time intervals of less than 1 day. The effects of vertical mixing are difficult to evaluate, although TMS was highest in the fall when vertical stability was least. Spatial variations in surface TMS were negatively correlated ($P < 0.05$) with salinity during each cruise (table 4), suggesting that much of the TMS in the apex was of estuarine origin. It is likely that vertical mixing tends to maintain a background level of TMS, which varies from month to month depending on vertical stability, and that spatial variations are primarily related to estuarine discharge and water circulation in the apex. This is consistent with results, reported by Drake (1974), which indicate that distributions of suspended matter (equivalent to TMS in this report) reflect circulation patterns and that resuspension caused by vertical mixing can represent an important input of particulate matter to the water column.

4. PHYTOPLANKTON

4.1 Standing Crop

Temporal patterns of chlorophyll-*a* variation changed systematically with distance from the mouth of the estuary and from land (fig. 9). The chlorophyll-*a* content of the water column varied from 10 to 210 mg m^{-2} in the apex (compared to 3 to 162 mg m^{-2} in the lower Hudson Estuary where values above 75 mg m^{-2} were only observed in the Lower Bay). Maximum concentrations ranged from 1 to 20 $\mu g\ l^{-1}$, with concentrations above 10 $\mu g\ l^{-1}$ restricted to stations within 10 nmi of the estuary during June and July. Peaks in the spatial distribution of mean water column chlorophyll-*a* generally occurred at stations in the outer apex (stations C3, D3, C5, and D5) during the fall and early winter (September to January) and at stations in the inner apex (stations P1, B2, C2, and D2) during late winter, spring, and summer (February to August).

Baseline levels of mean water column chlorophyll-*a* ranged from 1 to 2 $\mu g\ l^{-1}$ at all bight stations except D5 where the baseline concentration was about 0.5 $\mu g\ l^{-1}$ (fig. 9). The amplitude of increases above these baselines decreased with distance from the estuary. Peak concentrations at station P1 were 6 to 9 $\mu g\ l^{-1}$ compared to 7 $\mu g\ l^{-1}$ in the dumping areas and 3 to 4 $\mu g\ l^{-1}$ at stations C5 and D5. Peaks were observed in October, February, and June at stations P1, D2, D3, and D4; in February and June at stations C2, C3, C4, and D5; and in December and February at station C5. The October, February, and June peaks followed by about 1 month (the resolution of our sampling program) increases in the proportion of estuarine water in the apex (fig. 3). Thus, the amplitude, frequency, and phasing of peaks in phytoplankton biomass appear to be coupled with increases in estuarine discharge depending on distance from the mouth of the estuary and from the New Jersey coast. Stations P1, D2, D3, and D4 were most frequently affected by increased estuarine discharge. Station C5 appeared to be near the limits of the influence of estuarine water on phytoplankton standing crop. The

Table 4. Linear Regression Analyses of Surface Microseston Concentration (mg l^{-1}) on Relative Salinity (Surface Salinity/Bottom Salinity at Station C5). All Correlation Coefficients (r) are Significant ($P \leq 0.05$); b = Slope and a = Intercept

Date	b	a	r
9.9	-124	126	0.93
10.9	-178	189	0.83
11.6	- 92	97	0.98
12.5	- 15	20	0.90
1.9	- 9	13	0.81
2.6	- 11	15	0.86
4.4	- 16	19	0.99
4.9	- 36	36	0.96
5.8	- 33	35	0.93
6.8	- 26	28	0.78
7.5	- 36	38	0.77
8.2	- 56	59	0.84

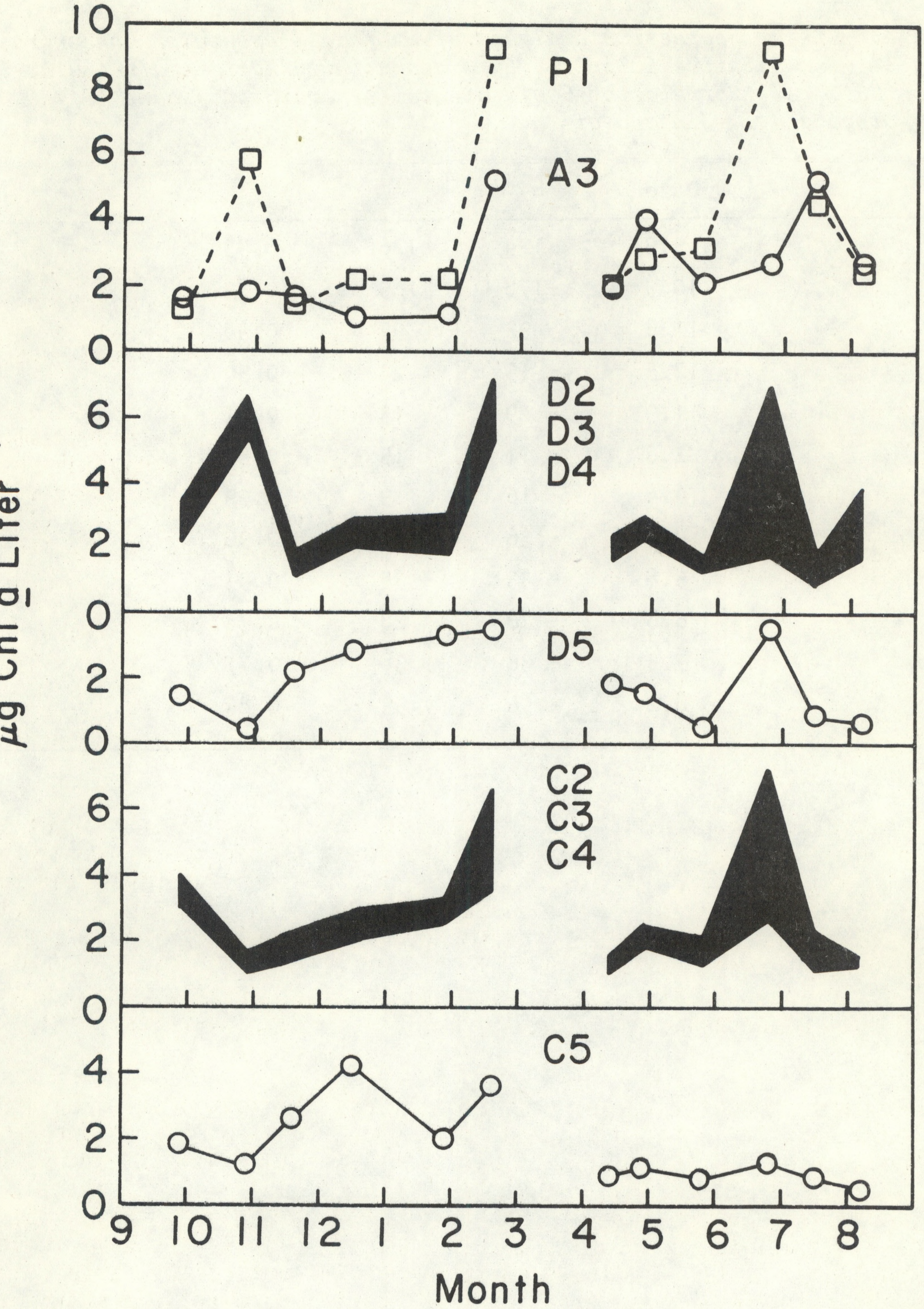

Figure 9. Monthly variations in mean water column chlorophyll-a concentration at stations A3, P1, C2, C3, C4, C5, D2, D3, D4, and D5.

occurrence of peaks exclusively during the winter and the persistently low chlorophyll-a concentrations observed during the spring and summer at this station suggest that temporal variations were influenced more by the influx of offshore coastal water than by estuarine discharge.

4.2 Productivity

Baseline levels of phytoplankton productivity in the apex ranged from 0.5 to 1.0 g C m^{-2} d^{-1} except at the outer stations (C5 and D5) where baseline productivity levels were 0.1 to 0.5 g C m^{-2} d^{-1}. Temporal variations near the mouth of the estuary and in the dumping areas exhibited June maxima of 3 to 6 g C m^{-2} d^{-1} and secondary peaks in February of about 2 g C m^{-2} d^{-1} (fig. 10). The amplitude of temporal variations was less at stations C5 and D5 where peaks of 1.0 to 1.5 g C m^{-2} d^{-1} were observed in September and February and in January and June, respectively. Annual production in the apex was about 370 g C m^{-2} in the Upper Bay), which is roughly equivalent to values quoted by Ryther (1969) for upwelling systems and by Riley (1956) for Long Island Sound. Netplankton and nanoplankton accounted for 41 and 59 percent of the annual production, respectively.

These levels of phytoplankton productivity require that dissolved inorganic nutrients be continuously supplied to the photic zone, especially during the summer months. Based on ambient DIN concentrations in the photic zone and assuming a carbon:nitrogen (C:N) assimilation ratio of 5 (Eppley et al., 1973), complete nitrogen depletion would occur in the apex within 0.4 to 3 days over most of the year (table 5).

Phytoplankton productivity also represented a significant input to the pool of particulate organic carbon in the apex. Water column levels of particulate organic carbon (POC) were relatively constant varying from 6 to 21 g C m^{-2}, with 63 percent of the values between 8 and 12 g C m^{-2}. Estimated levels of phytoplankton carbon (assuming a carbon:chlorophyll (C:Chl) ratio of 35) rarely exceeded 20 percent of the POC (table 6), although the time required for phytoplankton to produce an amount of organic carbon equivalent to the pool of organic detritus was less than 5 days over most of the year (table 5).

Primary productivity per unit photic zone chlorophyll-a (P/B) showed little variability between stations throughout the year except during July and August when P/B at station C5 was much lower than at stations A3 and C3 (fig. 11). P/B was generally less than 40 g C/g Chl • day except during June, July, and August when P/B ranged from 50 to 120 g C/g Chl • day. Temporal variations in the assimilation number followed the same trend as P/B and tended to be relatively uniform over the entire apex area (fig. 11). These observations suggest that observed spatial gradients in nutrient concentrations had little effect on phytoplankton growth except possibly at station C5 during July and August.

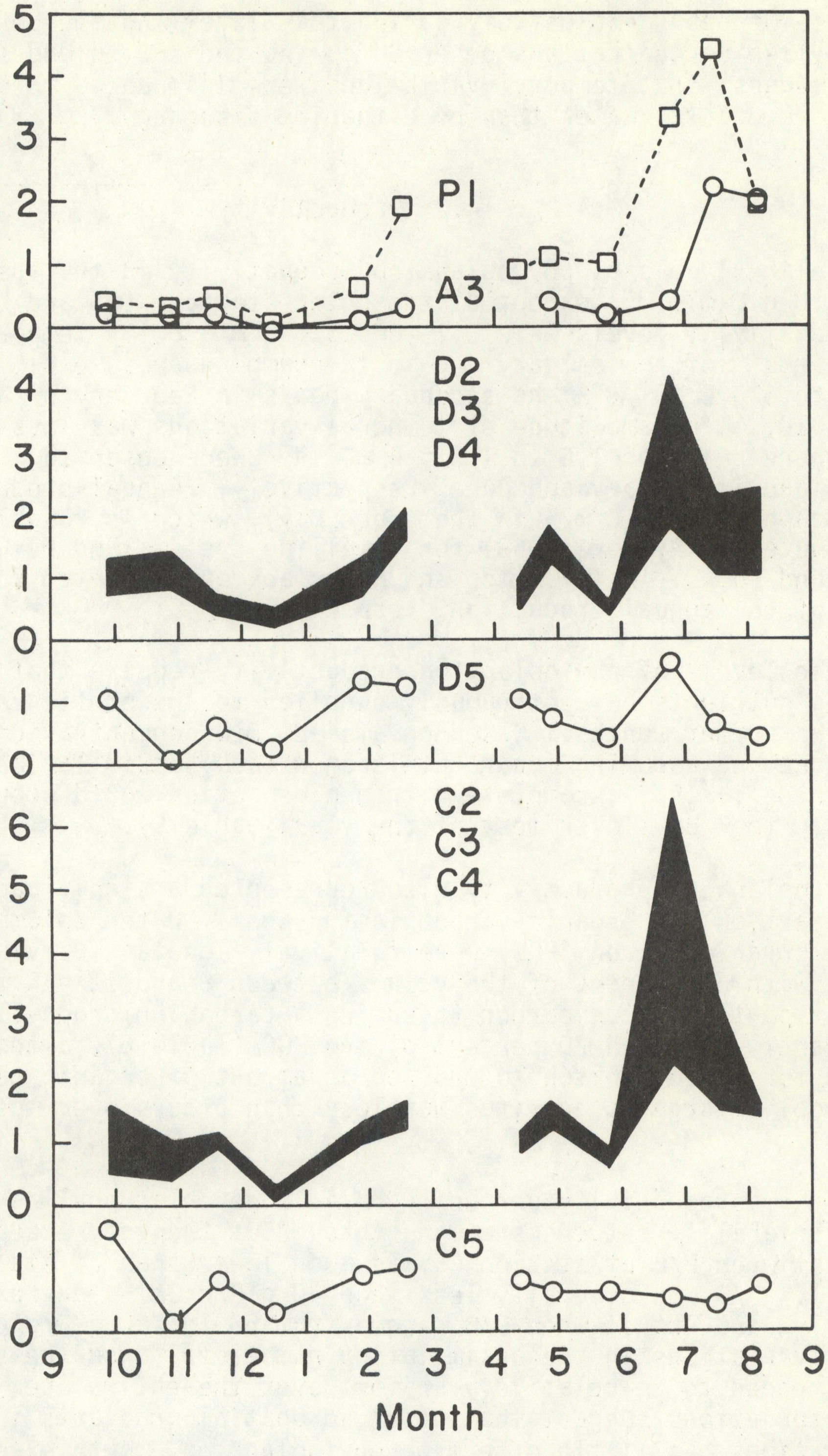

Figure 10. Monthly variations in photic zone primary productivity at stations A3, P1, D2, D3, D4, D5, C2, C3, C4, and C5 (values for stations P1, D2, D3, D5, C2, and C4 were calculated from measured chlorophyll-a concentrations and from productivity/chlorophyll-a at stations A3, C3, and C5).

Table 5. Estimated Times Required for Phytoplankton to Produce an Amount of Carbon Equal to the Standing Stock of Detrital Carbon and to Assimilate the Standing Stock of Dissolved Inorganic Nitrogen

Date	Detrital-C	Dissolved-N
9.9	2.8 days	1.5 days
10.9	13.8	10.0
11.6	3.8	1.6
12.5	12.6	10.9
1.9	2.9	3.9
2.6	3.3	2.8
4.4	2.6	2.8
4.9	3.6	2.0
5.8	4.3	1.0
6.8	3.6	1.1
7.5	3.2	0.6
8.2	2.8	0.4

Table 6. Percent Phytoplankton by Weight of Particulate Organic Carbon in the Water Column

Date	A3	P1	C3	C5	D3	D5
9.9	1.0	5.8	12.6	10.0	10.0	6.7
10.9	5.7	12.8	7.8	5.0	20.0	2.5
11.6	5.0	--	15.0	15.2	9.5	13.6
12.5	2.8	6.9	13.9	27.5	17.3	19.1
1.9	2.7	12.3	21.2	13.8	15.0	27.5
2.6	12.2	34.1	19.0	16.1	28.1	20.4
4.4	4.2	10.5	10.7	7.3	13.8	14.0
4.9	7.8	13.4	17.0	10.0	13.0	11.4
5.8	4.0	8.2	8.5	5.6	6.5	3.4
6.8	6.2	27.1	17.5	7.6	10.2	10.0
7.5	11.7	15.0	10.0	3.1	6.2	4.5
8.2	5.3	9.7	8.2	3.6	6.8	4.0

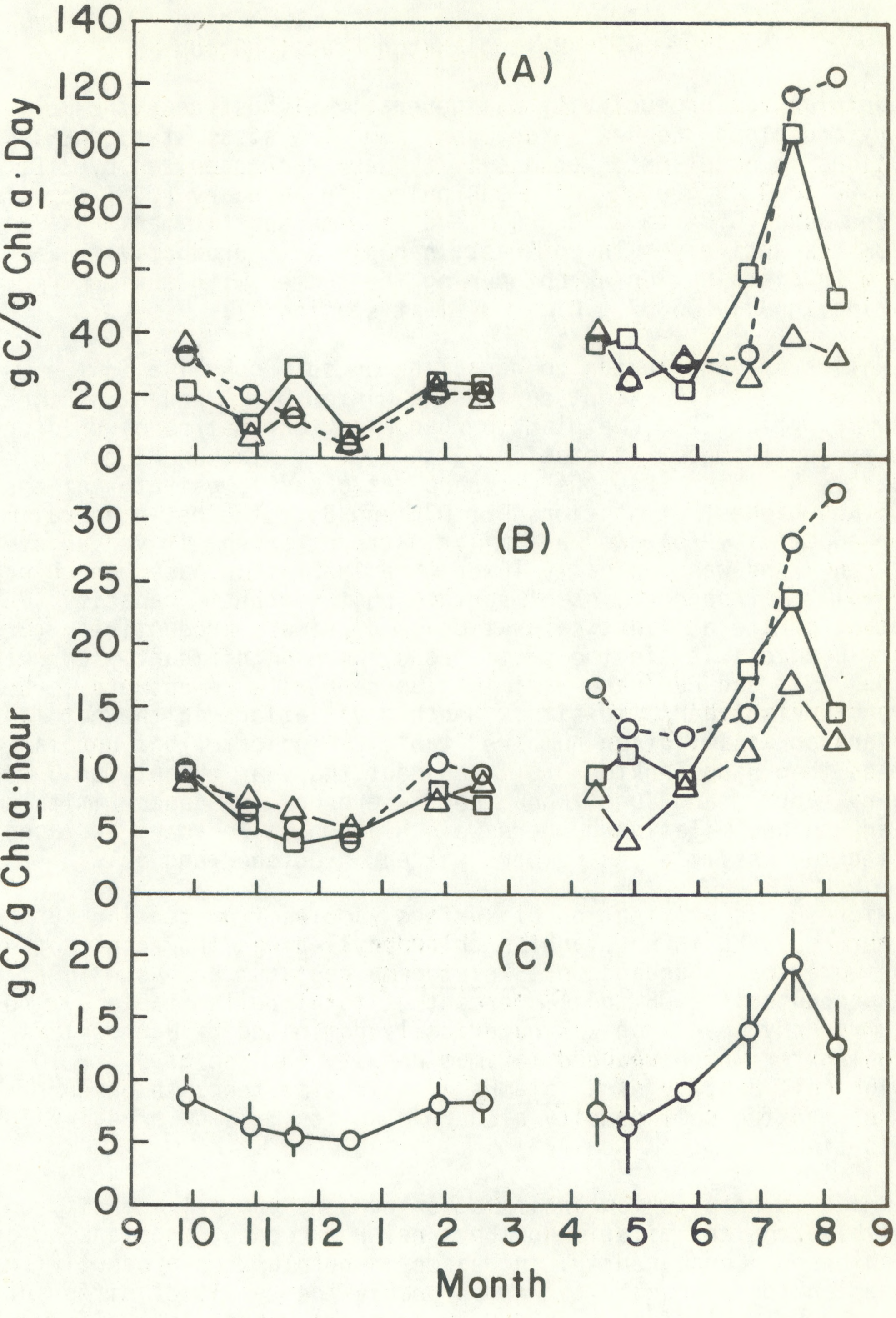

Figure 11. (A) Monthly variations in photic zone productivity/chlorophyll-a (g C/g Chl-a · day); (B) surface assimilation numbers (P_{max}/Chl = g C/g Chl-a · hr) at stations A3 (○), C3 (□), and C5 (△); and (C) mean assimiliation numbers (stations P1, C3, C5, D3, and D5) with 95-percent confidence limits (vertical bars).

4.3 Phytoplankton Fractionation

Netplankton productivity was generally highest near the mouth of the estuary and along the New Jersey coast and lowest at station C5. Temporal variations in netplankton productivity were characterized by a December minimum (0.02 to 0.09 g C m^{-2} d^{-1}) and pulses in February (0.81 to 1.67 g C m^{-2} d^{-1}) and June (0.84 to 2.20 g C m^{-2} d^{-1}) with spatial maxima at stations P1 and C3, respectively. In contrast, nanoplankton productivity was relatively uniform in distribution except during the summer with maximum productivity occurring in July (3.67 g C m^{-2} d^{-1}) at station P1.

Ratios of netplankton to nanoplankton chlorophyll-*a* in the water column fluctuated about 1.0 except during the winter bloom and at station D5 during the summer (fig. 12). Netplankton/nanoplankton (net/nano) chlorophyll-*a* ratio ranged from 4.2 at station C5 to 10.5 at station P1 during the February peak. At this time, the net/nano ratio was lowest at stations A3, C3, and C5 and highest at stations P1, D3, and D5. The net/nano ratio of primary productivity followed a similar pattern, except it varied over a narrower range and was typically lower than the ratios based on chlorophyll-*a* (fig. 13). Net/nano ratios of surface photosynthetic capacity (P_{max} = photosynthetic rate at light saturation) and primary productivity (Prod = daily primary productivity in the photic zone) were significantly correlated (see section 2.3), and net/nano assimilation numbers were assumed to be representative of relative P/B *in situ*. Monthly variations in the netplankton and nanoplankton assimilation numbers (table 7) indicate that netplankton P/B was less than nanoplankton P/B throughout the year except for 3 months, February, April, and June, when the 95-percent confidence limits overlapped. Netplankton assimilation numbers were highest in February and June, while nanoplankton assimilation numbers peaked in October and July.

Microscopic examination of surface samples from station C3 shows that the February peak in netplankton chlorophyll-*a* was the result of an increase in the numerical abundance of *Skeletonema costatum* and *Asterionella japonica* which accounted for 66 and 18 percent of total cells (table 8), respectively. The summer phytoplankton was numerically dominated by *Nannochloris atomus*, a nanoplankter which reached maximum density in June of 4.2 x 10^9 cells l^{-1}. The high cell density of *N. atomus* at this time tends to obscure the fact that netplankton cell density also reached its maximum of 4.1 x 10^6 cells l^{-1} at this time.

Peaks in netplankton assimilation numbers and cell density coincided, but netplankton assimilation numbers never exceeded nanoplankton assimilation numbers. Consequently, increases in netplankton productivity relative to nanoplankton productivity were probably the result of differential cropping rates (circulation, sinking, or grazing) rather than differential growth rates. Similar observations have been reported for upwelling systems off the California coast (Malone, 1971).

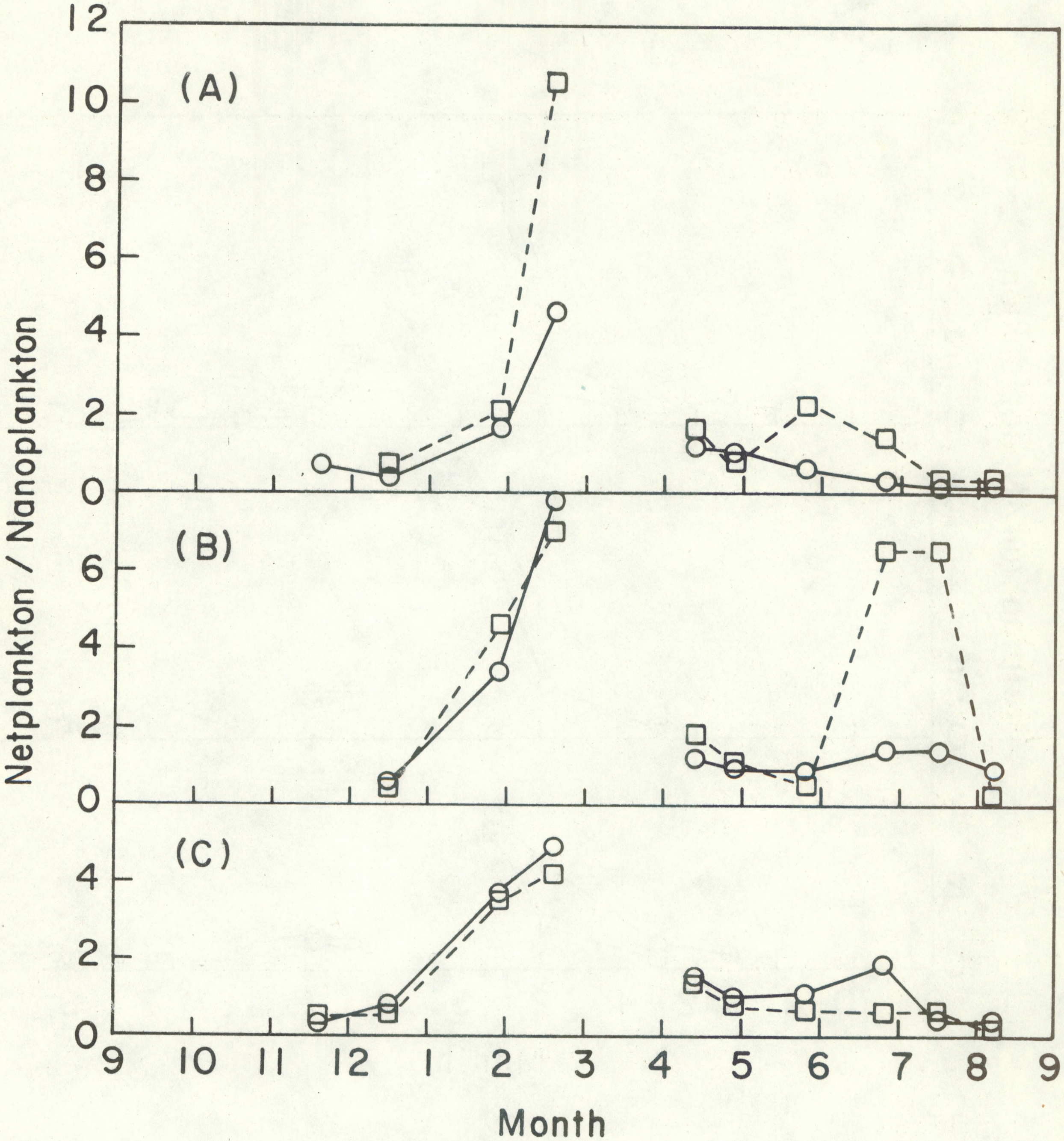

Figure 12. Monthly variations in the netplankton/nanoplankton ratio of water column chlorophyll-a: (A) stations A3 (○) and P1 (□); (B) stations D3 (○) and D5 (□); and (C) stations C3 (○) and C5 (□).

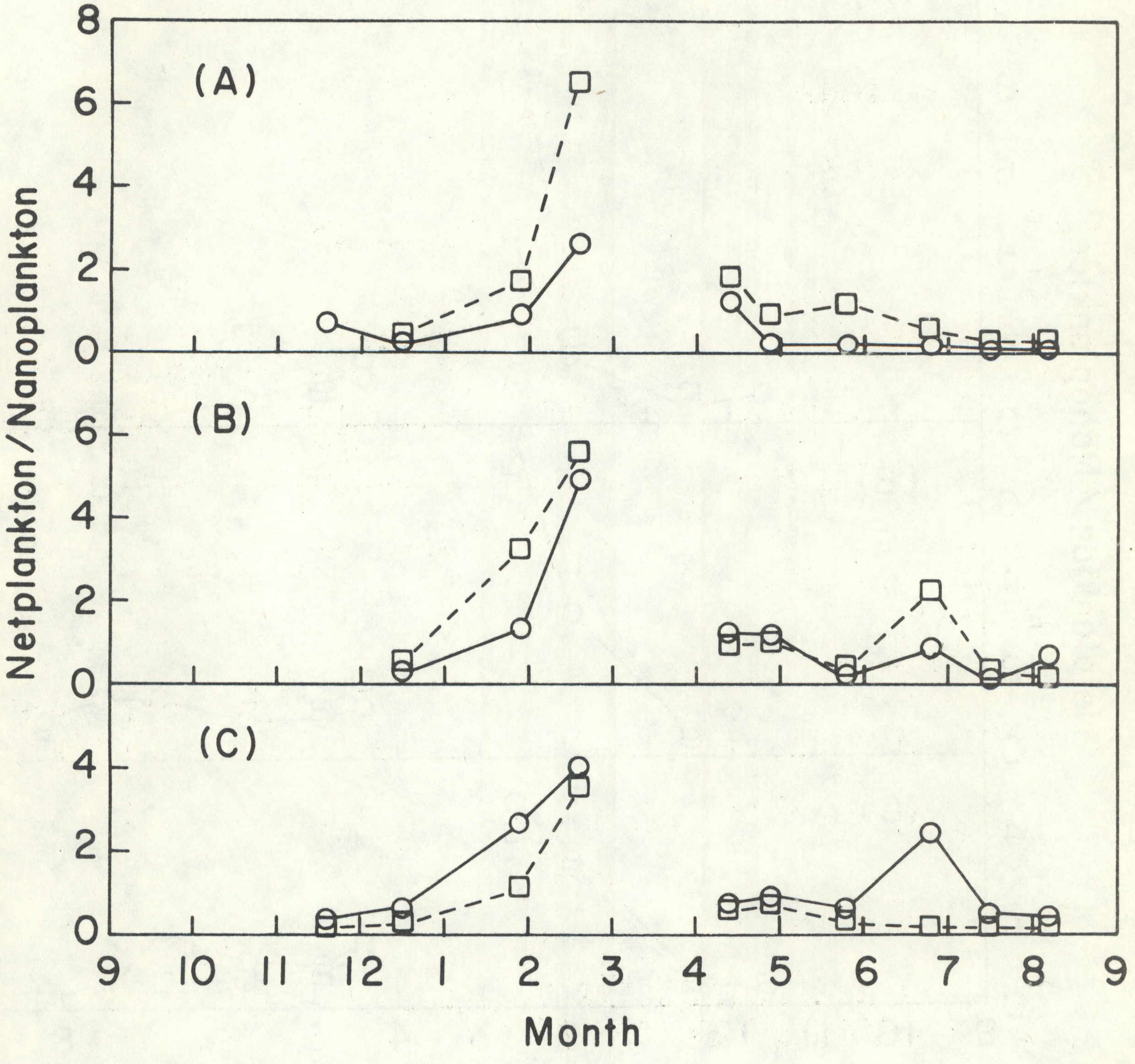

Figure 13. Monthly variations in the netplankton/nanoplankton ratio of photic zone primary productivity: (A) stations A3 (○) and P1 (□); (B) stations D3 (○) and D5 (□); and (C) stations C3 (○) and C5 (□).

Table 7. Monthly Variations in Mean Netplankton and Nanoplankton Assimilation Numbers (P_{max}/Chl; Stations A3, P1, C3, C5, D3, and D5) With 95-Percent Confidence Limits

	Netplankton		Nanoplankton	
Date	mean	95%CL	mean	95%CL
12.5	3.2	0.7	6.3	1.1
1.9	6.5	1.2	13.6	5.7
2.6	7.8	1.3	10.6	2.5
4.4	6.2	2.5	9.2	4.4
4.9	4.7	3.5	6.8	2.9
5.8	3.6	2.9	12.9	1.3
6.8	10.6	1.9	19.4	8.4
7.5	9.1	3.3	21.3	1.6
8.2	4.9	1.6	16.2	3.4

Table 8. Nanoplankton and Netplankton Cell Densities (x 10^6 l^{-1}) and Dominant Species (Smallest Number of Species Whose Cumulative Abundance Exceeded 75-Percent of Total Cells) in Surface Samples From Station C3

Date	Net	Nano	Total	Dominant organisms
9.9	1.8	1.4	3.2	Ld, O
10.9	0.7	0.4	1.1	Sc, Rf
11.6	0.1	0.6	0.7	O
12.5	0.4	0.3	0.7	Sc, T, Tn
1.9	1.5	0.2	1.7	Sc, Aj, T
2.6	3.0	0.4	3.4	Sc, Aj
4.4	0.3	0.2	0.5	Rd, Ns, Sc
4.9	0.4	0.2	0.6	Ld, Sc, Rd
5.8	0.1	0.1	0.2	Na, Cl
6.8	4.1	823	823.4	Na
7.5	0.4	4200	4204.1	Na
8.2	0.7	83	83.7	Na

Ld = Leptocylindrus danicus, O = nanoplankton,

Sc = Skeletonema costatum, Rf = Rhizosolenia faeroense,

T = Thalassiosira sp., Tn = Thalassionema nitzschioides,

Aj = Asterionella japonica, Rd = Rhizosolenia delicatula,

Ns = Nitzschia seriata, Na = Nannochloris atomus,

Cl = Ceratium longipes.

5. COPEPOD BIOMASS

Copepods were the most abundant group of macrozooplankton in the apex throughout the year. Temporal variations in copepod biomass (dry weight) were characterized by a baseline of 5 to 10 mg m^{-3}, a November maximum, a secondary peak in May, and a winter low from January through April (fig. 14). The only exception to this pattern was observed at station C3 where peaks occurred in September, November, and July. In contrast with phytoplankton biomass, the amplitude of these peaks increased with distance from the estuary, and the peaks were highest along the New Jersey coast where maximum copepod biomass was observed at station D5.

Peaks in copepod and phytoplankton biomass were out of phase with each other, but only at station D3 did peaks in copepod biomass consistently follow phytoplankton peaks (fig. 15). In fact, zooplankton biomass was greatest at stations C5 and D5 before major increases in phytoplankton abundance. This implies that zooplankton growth was not food-limited over much of the year and that the zooplankton biomass observed at the outer stations was a consequence of advective transport into the area rather than growth within them. The winter phytoplankton bloom was probably caused more by decreased zooplankton grazing than by increased phytoplankton growth rates. Low temperatures and lack of a zooplankton response to the winter phytoplankton bloom suggest that zooplankton growth was temperature-limited at this time.

6. CONCLUSIONS

6.1 Environmental Regulation

Phytoplankton productivity is a function of phytoplankton biomass and the specific growth rate of that biomass. In this report, chlorophyll-*a* is assumed to be an index of phytoplankton biomass, and production per unit chlorophyll-*a* (P/B = gC/gChl · day) is an index of growth rate. The assimilation number (gC/gChl · hr at light saturation) can be considered an index of the maximum potential growth rate for a given temperature and nutrient regime. Eppley (1972) has reviewed the errors associated with these assumptions caused by environmentally induced variations in the C:Chl ratio.

Mean mixed layer DIN varied between 1 and 14 μg-at l^{-1}, with maximum concentrations during the winter and minimum concentrations during the summer exclusive of station P1 (fig. 5). Atomic N:P ratios rarely exceeded 10, and both DIN and N:P were depressed during phytoplankton blooms. However, the DIN pool in the apex was never depleted, and phytoplankton assimilation numbers were highest during the summer when DIN concentrations were lowest (fig. 11). These observations seem to rule out nitrogen as a growth controlling factor, even at station C5 where the influence of estuarine discharge was least. A more detailed time series during bloom periods is required to substantiate this conclusion.

Variations in photic zone P/B at stations A3, C3, and C5 (where direct measurements were made) were directly related to variations in mean photic

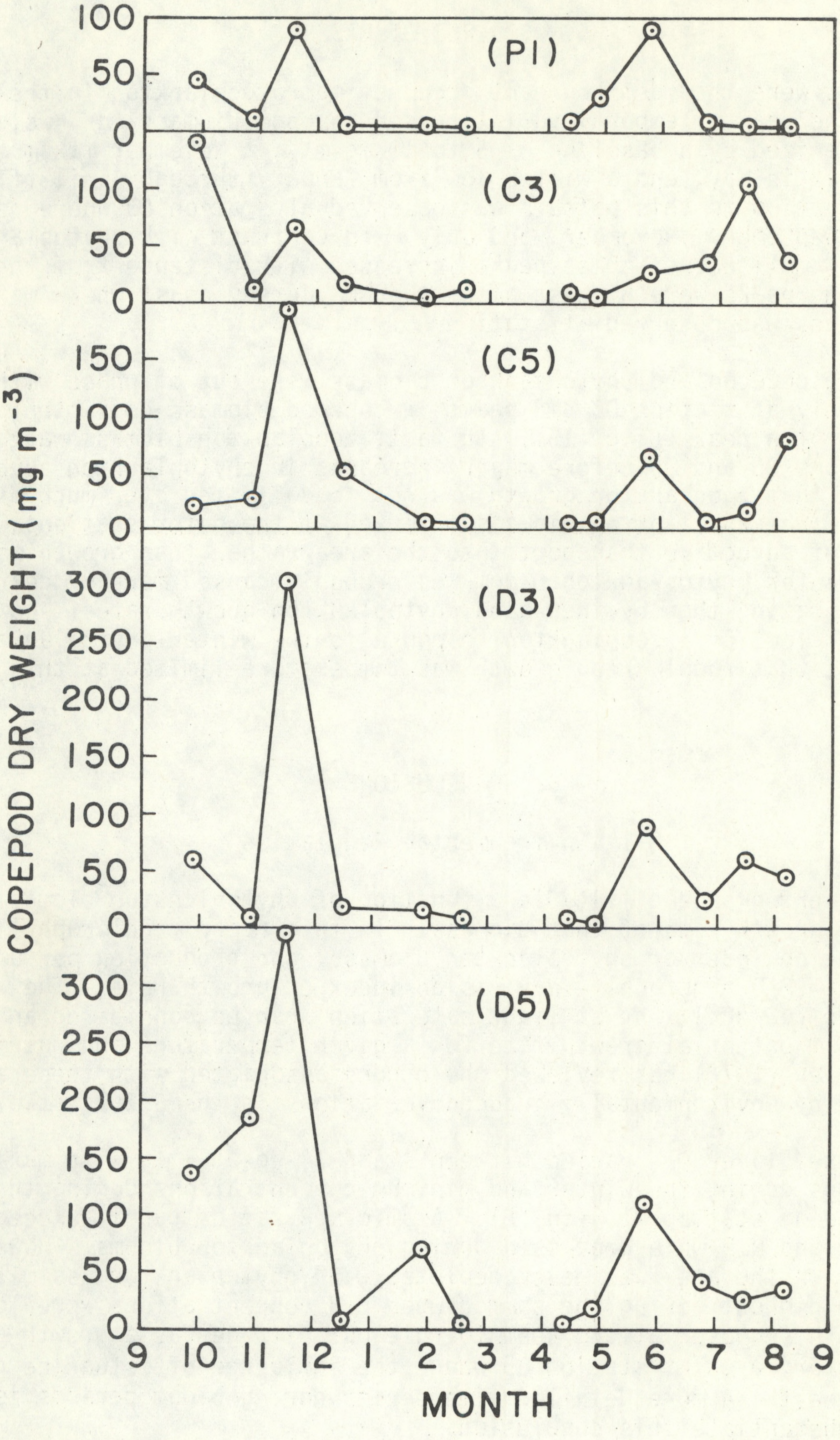

Figure 14. Monthly variations in copepod dry weight at stations P1, C3, C5, D3, and D5.

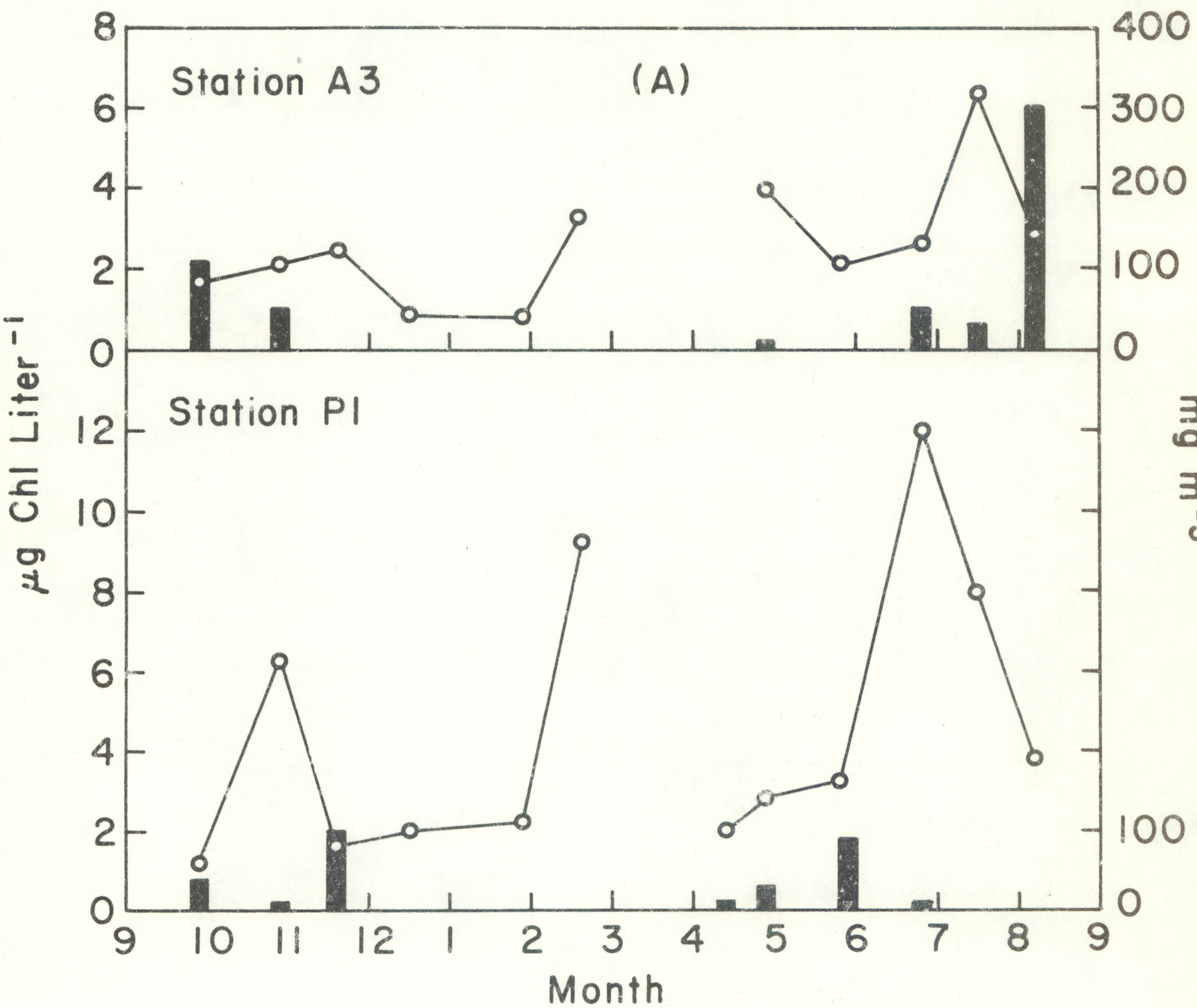

Figure 15A. Monthly variations in copepod dry weight (vertical bars, mg m^{-3}) and mean photic zone chlorophyll-a: stations A3 and P1.

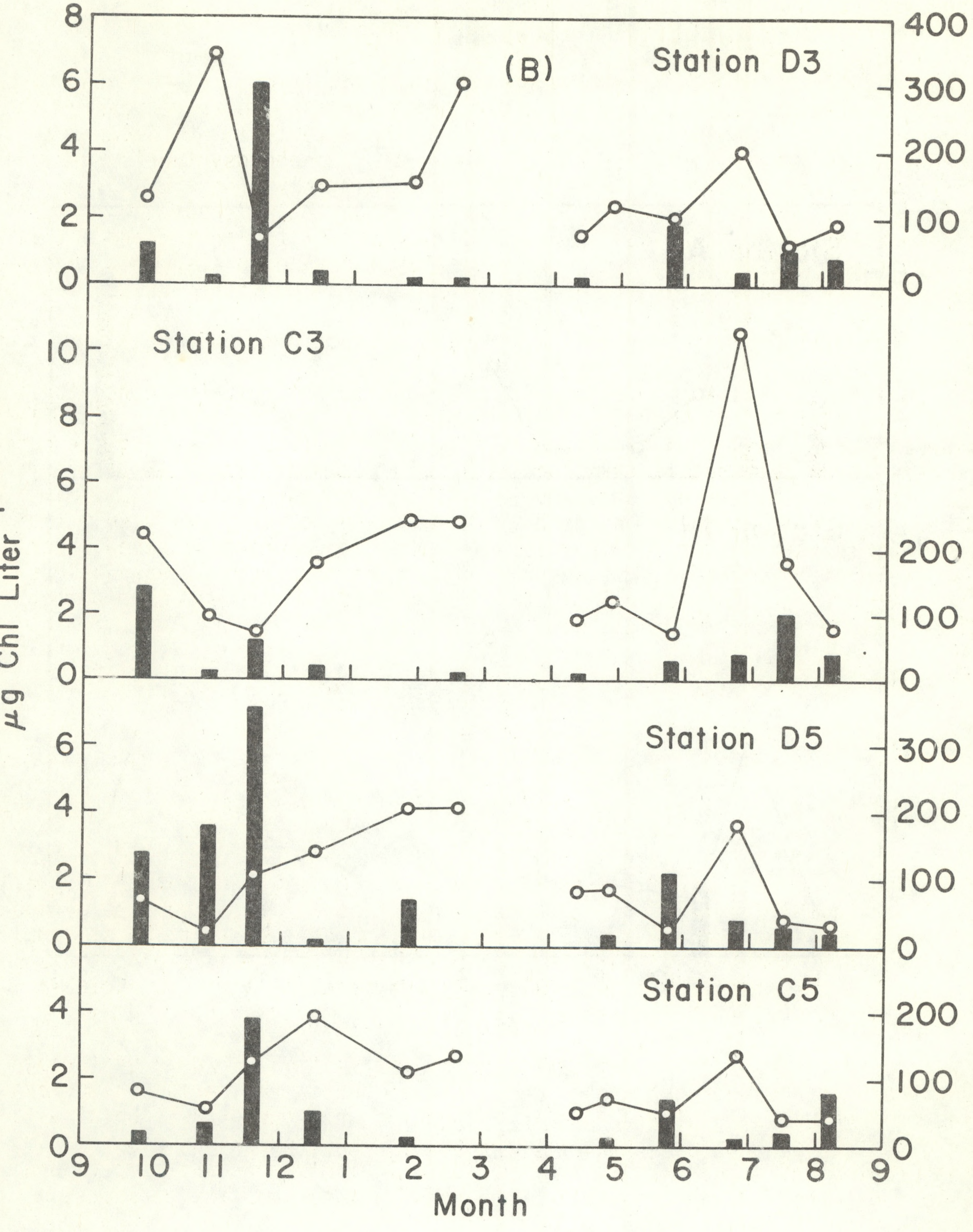

Figure 15B. Monthly variations in copepod dry weight (vertical bars, mg m^{-3}) and mean photic zone chlorophyll-a: stations D3, C3, D5, and C5.

zone radiation (I') (fig. 16). The regression $P/B = 0.43I' + 0.97$ was highly significant ($r = 0.968$, $P < 0.01$) and is good evidence that P/B, when based on productivity and chlorophyll-a values integrated over the photic zone, was light-limited, assuming steady-state conditions. Consequently, phytoplankton productivity in the apex can be expected to be responsive to changes in the rate of light attenuation in the water column. Because absorption and scattering were primarily caused by nonphotosynthetic particles (mostly sediments and organic detritus) derived mainly from the Hudson Estuary, any change in the detritus load of estuarine water or the volume transport of this water into the apex will affect phytoplankton productivity within the limited area of the apex (e.g., an increase in suspended load would result in a predictable decrease in P/B). In contrast, an increase in DIN supply to the apex will not affect phytoplankton productivity within the apex, but will increase the area over which productivity is high.

While assimilation numbers were not regulated by nutrient concentrations, variations in water temperature appeared to be important. Assimilation numbers were significantly correlated with temperature during the period of decreasing temperature from August through December (fig. 17A) and during the period of increasing temperature from April through July (fig. 17B). The high assimilation numbers observed in January and February may result from temperature acclimation (Eppley, 1972), a phenomenon which has been reported for Skeletonema costatum (Jorgensen, 1968). The two regression equations (with 95-percent confidence limits for the slopes) of assimilation number (P_{max}/Chl) on temperature (T) were:

$$\log_{10} (P_{max}/Chl) = 0.031 \pm 0.006\ T + 0.383 \qquad (1)$$

$$\log_{10} (P_{max}/Chl) = 0.045 \pm 0.007\ T = 0.261. \qquad (2)$$

The slope of equation (1) for the period of decreasing temperature ($Q_{10} = 2.04$) was significantly less than the slope of equation (2) for the period of increasing temperature ($Q_{10} = 2.82$). Thus, with the exception of January and February, temperature sets the upper limit on the maximum potential rate of photosynthesis per unit chlorophyll-a, and the limit is variable depending on whether temperature is decreasing or increasing.

It is interesting to note that the Q_{10} at station C5 was 2.04 throughout the year and that the higher Q_{10} observed during the period of increasing temperature also corresponds to the period when the proportion of estuarine water in the photic zone was greatest. This adds a new dimension to the problem and suggests that the two assimilation number and temperature relations observed may also reflect changes in water quality or species composition (Mandelli et al., 1970).

Takahashi et al. (1973) synthesized a mathematical model which calculates photosynthesis/chlorophyll (P/Chl) at any given point in time and space from the corresponding light intensity (I) and temperature (T). The model is based on Steele's (1962) expression of P/Chl,I and on a linear

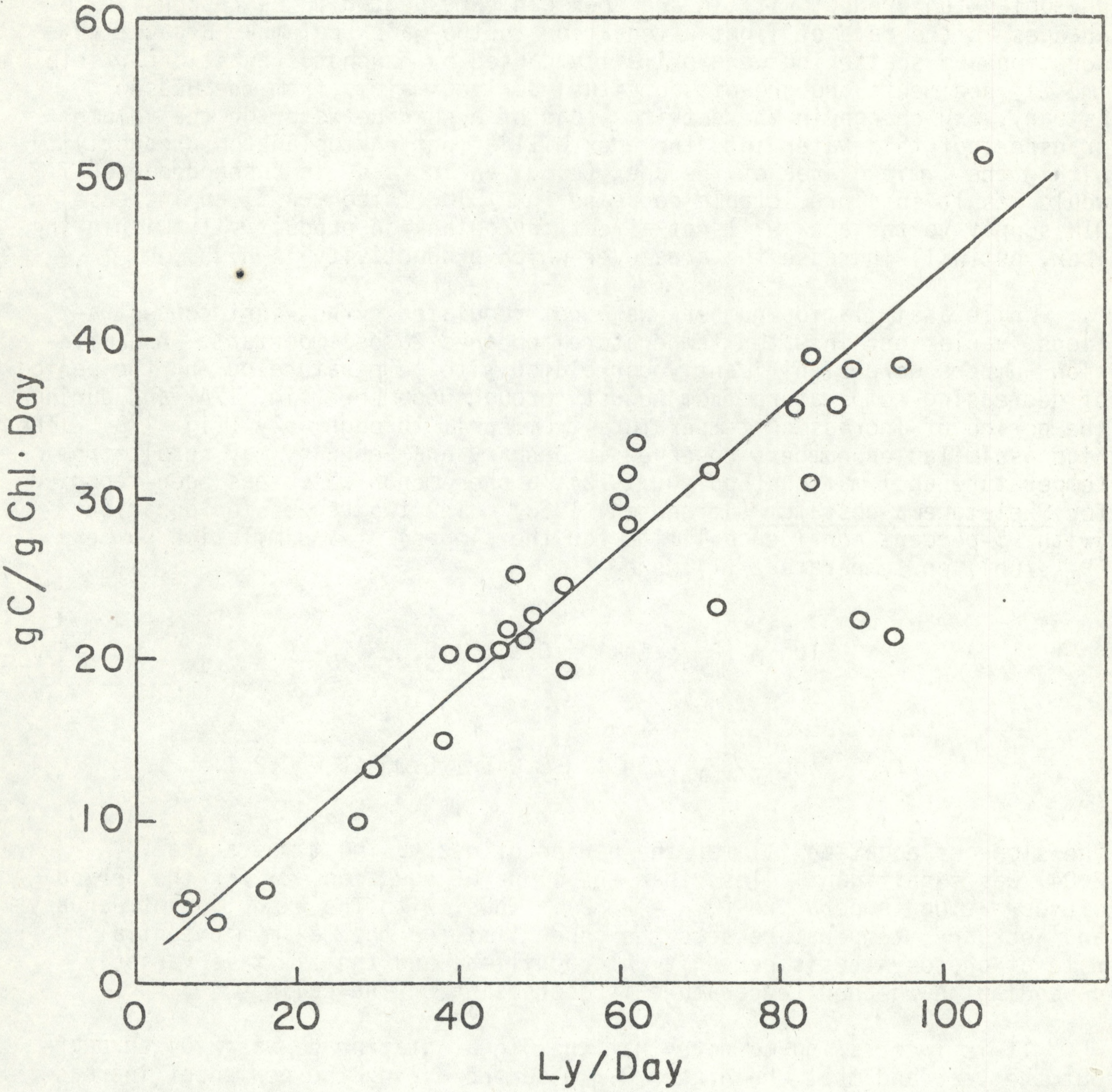

Figure 16. Phytoplankton productivity/chlorophyll-a (g C/g Chl-a · d) at stations A3, C3, and C5 as a function of mean photic zone light energy (ly d^{-1}); the regression Y = 0.43, X = 0.97 (r = 0.97, P < 0.01) is based on all points except two (Y = 20, 22 g C/g Chl-a · d; X = 90, 95 ly d^{-1}).

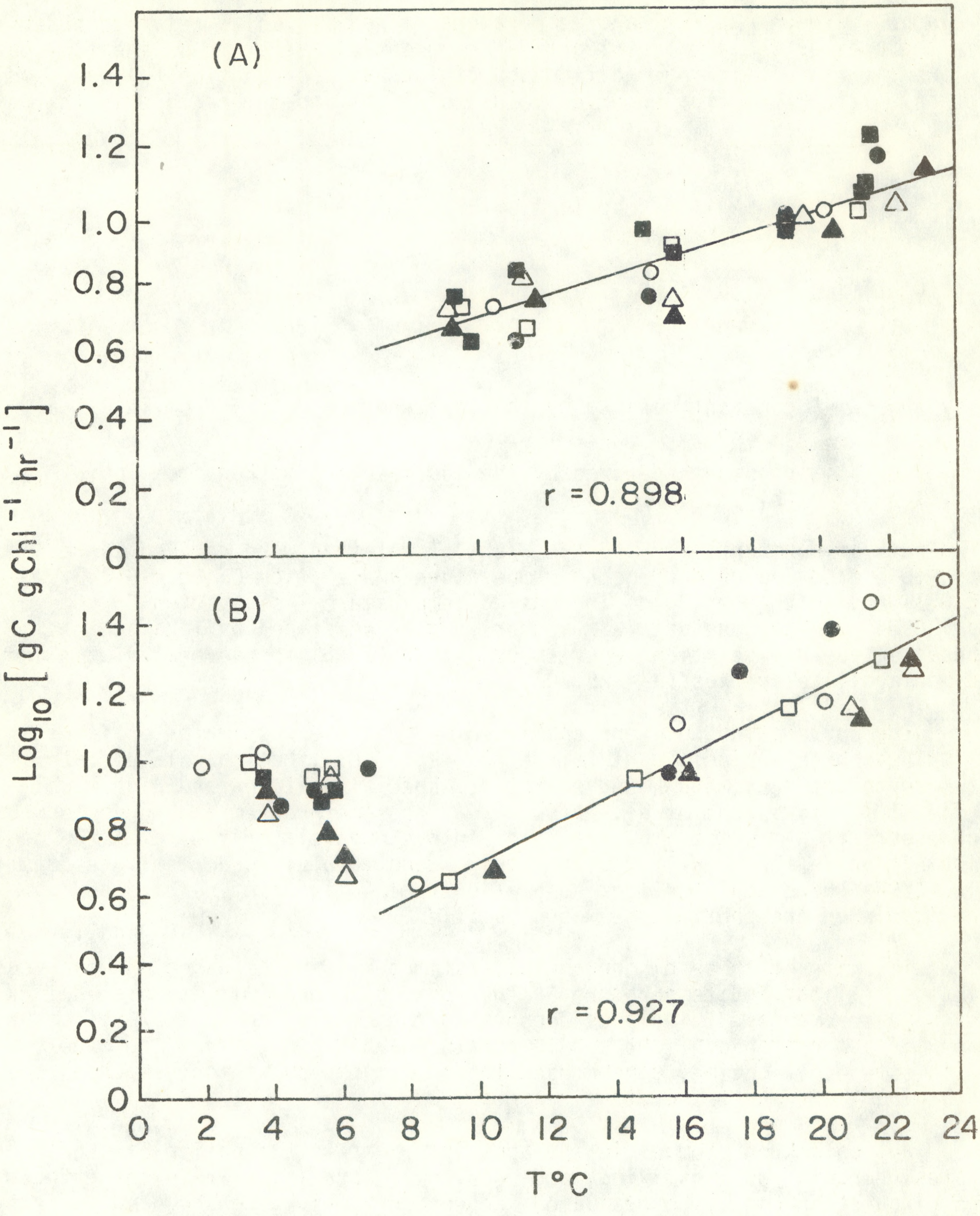

Figure 17. Log_{10} transformed assimilation numbers as a function of temperature (○ - A3, ● - P1, □ - C3, ■ - C5, △ - D3, ▲ - D5): (A) September through December 1973 and August 1974; and (B) April through July 1974. Assimilation numbers for station C5 conformed to the regression in fig. 15 (A) throughout the year except for January and February.

relation between P_{max}/Chl and temperature. The P_{max}/Chl,T relation observed in the apex of the New York Bight was exponential rather than linear. Consequently, the following modification of Takahashi's equation (7) was used to calculate P/Chl from observed values of light and temperature in the lower estuary and apex:

$$P/Chl = a \cdot I \cdot \exp\left(1 - a \cdot I \cdot 10^{-(d \cdot T + c)}\right) \qquad (3)$$

where P/Chl = G C Chl · hr,

- I = ly min^{-1},
- T = °C,
- a = constant derived by the least-square method from ln(P/I·e), I, and
- c, d = constants derived by the least-square method from $\log_{10}(P_{max}/$Chl),T.

Two sets of constants for the (P_{max}/Chl),T relation were derived corresponding to the period of decreasing temperature and station C5 (c = 0.383, d = 0.031) and to the period of increasing temperature less station C5 (c = 0.262, d = 0.045). The constant "a" was derived, as described by Takahashi et al., based on the P,I relation reported by Ryther (1956) for several diatom and dinoflagellate species (a = 25.40).

The correlation between calculated and observed estimates of in situ P/Chl was highly significant ($r = 0.821$, $P < 0.01$), but calculated rates tended to underestimate observed rates, especially at low and high P/Chl (fig. 18). Takahashi et al. encountered the same problem and suggested that underestimates might be the result of an overemphasis of the rate of photoinhibition in the model. However, this cannot explain underestimates of low P/Chl which could reflect adaptation to low light intensities during periods when the photic zone was stratified.

In spite of these discrepancies, estimates of P/Chl based on observed levels of light and temperature in the apex agree well with simulated in situ measurements. This lends support to the conclusion that P/Chl in the apex is a function of light and temperature and suggests that the model, with some modification, can be used to predict phytoplankton responses to changing light and temperature regimes.

Phytoplankton biomass in the apex is primarily a function of growth rates, circulation and mixing, and zooplankton grazing. While the effects of circulation cannot be evaluated, copepod dry weight can be used to estimate seasonal variations in grazing pressure. The most striking feature of the biomass distribution of copepods was the November maximum followed by a rapid decline to a January-February minimum (fig. 14). Phytoplankton productivity was simultaneously increasing to a peak in February (fig. 10), partially the result of an increase in P/B (fig. 11) but primarily the result of an increase in biomass (fig. 9). This supports the view that the winter phytoplankton bloom was a consequence of reduced grazing pressure, with the

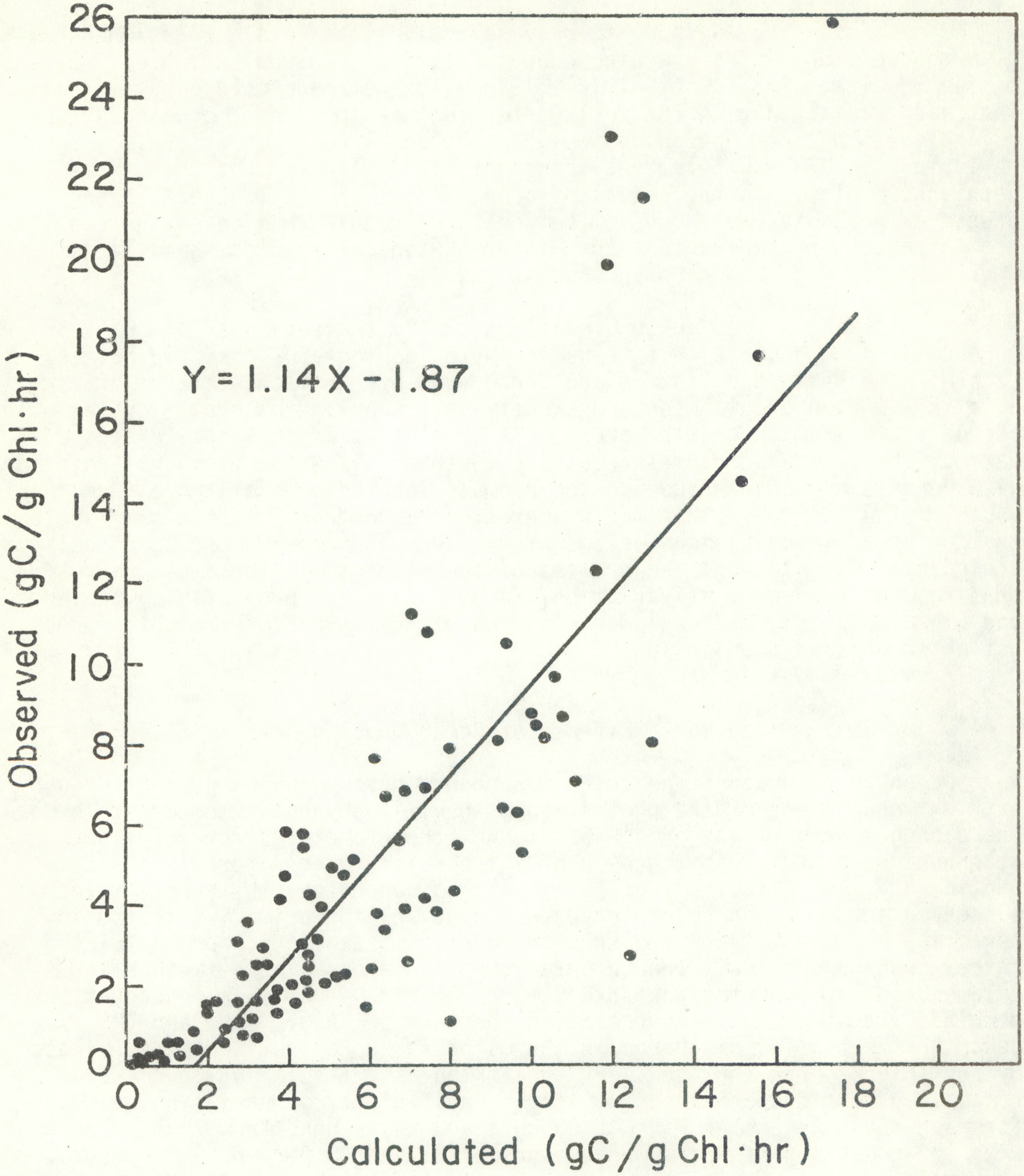

Figure 18. Regression of P/B (g C/g Chl-a · hr) measured at each light percent depth (simulated in situ) on P/B calculated by the mathematical model.

increase in P/B (presumably a reflection of the increased water column stratification observed during January and February) of secondary importance.

Copepods have been shown to prey selectively on netplankters when netplankton cell densities are high enough relative to nanoplankton cell densities (Mullin, 1963; Frost, 1972). Since the net/nano chlorophyll-a ratio increased rapidly during the fall-winter decline in copepod grazing pressure, as indicated by the copepod dry weight/chlorophyll-a ratio (fig. 19), and phytoplankton P/B was relatively constant, it is likely that the winter netplankton bloom was the result of a relaxation of zooplankton grazing pressure (probably caused by low temperature) rather than to an increase in growth rate. It appears that the winter phytoplankton bloom goes largely unused by resident zooplankton populations.

Phytoplankton-zooplankton relations during the remainder of the year are more complex. The fact that peaks in phytoplankton abundance did not coincide with peaks in zooplankton abundance suggests that zooplankton grazing does influence phytoplankton abundance (i.e., zooplankton grazing rates often exceed phytoplankton growth rates). It is also clear that the centers of maximum phytoplankton biomass near the mouth of the estuary did not coincide with centers of maximum zooplankton biomass located some distance from the mouth of the estuary. This may represent a "downstream" effect similar to that observed in upwelling systems or it may be a combined effect of salinity and coastal circulation. Regardless of the mechanisms, the amplitude, phasing, and frequency of variations in phytoplankton productivity and copepod biomass suggest that a large fraction of phytoplankton production does not enter copepod food chains.

6.2 Effects of Ocean Dumping

Ocean dumping can be expected to enhance phytoplankton growth through nutrient enrichment of the photic zone; to limit phytoplankton growth by increasing the turbidity of the water and, therefore, the rate of light attenuation; or to inhibit growth by introducing toxic materials to the photic zone. Distributions of nutrients and nonphotosynthetic particles suspended in the water column appeared to be related primarily to the interaction between estuarine discharge, vertical stability, and circulation rather than to dumping. The temporal covariance observed between water column stability, phytoplankton P/B, and the rate of ammonia regeneration, combined with the spatial correlations between salinity, DIN, and TMS, suggests that estuarine discharge is the major source of nutrients assimilated by phytoplankton in the apex. Phytoplankton assimilation numbers showed relatively little spatial variability. Coefficients of variation calculated for each month (stations P1, C3, C5, D3, and D5) ranged from 2 to 22 percent, with the exception of April when values of 32 and 48 percent were observed resulting from low assimilation numbers at stations D3 and D5 (C = 32 percent) and to a high assimilation number at station P1 (C = 48 percent). Using the Wilcoxon signed-rank test of differences between stations, no significant difference ($P < 0.01$) was found between stations P1 and C3, P1 and D3, C3 and C5, and D3 and D5. Ocean dumping had no observable effect on phytoplankton assimilation numbers within the dumping areas (stations C3 and D3) relative to station P1 near the mouth of the estuary and to stations C5

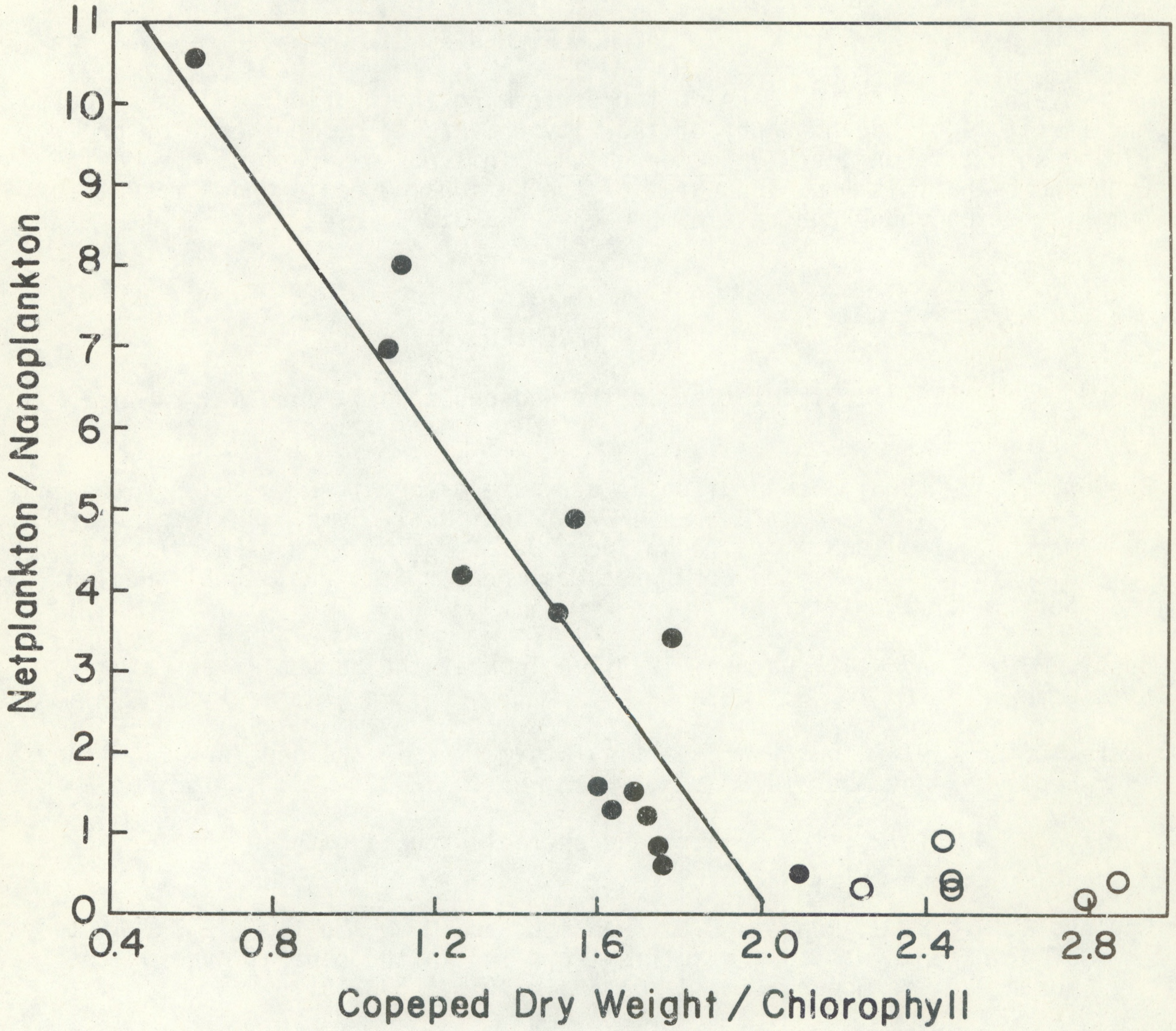

Figure 19. Netplankton/nanoplankton ratios of water column chlorophyll as a function of log_{10} (10(copepod dry weight/mean water column chlorophyll)) for September 1973 through February 1974 and August 1974.

and D5 20 nmi from the mouth of the estuary. This conclusion is consistent with the distributions of environmental variables which have been shown to regulate phytoplankton P/B in the apex (mean photic zone light energy and temperature).

7. ACKNOWLEDGMENTS

My thanks to Dr. C. Garside for performing the nutrient analyses and to the Institute of Oceanography of the City University of New York for providing ship-time on the R/V Commonwealth. This work is part of the Marine Ecosystems Analysis (MESA) program of the National Oceanic and Atmospheric Administration under contract number 03-4-043-310.

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CRUISE NO. I   DATE 28-30 Sept. 1973

Table A1. Hydrographic Data

STA.	Z	T°C.	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	20.2	13.71	3.4	41.7	52.5	5.88	30.9	16.5
	2	20.2	13.69						
	6	20.1	13.81	3.1	42.4	55.0	5.88	30.6	16.6
A2	0	20.2	17.39	2.8	31.5	67.5	5.25	29.1	18.8
	3	20.2	18.83						
	8	20.2	20.09	1.7	20.0	64.4	5.37	21.6	15.7
A3	0	20.2	23.95	2.6	17.8	46.9	3.84	12.0	16.8
	3	20.0	24.29	2.4	17.0	78.1	5.52	23.1	
	10	19.6	26.02	3.1	14.4	68.1	4.50	18.9	18.3
M4	0	20.3	23.86	2.5	17.5	78.1	5.22	24.2	18.3
	5	20.1	24.55						
	10	19.9	25.44	2.6	11.3	65.6	4.08	17.0	18.8
A4	0	20.2	23.97	2.5	10.9	55.0	3.66	12.8	18.0
	5	19.8	25.32						
	8	19.8	25.81	3.4	10.7	68.8	3.69	16.4	21.5
P1	0	19.1	28.13	5.2	9.8	48.1	2.88	12.3	20.1
	6	18.8	30.62	6.2	1.8	11.8	1.05	3.9	
	12	17.2	31.08	3.9	2.1	10.0	1.50	11.2	8.1
C2	0	18.6	30.66	7.8	0.0	0.9	0.45	9.0	2.0
	2	18.6	30.66						
	6	18.6	30.68						
	14	18.4	30.90						
	20	17.0	31.04	4.6	1.9	5.7	1.35	6.3	5.6
C3	0	19.1	29.61	7.3	0.3	2.2	0.48	1.4	5.4
	2	19.1	30.72	7.7	0.1	5.7	0.69	0.8	
	6	19.0	30.76	7.4	0.4	1.4	0.81	0.8	
	13	-	31.40	6.7	0.3	1.8	0.66	2.4	
	20	18.0	31.00	5.4	0.5	4.4	0.96	3.9	5.1
C4	0	18.7	30.55	7.4	0.7	1.6	0.72	1.8	3.2
	2	18.8	30.56						
	6	18.7	30.56						
	14	18.4	30.96						
	20	18.0	31.57	5.6	0.4	6.1	0.63	3.0	10.3
C5	0	19.1	30.94	6.9	0.1	1.8	0.54	2.0	3.6
	2	19.1	30.91	7.1	0.2	1.6	0.57	1.5	
	4	18.9	30.97	7.4	0.2	4.0	0.69	1.8	
	7	18.7	31.23	7.0	0.2	1.6	0.63	1.5	
	18	18.3	31.86	6.6	0.6	2.7	0.60	3.3	
	25	18.3	31.91	6.2	0.1	2.9	0.60	3.4	5.0

CRUISE NO. I DATE 28-30 Sept. 1973

Table AI. Hydrographic Data (cont.)

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
D2	0	18.6	30.48	7.6	0.4	1.6	0.66	1.8	3.0
	2	18.6	30.59						
	6	18.6	30.53						
	14	18.5	30.60						
	22	18.6	30.34	4.0	3.2	7.1	1.14	11.2	9.0
D3	0	19.6	29.48		0.7	7.4	0.78	2.4	10.4
	2	19.3	30.07		2.6	6.4	1.08	2.0	
	4	19.2	30.30		1.7	6.1	0.93	1.8	
	8	18.9	30.75		0.4	4.1	0.81	1.8	
	18	16.1	31.58		1.6	8.1	1.26	9.9	7.7
D4	0	-	30.25	7.2	2.9	3.6	1.11	2.2	5.8
	2	18.6	30.25						
	6	18.7	30.25						
	14	18.6	30.50						
	18	-	30.91	4.9	1.6	6.8	1.20	11.0	7.0
D5	0	20.4	30.24	7.8	0.0	1.5	0.45	1.2	3.3
	1	19.9	30.41	7.7	0.1	1.2	0.51	0.6	
	3	19.6	30.89	6.9	0.1	5.2	1.02	0.9	
	5	19.6	30.94	7.1	0.0	1.6	0.54	0.9	
	12	19.3	30.96	6.3	0.2	3.0	0.60	1.4	
	20	16.9	31.58	5.2	1.1	3.4	0.87	5.4	5.2
M15	0	18.6	30.72	7.5	0.0	0.8	0.39	0.6	2.0
	2	18.6	30.73						
	4	18.6	30.75						
	11	18.4	30.92						
	18	16.1	31.21						
	28	11.9	31.93	5.2	4.1	2.6	0.93	10.8	7.2
B4	0	19.0	30.37	6.8	1.5	4.6	0.90	6.9	6.8
	2	19.0	30.38						
	5	18.6	30.36						
	13	17.5	31.08						
	17	17.4	31.12	4.9	1.3	6.0	1.05	6.8	7.0

CRUISE NO. II DATE 27-28 Oct. 1973

Table AI. Hydrographic Data

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	15.3	14.74	5.0	19.5	35.0	2.45	10.7	22.2
	3	15.4	15.66						
	8	15.5	16.96	5.1					
A2	0	15.4	19.65	5.1	22.1	43.1	3.41	13.9	19.1
	3	15.5	20.36						
	7	15.5	23.84	3.8	14.3	42.5	3.19	11.2	17.8
A3	0	15.1	26.35	4.9	13.0	46.9	2.86	12.3	20.9
	4	14.8	27.05	5.0	13.9	60.6	2.48	14.3	
	9	14.5	28.43	5.6	9.4	33.1	2.26	9.6	18.8
M4	0	15.1	26.22	4.7	15.8	56.9	3.19	16.5	22.8
	5	14.8	26.94						
	10	14.5	28.08	5.6	9.2	34.4	2.86	8.8	15.2
A4	0	15.2	26.25	5.3	10.6	41.2	-	10.7	
	5	14.8	27.39						
	8	14.6	27.76	6.0	7.9	22.8	2.53	6.9	12.1
P1	0	14.4	29.64	7.5	14.3	18.7	2.09	10.2	15.8
	6	14.3	30.78	8.1	2.8	5.7	0.41	2.5	
	13	14.8	30.96	8.2	2.4	6.1	0.58	1.9	14.6
C3	0	15.7	32.10	7.2	0.3	2.5	0.72	0.9	4.0
	3	15.7	32.12	6.9	0.3	1.9	0.52	0.9	
	6	15.6	32.14	7.0	0.4	2.0	0.74	0.8	
	9	15.6	32.14	7.0	0.2	1.3	0.60	0.9	
	21	15.6	32.17	6.9	0.6	4.2	0.78	1.6	6.2
C5	0	15.8	31.75	6.9	0.3	5.5	0.72	1.1	8.0
	2	15.8	31.77	7.1	0.0	3.8	0.38	0.9	
	4	15.8	31.79	6.9	0.3	2.6	0.69	0.8	
	7	15.8	31.81	7.0	0.2	2.3	0.91	0.9	
	16	15.8	31.82	7.0	0.2	6.0	0.77	1.1	
	24	15.8	31.84	7.0	0.3	1.2	.97	2.5	
D3	0	-	31.68	7.4	0.9	4.6	0.60	0.6	9.0
	2	-	31.70	7.5	0.8	2.9	0.44	2.2	
	6	-	31.71	7.5	0.8	1.9	0.63	0.8	
	9	-	32.50	7.6	0.6	3.5	0.55	0.6	
	21	-	32.09	4.8	2.9	4.9	0.77	4.7	10.1
D5	0	15.8	32.14	7.2	0.1	1.6	0.88	1.7	1.9
	3	15.8	32.14	7.1	0.3	1.2	0.66	0.9	
	6	15.6	32.15	7.1	0.0	1.0	0.69	0.8	
	11	15.6	32.17	7.2	0.1	2.0	0.55	0.9	
	21	15.6	32.19	7.2	0.2	1.9	0.60	2.0	3.5

CRUISE NO. III DATE 17-19 Nov. 1973

Table AI. Hydrographic Data

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	9.4	9.70	8.7	16.1	16.1	2.62	6.5	12.3
	2	9.4	9.80						
	6	9.5	10.36	8.2	21.6	19.4	2.50	10.1	16.4
A2	0	9.8	12.64	7.7	10.6	14.2	2.14	5.2	11.6
	2	9.8	12.65						
	7	10.0	14.06	7.3	33.2	41.2	2.67	17.5	27.9
A3	0	10.5	22.08	6.9	16.9	39.4	2.92	11.7	19.3
	3	10.5	22.22	6.4	9.5	22.3	0.66	6.3	
	10	10.7	24.52	5.8	9.7	25.5	1.18	7.6	29.8
M4	0	10.4	23.55	6.8	17.4	41.9	1.10	12.3	53.9
	5	10.4	26.48						
	10	10.4	27.10	7.0	7.9	22.5	-	6.8	
A4	0	10.3	27.42	7.0	9.6	21.5	2.04	7.4	15.2
	5	10.4	27.88						
	10	10.4	29.19	7.3	8.5	19.2	2.06	8.0	13.4
P1	0	11.2	31.67	8.1	3.3	6.4	0.99	4.1	9.8
	5	11.3	31.71	7.8	3.8	6.8	1.16	4.2	
	15	12.1	32.96	6.6	4.0	-	1.15	5.7	
C2	0	11.4	32.04	8.0	0.3	5.0	0.52	1.4	10.2
	3	11.4	32.04						
	8	11.4	32.05						
	19	11.8	32.46						
	30	12.5	34.61	4.8	10.2	2.7	1.32	14.0	9.8
C3	0	11.5	32.33	8.0	0.6	3.2	0.60	1.7	6.4
	2	11.5	32.32	7.8	0.5	1.7	2.20	1.4	
	4	11.5	32.32	7.9	0.4	1.8	0.63	1.4	
	8	11.5	32.34	7.8	0.6	4.1	0.82	2.0	
	15	11.5	32.36	7.7	0.3	1.8	3.80	1.2	0.6
C4	0	11.6	32.09	7.9	0.4	1.0	-	1.2	
	4	11.6	32.11						
	8	11.6	32.14						
	21	12.1	32.63						
	30	12.5	34.65	5.0	10.1	1.9	0.74	16.2	16.2
C5	0	11.2	32.06	8.2	0.6	1.0	0.77	1.1	2.1
	2	11.2	32.05	8.0	0.4	1.4	0.66	1.2	
	4	11.2	32.05	8.0	0.6	2.0	0.55	1.1	
	8	11.2	32.05	7.9	0.4	2.2	0.55	1.7	
	15	11.2	32.05	8.0	0.5	1.2	0.72	1.4	
	22	11.3	32.07	7.8	0.6	1.3	1.04	1.2	1.8

CRUISE NO. III DATE 17-19 Nov. 1973

Table AI. Hydrographic Data (cont.)

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
D2	0	11.1	31.80	8.2	0.5	3.4	0.38	1.2	10.2
	3	11.1	31.81						
	7	11.1	31.80						
	12	11.3	31.96						
	20	12.3	34.36	5.2	7.9	3.4	1.21	9.0	9.3
D3	0	11.4	32.17	7.8	0.8	1.8	0.77	2.4	3.4
	2	11.4	32.18	7.8	0.7	4.4	1.13	2.0	
	4	11.5	32.18	7.9	1.0	5.1	0.74	2.0	
	7	11.4	32.19	7.8	0.9	5.3	0.55	2.0	
	18	11.5	32.22	7.5	0.7	4.3	0.55	1.4	9.1
D4	0	11.0	31.74	8.2	0.4	1.0	0.77	1.4	1.8
	3	11.0	31.74						
	7	11.0	31.76						
	11	11.4	31.96						
	18	12.1	33.67	6.2	6.6	2.4	1.04	8.0	8.6
D5	0	11.8	32.28	8.1	0.2	3.9	0.60	0.9	6.8
	3	11.8	32.29	8.0	0.3	4.4	-	0.9	
	8	11.8	32.29	7.9	0.1	1.8	0.66	0.8	
	12	11.9	32.33	7.9	0.2	2.7	2.58	1.1	
	20	11.9	32.34	8.0	0.2	3.2	0.63	0.9	5.4
M15	0	11.3	32.08	8.0	0.2	2.6	0.72	7.4	3.9
	2	11.3	32.04						
	6	11.3	32.04						
	10	11.4	32.08						
	14	11.4	32.12						
	19	11.6	32.20	7.8	0.2	2.5	0.55	2.2	4.9
B4	0	10.8	31.64	6.9	3.5	8.1	3.68	5.0	3.2
	4	10.8	31.66						
	14	11.9	32.87						
	18	12.0	33.01	7.7	2.8	1.8	0.66	4.2	7.0

CRUISE NO. IV DATE 15-16 Dec. 1973

Table AI. Hydrographic Data

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	6.4	2.38	9.7	39.1	10.7	1.65	10.0	30.2
	3	6.4	2.46						
	6	6.4	2.58	9.7	39.7	11.2	1.50	10.5	33.9
A2	0	6.8	5.08	9.8	29.3	13.8	1.95	8.6	22.1
	3	6.9	5.83						
	7	7.0	9.46	8.2	26.4	19.6	1.95	10.8	23.6
A3	0	8.2	16.50	6.9	15.6	25.3	1.92	8.8	21.3
	4	8.4	20.21	6.6	19.9	29.9	2.00	13.0	
	11	8.6	24.52	7.1	12.0	19.3	1.67	2.8	18.7
M4	0	8.3	17.44	6.6	14.2	33.9	2.70	9.0	17.8
	4	8.2	21.33						
	12	8.4	24.16	7.4	12.0	18.9	1.60	8.1	19.3
A4	0	8.1	19.75	6.5	21.0	31.0	2.07	12.6	25.1
	4	8.1	22.95						
	9	8.6	26.51	7.0	12.5	18.3	1.58	9.3	19.5
P1	0	8.8	28.74	7.9	11.2	14.8	1.32	8.0	19.7
	6	8.7	28.89	8.1	8.5	12.1	1.35	6.0	
	12	9.8	31.98	7.8	3.5	4.5	0.90	2.7	8.9
C3	0	9.6	32.36	8.3	4.0	4.0	0.80	2.2	10.0
	3	9.6	32.37	8.2	3.2	3.2	0.80	2.0	
	6	9.6	32.37	8.0	3.4	2.6	0.80	3.6	
	13	9.6	32.37	7.9	3.3	2.6	0.88	2.2	
	20	10.0	32.44	7.9	2.9	4.2	0.62	1.5	11.4
C5	0	9.4	32.24	8.3	3.1	3.0	0.68	0.8	9.0
	3	9.4	32.24	8.1	2.6	2.1	0.60	0.8	
	7	9.4	32.23	8.1	2.8	2.4	0.68	0.6	
	15	9.4	32.23	8.2	-	-	-	-	
	21	9.4	32.23	8.2	3.3	2.6	0.60	1.4	9.8
D3	0	-	31.02	8.2	4.1	4.9	0.80	2.1	11.2
	3	9.2	31.03	8.5	4.0	3.7	0.88	2.0	
	6	9.3	31.03	8.3	3.9	3.8	0.85	2.6	
	14	9.5	32.07	7.9	3.0	3.9	0.75	1.8	
	17	9.8	32.25	8.1	3.5	3.8	0.82	17.1	8.9
D5	0	9.4	32.40	7.9	2.7	2.6	0.62	2.0	8.5
	3	9.6	32.40	7.9	2.6	3.7	0.65	1.5	
	7	9.6	32.40	7.9	3.6	2.5	0.70	1.5	
	13	9.6	32.40	7.9	2.7	2.2	0.68	1.8	
	22	9.6	32.40	7.9	2.8	2.3	0.65	1.2	7.8

CRUISE NO. V DATE 26-28 Jan. 1974

Table AI. Hydrographic Data

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	1.2	3.93	11.5	34.1	24.9	1.47	51.10	40.1
	2	1.2	3.99						
	6	1.2	4.26	12.0	36.8	24.6	2.25	50.75	27.3
A2	0	1.7	7.63	10.1	27.0	19.8	1.80	46.55	26.0
	3	1.8	10.20						
	7	3.2	15.67	8.4	17.9	19.6	1.83	18.90	20.5
A3	0	3.7	17.88	8.2	17.4	19.8	2.07	18.20	18.0
	5	3.9	20.13	8.2	13.9	18.0	1.89	13.51	
	9	4.2	22.76	8.7	11.9	16.0	1.86	12.04	15.0
M4	0	3.9	17.78	7.4	15.7	21.0	2.25	16.59	16.3
	4	3.9	19.71						
	8	4.3	23.01	7.8	21.6	24.4	2.61	21.07	17.6
A4	0	4.0	17.39	7.6	13.2	17.9	1.80	14.07	17.3
	2	4.5	23.50						
	5	4.6	24.87	8.1	10.6	14.5	1.98	10.01	12.7
P1	0	5.2	27.36	8.5	14.2	15.2	1.71	11.90	17.2
	5	5.4	28.89	8.5	7.1	6.9	1.53	5.46	
	12	6.4	32.66	8.5	4.8	3.0	1.62	2.24	4.8
C2	0	5.6	28.15	10.0	8.7	15.4	1.35	5.25	17.8
	4	5.6	29.66						
	12	6.1	32.05						
	20	6.7	32.58						
	27	7.2	32.73	9.0	4.5	2.6	1.95	2.87	3.6
C3	0	5.1	29.71	10.1	10.8	7.1	1.44	4.06	12.4
	2	5.1	29.71	9.8	7.8	5.2	1.11	2.73	
	4	5.1	29.73	10.6	9.2	6.6	1.41	3.36	
	10	5.1	30.13	10.2	6.9	4.8	1.62	2.38	
	20	5.3	31.73	10.0	3.3	2.4	1.05	0.35	5.4
C4	0	5.9	29.00	10.5	11.2	20.5	2.61	4.55	12.1
	4	5.6	29.75						
	9	5.6	30.64						
	15	6.3	32.28						
	29	7.9	32.91	9.0	3.9	3.7	1.20	3.36	6.3
C5	0	5.5	31.46	9.9	5.9	5.8	1.29	0.77	9.1
	4	5.5	31.46	10.0	5.1	2.0	1.29	0.63	
	8	5.4	31.69	10.0	5.0	1.8	1.11	0.42	
	15	5.3	31.77	9.8	6.0	3.7	1.29	3.99	
	23	5.1	31.96	9.6	5.0	4.6	1.38	1.26	7.0

CRUISE NO. V DATE 26-28 Jan. 1974

Table AI. Hydrographic Data (cont.)

STA	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
D2	0	6.0	30.90	9.4	5.9	4.3	1.14	1.89	8.9
	3	6.0	30.62						
	8	6.4	32.14						
	15	6.2	32.18						
	20	6.6	32.43	9.0	5.1	4.8	1.62	2.03	6.1
D3	0	5.7	30.31	9.4	7.1	4.5	1.29	2.17	9.0
	2	5.7	30.32	10.0	6.0	4.8	1.26	2.17	
	6	5.6	30.53	9.7	7.6	5.4	1.32	2.66	
	12	6.8	32.67	8.9	4.3	1.9	1.32	2.03	
	17	7.0	32.74	8.7	4.9	2.5	1.44	2.66	5.1
D4	0	5.7	30.35	9.3	10.4	5.4	1.29	3.92	12.2
	5	5.7	30.40						
	10	5.7	31.22						
	15	5.7	32.26						
	25	6.9	32.78	8.7	3.7	3.5	1.23	1.82	5.8
D5	0	5.6	30.76	10.0	4.8	2.1	1.17	2.17	5.9
	3	5.6	30.77	10.1	6.9	3.1	0.96	0.63	
	8	5.7	31.30	9.9	5.7	2.1	1.08	0.63	
	15	6.7	32.51	9.2	3.8	3.1	1.92	1.05	
	21	7.5	32.81	8.2	4.3	-	1.23	2.94	

CRUISE NO. VI   DATE 16-18 Feb. 1974

Table AI. Hydrographic Data

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A-1	0	0.9	6.90	13.3	31.7	21.5	1.50	61.6	35.5
	2	1.4	9.39						
	5	2.9	20.94	10.9	16.2	17.4	1.43	16.9	23.5
A-2	0	0.6	7.92	13.4	23.6	19.0	1.35	39.2	31.6
	3	2.0	18.75						
	7	3.2	22.55	11.6	15.0	15.8	1.61	15.0	19.1
A-3	0	1.9	15.77	12.2	18.7	18.0	1.40	23.0	26.2
	2	2.2	17.48	12.0	13.9	14.9	1.30	16.4	
	12	3.2	27.26	12.0	8.2	6.4	1.04	5.5	14.0
A-4	0	2.5	18.32	12.0	18.8	19.0	1.53	21.7	24.7
	4	3.6	25.65						
	9	3.9	27.82	12.5	9.8	5.9	1.17	5.7	13.4
P-1	0	4.2	30.30	11.5	3.4	2.2	0.83	1.1	6.7
	4	4.2	30.33	11.6	3.6	2.9	0.84	1.2	
	10	4.4	30.98	11.4	2.1	2.2	0.80	0.3	5.4
B-2	0	4.0	30.86	11.8	2.6	1.4	0.81	0.7	4.9
	5	4.0	30.74						
	15	4.0	30.44						
	20	6.1	32.03	9.7	4.1	2.0	1.17	2.6	5.2
B-3	0	4.9	31.43	11.0	3.0	1.8	0.88	0.9	5.4
	4	4.9	31.43						
	10	4.9	31.42						
	17	5.0	31.38	11.4	2.6	1.4	0.80	0.9	5.0
B-4	0	2.4	31.04	11.0	3.7	2.0	0.83	0.6	6.9
	4	2.4	30.98	11.8	5.8	2.2	1.06	1.8	
	11	2.4	30.87	11.5	4.9	1.4	1.06	1.3	
	15	2.5	31.05	11.0	6.7	1.6	1.30	1.7	6.4
C-2	0	3.6	30.62	11.2	4.1	4.0	0.96	0.8	8.4
	3	3.6	30.67						
	8	3.6	30.65						
	15	3.6	30.53						
	25	6.3	32.08	9.7	3.1	1.8	0.84	2.7	5.8
C-3	0	3.3	31.44	12.3	4.4	2.2	0.80	1.0	8.2
	2	3.2	31.43	11.8	4.0	1.6	0.86	0.8	
	4	3.2	31.42	11.2	4.0	1.9	0.68	0.4	
	12	3.6	31.71	11.0	4.5	3.2	0.86	0.8	
	23	5.9	32.98	9.8	3.3	1.4	0.94	2.2	5.0

CRUISE NO. VI DATE 16-18 Feb. 1974

Table AI. Hydrographic Data (cont.)

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
C-4	0	4.3	31.41	11.6	3.5	3.0	0.88	0.8	7.4
	3	4.3	31.44						
	7	4.3	31.37						
	12	4.4	31.42						
	20	4.5	31.24	11.3	3.6	2.8	0.94	1.1	6.8
C-5	0	3.7	32.09	12.5	3.0	1.4	0.86	0.4	5.1
	3	3.7	32.14	11.1	2.7	1.2	0.81	0.6	
	8	3.7	32.13	10.7	3.3	2.4	0.91	0.4	
	21	4.0	32.17	10.2	3.8	1.5	0.78	0.9	
	25	4.0	32.17	10.2	3.7	1.3	0.83	0.7	6.0
D-2	0	3.6	31.22	12.6	3.7	3.8	0.91	1.3	8.2
	3	3.7	31.30						
	6	3.6	31.53						
	15	3.9	31.64						
	20	5.8	32.51	10.6	3.8	2.6	0.91	1.9	7.0
D-3	0	3.8	31.58	12.3	2.3	2.2	0.70	0.4	6.4
	3	3.9	31.57	12.0	2.1	1.1	0.83	0.5	
	7	3.9	31.51	11.8	1.9	1.1	0.78	0.4	
	12	4.0	31.67	11.5	2.5	2.5	0.76	0.5	
	20	6.3	32.73	9.5	3.0	1.7	0.91	1.9	5.2
D-4	0	4.0	31.66	12.8	2.7	1.0	0.80	1.4	4.6
	3	4.0	31.55						
	7	4.0	31.62						
	12	4.1	31.80						
	18	6.0	32.70	10.3	3.8	3.3	0.94	2.0	7.6
D-5	0	3.8	31.72	13.2	2.3	1.1	0.81	0.5	4.2
	3	3.7	31.63	12.6	4.0	1.7	0.88	1.0	
	6	3.7	31.60	12.2	3.3	1.8	0.84	0.6	
	16	5.8	32.65	9.7	3.4	1.8	0.96	1.5	
	22	6.0	32.77	9.6	3.8	3.0	0.99	1.9	6.9

CRUISE NO. VII DATE 10-11 Apr. 1974

Table AI. Hydrographic Data

STA	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A3	0	-	11.68	8.5	17.9	26.8	1.35	25.99	33.1
	3	-	15.20	9.1	17.1	17.0	1.46	19.53	
	12	-	24.30	9.2	11.6	2.9	1.23	11.46	11.8
P1	0	6.8	26.01	9.8	8.5	10.9	1.06	8.10	18.3
	3	6.2	30.10	10.4	3.1	6.1	1.18	1.80	
	12	6.1	31.67	10.2	1.7	4.7	0.71	0.71	9.0
B4	0	5.8	32.06	10.2	1.8	3.3	0.70	1.34	7.3
	4	5.7	32.12	10.2	2.2	4.0	0.85	1.66	
	10	5.7	32.08	10.3	1.9	6.4	1.11	1.39	
	19	5.8	32.06	10.6	2.1	2.2	0.89	1.59	4.8
C3	0	5.7	31.19	10.2	1.6	7.8	0.93	0.63	10.1
	4	5.7	31.26	10.3	2.3	2.2	0.65	0.66	
	8	5.7	31.29	10.2	2.1	3.0	1.12	0.61	
	21	5.8	31.77	10.1	2.0	4.0	0.68	0.83	
	23	5.9	32.01	9.7	1.3	3.2	0.68	0.84	6.6
C5	0	5.9	32.22	9.9	1.4	4.1	0.85	0.92	6.5
	4	5.9	32.19	10.0	1.5	3.2	0.68	1.16	
	9	5.8	32.29	10.0	1.4	1.3	0.81	1.18	
	15	5.9	32.30	9.9	2.4	7.1	0.85	1.92	
	23	6.0	32.63	9.7	1.0	2.8	0.67	0.84	5.7
D3	0	6.1	31.77	9.9	1.8	2.5	0.70	0.81	6.1
	3	6.1	31.17	9.8	1.8	2.3	0.74	1.00	
	6	6.1	31.13	10.0	-	-	-	-	
	15	6.0	31.23	9.9	3.5	3.2	1.06	1.70	
	21	6.1	31.51	9.6	3.3	5.8	1.14	2.00	8.0
D5	0	6.1	31.40	9.9	1.8	1.9	0.71	0.59	5.2
	3	6.2	31.34	9.7	1.6	5.5	0.69	0.70	
	6	6.2	31.46	9.8	1.7	2.4	0.58	0.51	
	15	6.2	31.53	9.8	2.4	2.8	0.96	0.74	
	23	6.2	31.78	9.7	2.3	2.2	1.11	0.88	4.0

CRUISE NO. VIII DATE 27-29 Apr. 1974

Table AI. Hydrographic Data

STA	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	10.7	2.77	9.2	44.5	2.8	1.82	65.90	26.0
	2	10.5	5.97						
	6	10.4	8.32	7.9	38.5	3.1	2.25	55.44	18.5
A2	0	10.7	5.03	8.2	42.3	27.9	1.85	62.26	37.9
	2	10.5	5.37						
	6	10.0	12.91	6.8	32.6	35.0	2.28	44.06	29.6
A3	0	10.3	17.53	6.7	27.6	37.8	2.55	30.38	25.6
	5	10.1	19.68	6.5	24.8	37.3	2.55	25.93	
	9	9.7	21.83	7.0	20.9	31.7	2.17	21.16	24.2
A4	0	10.4	19.40	7.0	23.6	31.6	2.35	25.76	23.5
	5	9.7	21.48						
	9	9.6	21.96	7.0	20.2	28.9	1.93	19.86	25.4
P1	0	9.7	28.27	8.7	8.6	8.2	1.24	4.31	13.5
	3	8.3	30.48	8.7	4.3	5.6	0.97	1.63	
	13	7.0	32.44	7.9	2.1	3.8	1.21	1.79	4.9
B2	0	9.6	28.79	9.1	6.4	8.1	2.16	2.74	6.7
	3	9.7	28.78						
	14	6.6	32.07						
	25	6.6	32.14	7.5	2.5	6.6	1.53	2.05	5.9
B3	0	10.4	27.79	8.8	9.7	6.9	1.01	2.84	16.4
	3	9.3	29.76						
	13	—	32.22						
	17	9.5	32.46	7.7	2.6	5.7	1.26	3.06	6.6
B4	0	9.5	30.17	8.9	3.7	4.2	0.74	0.89	10.7
	3	9.4	30.42	9.0	3.3	2.6	0.61	1.60	
	15	6.8	32.31	7.9	2.5	5.3	1.04	2.65	
	17	6.8	32.37	7.9	2.7	8.2	0.92	2.92	11.8
C2	0	9.4	28.60	9.1	7.1	5.6	1.05	1.75	12.1
	3	9.4	28.60						
	6	9.3	28.82						
	14	--	32.07						
	30	7.0	32.59	8.0	1.8	9.2	1.26	3.31	8.7
C3	0	9.1		9.9	2.0	5.8	1.19	0.73	6.6
	3	8.9	30.03	9.8	1.9	2.5	0.60	0.74	
	6	8.9	30.25	9.9	1.0	3.6	0.77	0.52	
	10	8.1	31.25	9.0	1.4	4.0	0.46	0.87	
	13	8.6	31.03	9.3	1.8	21.9	1.33	0.80	17.8
C4	0	9.8	28.86	9.3	5.2	3.6	0.99	2.12	8.9
	3	9.8	28.76						
	6	9.7	29.05						
	14	6.9	32.02						
	21	7.0	32.13	8.0	2.3	4.1	0.96	2.57	6.7

CRUISE NO. VIII DATE 27-29 Apr. 1974

Table AI. Hydrographic Data (cont.)

STA	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
C5	0	9.9	29.95	9.4	0.3	3.1	0.43	0.40	7.9
	3	9.6	29.93	9.4	0.2	2.0	0.53	0.39	
	9	9.3	30.35	9.1	0.2	2.7	0.76	0.38	
	21	7.1	32.64	8.4	0.8	2.9	0.55	1.24	
	28	7.1	32.65	8.4	1.0	7.0	0.96	1.53	8.3
D2	0	9.4	27.75	9.7	6.9	5.2	0.90	2.25	13.4
	3	9.3	27.89						
	6	8.2	30.81						
	14	7.3	32.42						
	23	7.3	32.83	7.8	1.3	4.3	1.20	2.84	4.7
D3	0	9.1	28.17	9.3	7.6	5.5	1.24	2.63	10.6
	3	8.8	28.55	9.2	7.3	6.5	0.93	3.39	
	6	8.2	30.41	8.7	5.1	6.7	1.99	5.05	
	14	7.2	32.76	8.3	1.4	4.7	0.91	2.91	
	23	7.2	32.91	8.0	1.9	6.3	1.34	3.67	6.1
D4	0	9.3	28.20	9.5	8.3	6.7	1.18	3.50	12.7
	3	9.1	28.26						
	6	8.7	28.93						
	15	7.3	32.80						
	17	7.3	32.93	8.2	1.4	6.4	1.80	3.08	4.3
D5	0	10.5	30.77	9.4	0.1	4.9	1.41	0.56	3.5
	3	10.0	30.77	9.5	0.0	2.5	0.78	0.41	
	8	9.4	31.36	9.3	0.0	1.5	0.61	1.41	
	18	7.2	32.78	8.4	0.9	2.0	1.02	2.04	
	25	7.2	32.77	8.4	1.0	2.6	0.88	1.92	4.1

CRUISE NO. IX DATE 25-27 May 1974

Table AI. Hydrographic Data

STA	Z	T^oC	S^o/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	17.3	2.59	7.3	27.8	14.2	1.07	24.67	39.2
	2	17.2	2.82						
	5	17.1	4.19	6.5	18.7	10.6	0.94	14.45	31.2
A2	0	17.0	5.33	6.1	31.7	25.9	1.64	24.52	35.1
	2	17.0	5.55						
	6	16.7	7.65	5.4	27.7	22.6	1.63	24.36	30.8
A3	0	15.9	16.46	4.4	14.6	27.4	1.61	12.23	26.1
	4	15.3	20.13	4.4	11.4	-	1.87	9.55	
	10	15.1	22.45	4.8	9.8	22.0	1.79	8.39	17.8
A4	0	15.7	21.24	5.0	10.9	21.0	1.55	9.42	20.6
	4	15.2	23.92						
	8	15.0	24.48	5.5	10.4	22.3	1.59	8.59	20.6
P1	0	15.6	28.99	8.8	0.2	3.4	0.41	0.68	8.8
	5	14.8	30.71	8.9	0.2	9.0	0.35	1.11	
	12	10.5	31.75	6.3	0.3	3.0	0.59	2.48	5.6
B2	0	15.9	29.76	8.2	0.1	1.0	0.23	0.45	4.8
	4	14.9	30.40						
	15	10.3	31.85						
	22	9.1	32.00	5.5	0.6	0.6	0.67	3.38	1.8
B3	0	14.7	30.52	8.2	0.0	1.9	0.32	0.47	5.9
	4	14.7	30.52						
	10	14.6	30.69						
	17	11.7	31.60	6.7	0.3	1.4	0.41	2.28	4.1
B4	0	14.3	30.52	7.8	0.2	1.6	0.36	1.16	5.0
	5	14.3	30.52	7.8	0.2	1.4	0.33	1.10	
	10	14.1	30.58	7.8	0.1	1.2	0.43	1.19	
	17	10.9	31.51	5.6	0.6	3.6	0.67	3.81	6.3
C2	0	15.8	30.14	8.5	0.0	3.0	0.29	0.46	10.3
	5	15.4	30.79						
	12	13.8	31.68						
	18	9.9	32.20						
	28	8.6	32.40	5.7	0.8	3.8	0.93	6.65	4.9
C3	0	14.6	31.09	8.3	0.5	2.9	0.41	0.85	8.3
	2	14.7	31.12	8.3	0.6	1.3	0.34	0.72	
	5	14.6	31.22	8.3	0.1	1.0	0.35	0.71	
	8	14.6	31.24	8.4	0.4	1.9	0.36	1.05	
	21	8.5	32.55	6.4	0.7	2.7	0.70	3.21	4.8
C4	0	15.5	30.29	8.4	0.1	0.8	0.22	0.29	4.1
	3	15.5	30.29						
	7	14.5	31.01						
	16	11.9	31.70						
	21	9.0	32.03	5.7	0.9	3.8	0.85	6.82	5.5

CRUISE NO. IX DATE 25-27 May 1974

Table AI. Hydrographic Data (cont.)

STA	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
C5	0	14.9	30.99	8.3	0.1	0.8	0.30	0.74	3.0
	2	14.4	31.06	8.2	0.0	1.0	0.41	0.69	
	6	13.9	31.21	8.3	0.0	0.6	0.24	0.45	
	9	13.2	31.55	8.3	0.3	1.0	0.37	0.72	
	24	7.8	32.51	7.0	1.5	1.0	1.10	6.01	2.3
D2	0	15.9	27.63	9.2	0.6	3.5	0.34	0.55	12.0
	2	15.7	27.95						
	6	15.0	30.34						
	12	11.7	31.71						
	20	8.5	32.40	6.1	0.6	4.6	0.66	2.29	7.9
D3	0	15.9	27.66	9.3	0.9	10.7	0.52	0.61	22.3
	2	15.8	27.69	9.4	0.4	2.5	0.24	0.37	
	4	13.9	29.29	8.7	0.3	6.2	0.37	0.65	
	10	11.0	31.75	7.0	0.3	9.5	0.50	1.71	
	20	8.2	32.52	6.2	0.7	6.7	0.72	2.71	10.3
D4	0	15.8	28.09	8.9	0.7	1.9	0.33	0.39	7.9
	2	15.4	28.61						
	5	14.0	29.08						
	10	9.8	31.68						
	20	8.0	32.59	6.4	0.6	5.8	0.67	2.49	9.6
D5	0	16.2	31.50	8.2	0.1	0.9	0.36	1.26	2.8
	3	14.8	31.50	8.3	0.1	0.8	0.33	1.23	
	7	14.6	31.52	8.4	0.0	1.0	0.34	0.96	
	11	14.3	31.61	8.4	0.2	3.5	0.33	0.56	
	24	7.9	32.51	5.5	1.7	6.2	0.89	3.45	8.9

CRUISE NO. X DATE 22-24 June 1974

Table AI. Hydrographic Data

STA	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	21.9	8.13	4.0	15.9	2.6	1.24	9.43	14.9
	2	21.8	8.16						
	5	21.7	8.88	3.5	27.2	30.9	2.11	16.36	27.5
A2	0	21.5	10.57	3.0	18.4	27.5	1.93	11.24	23.8
	2	21.4	10.66						
	6	21.4	12.18	2.1	22.3	36.0	2.51	14.86	23.2
A3	0	20.1	22.08	2.4	14.8	48.2	3.79	13.39	16.6
	5	20.0	22.88	2.5	13.9	45.5	3.45	12.96	
	10	19.5	24.79	3.3	10.6	37.2	3.21	10.55	14.9
A4	0	18.9	25.93	4.9	8.4	28.9	2.55	8.08	14.6
	7	18.1	27.30						
	17	18.0	28.13	5.7	5.3	25.9	1.93	5.68	16.2
P1	0	17.7	29.38	7.9	0.6	2.9	0.64	1.31	5.5
	6	17.2	29.47	7.2	1.4	2.2	0.72	2.02	
	12	13.7	31.12	6.1	0.8	3.2	0.81	4.51	4.9
B2	0	18.2	28.96	8.8	0.1	1.3	0.41	0.32	3.4
	5	18.0	29.09						
	12	14.8	30.97						
	25	10.8	31.73	4.9	1.5	5.0	1.19	10.82	5.5
B3	0	19.3	28.97	8.1	0.1	1.6	0.44	0.40	3.9
	4	19.3	28.98						
	10	15.1	30.91						
	19	12.3	31.34	4.6	0.8	4.2	1.33	10.71	3.8
B4	0	19.2	29.67	8.0	0.1	1.4	0.43	0.42	3.5
	4	19.2	29.68	7.9	0.2	7.4	0.46	3.09	
	10	15.7	31.17	6.7	0.3	7.9	0.62	3.44	
	15	14.2	31.24	5.9	0.6	1.8	0.90	6.95	2.7
C2	0	17.5	28.78	7.3	2.8	4.1	0.94	2.08	7.3
	2	17.5	28.76						
	4	17.5	28.77						
	8	17.4	-						
	29	8.8	32.27	4.7	2.0	6.2	1.10	12.80	7.4
C3	0	19.1	27.18	8.0	.3	3.4	0.78	1.82	9.9
	2	19.3	28.30	8.1	0.6	2.5	0.26	0.45	
	6	18.6	29.87	7.8	0.3	5.7	0.39	0.74	
	12	15.7	31.45	7.2	0.1	1.5	0.44	1.84	
	22	11.6	31.68	5.5	1.0	4.4	0.98	8.26	5.5
C4	0	20.1	29.08	8.2	0.1	1.2	0.41	0.33	3.2
	2	20.1	29.08						
	4	20.1	29.11						
	10	16.7	31.46						
	21	11.6	31.65	5.5	0.8	3.2	0.84	7.52	4.8

CRUISE NO. X DATE 22-24 June 1974

Table AI. Hydrographic Data (cont.)

STA	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
C5	0	21.3	29.50	8.1	0.0	2.1	0.45	0.42	4.7
	3	20.6	29.69	8.0	0.2	4.1	0.35	0.59	
	9	15.2	31.10	7.7	0.4	1.3	0.65	2.04	
	15	-	31.55	8.0	0.1	4.2	0.54	1.87	
	28	11.2	32.09	6.7	1.6	3.6	1.03	8.09	5.0
D2	0	20.1	26.50	8.2	6.4	7.4	1.33	3.11	10.4
	4	19.4	27.53						
	9	17.0	30.76						
	15	14.1	31.02						
	21	11.5	31.47	4.8	1.2	5.0	1.27	10.24	4.9
D3	0	20.9	28.40	10.9	0.1	1.0	0.26	0.58	4.2
	3	19.9	28.81	9.4	0.0	1.5	0.37	0.56	
	8	16.8	30.71	7.4	0.1	1.5	0.63	1.20	
	14	15.0	31.07	6.6	0.6	1.4	0.52	2.71	
	21	11.2	31.52	4.9	1.3	5.8	1.15	9.38	6.2
D4	0	-	29.13	8.8	0.1	2.1	0.63	0.67	3.5
	3	19.3	29.82						
	6	18.2	30.70						
	15	14.0	31.17						
	20	11.9	31.42	5.0	1.1	4.2	0.96	8.91	5.5
D5	0	21.2	30.47	8.4	0.5	1.2	0.42	1.66	4.0
	5	-	30.50	8.1	0.2	1.2	0.50	1.88	
	10	16.6	30.75	7.7	0.1	1.7	0.32	1.41	
	18	11.1	31.65	6.7	0.1	1.6	0.66	3.96	
	23	10.2	31.69	5.4	0.8	3.3	0.95	6.52	4.3

CRUISE NO. XI DATE 15-17 July 1974

Table AI. Hydrographic Data

STA	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	24.3	7.68	7.7	-	6.1	1.06	0.87	-
	2	23.4	8.94						
	5	21.8	16.90	4.0	-	10.8	1.94	3.83	-
A2	0	23.8	10.24	7.2	14.5	8.0	1.04	1.64	21.6
	3	22.7	11.17						
	6	21.0	21.06	2.8	8.0	33.4	0.28	6.23	14.8
A3	0	21.5	20.10	4.8	9.8	38.1	2.31	3.50	20.7
	4	20.4	23.65	4.1	-	47.9	2.71	4.56	
	8	19.3	26.58	4.9	5.6	8.2	2.51	4.23	5.5
A4	0	20.6	23.50	4.6	9.2	8.3	2.41	4.09	7.3
	5	19.2	27.21						
	10	19.0	27.66	5.2	5.0	0.8	2.12	3.64	2.7
P1	0	20.3	26.79	7.4	4.6	6.9	1.15	2.12	10.0
	5	18.8	29.47	6.1	2.1	3.5	0.99	2.78	
	13	14.4	31.98	5.6	0.2	2.1	0.34	4.80	6.8
B2	0	22.0	27.59	9.9	0.0	1.8	0.75	0.64	2.4
	2	21.8	28.20						
	8	20.3	31.03						
	22	14.6	32.03	5.4	0.3	2.3	0.78	5.31	3.3
B3	0	21.0	29.68	7.6	0.0	1.2	0.59	0.60	2.0
	4	20.4	30.48						
	10	15.4	31.72						
	16	14.6	31.80	4.0	0.4	3.2	1.19	7.74	3.0
B4	0	19.6	31.76	7.3	0.0	1.0	0.34	3.93	2.9
	3	19.5	31.74	7.3	0.1	1.7	0.49	3.97	
	10	15.2	31.84	5.4	0.2	2.3	0.77	2.18	
	18	14.7	31.99	3.7	0.4	2.8	1.52	8.10	2.1
C2	0	23.5*	27.35	9.5	0.1	2.6	0.41	0.57	6.6
	3	22.5	28.42						
	8	25.6	30.55						
	15	16.0	31.90						
	29	13.4	32.37	6.9	0.2	2.0	0.80	5.06	2.8
C3	0	21.8*	28.35	8.4	0.0	2.7	0.78	0.71	3.5
	2	21.8	28.39	8.3	0.0	1.3	0.70	0.81	
	5	21.8	28.59	8.4	0.0	1.7	0.46	0.94	
	10	18.3	30.84	6.7	0.1	3.9	0.53	1.07	
	21	13.5	32.14	5.3	0.5	3.3	1.27	8.76	3.0
C4	0	23.5*	29.74	8.2	0.2	1.9	0.33	0.46	6.4
	3	22.0	30.03						
	8	21.6	30.30						
	12	18.4	31.17						
	21	14.5	32.15	6.0	0.3	2.8	0.49	4.91	6.3

CRUISE NO. XI   DATE 15-17 July 1974

Table AI. Hydrographic Data (cont.)

STA	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
C5	0	22.5*	30.07	7.3	-				
	2	22.3	30.05	7.2	0.0	0.8	0.38	0.93	2.1
	6	22.3	30.18	7.1	0.0	1.5	0.32	1.14	
	15	15.4	31.83	6.8	0.0	1.1	0.68	4.32	
	22	14.6	32.50	7.4	0.0	3.1	0.42	2.42	7.4
D2	0	24.9*	26.49	10.4	0.1	1.8	0.88	1.71	2.2
	2	22.4	29.09						
	7	20.7	30.90						
	13	15.1	31.67						
	20	13.6	31.93	4.8	1.0	5.9	1.74	11.72	4.0
D3	0	25.0*	29.39	7.7	0.0	1.4	0.47	0.59	3.0
	2	22.7	29.40	7.8	0.0	1.3	0.40	0.77	
	5	22.4	29.60	7.7	0.0	3.4	0.23	0.52	
	9	20.8	30.94	6.9	0.1	0.9	0.35	1.53	
	19	13.4	32.02	5.0	0.4	2.4	1.19	5.92	2.4
D4	0	23.5*	29.69	7.3	0.0	1.0	0.36	0.71	2.9
	3	22.8	29.79						
	8	20.9	31.08						
	12	17.5	31.29						
	18	14.2	31.82	4.5	0.2	3.4	1.49	10.10	2.4
D5	0	23.0*	30.90	6.7	0.1	1.8	0.46	1.86	4.1
	3	22.7	30.91	6.9	0.0	2.2	0.41	1.17	
	9	20.0	31.23	7.4	0.1	0.7	0.42	2.07	
	15	15.3	31.83	5.4	0.1	2.6	0.65	5.54	
	21	13.3	32.03	4.2	1.0	3.7	0.95	7.56	4.9

*Bucket temperature.

CRUISE XII DATE 5-7 Aug. 1974

Table AI. Hydrographic Data

STA	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	24.5	9.95	5.4	21.9	9.2	2.80	11.2	8.2
	3	24.4	10.43						
	6	24.4	10.86	4.7	29.5	16.4	3.65	16.0	
A2	0	24.1	12.41	4.7	14.0	12.8	2.98	9.1	9.0
	3	24.0	13.20						
	7	23.9	14.21	3.4	15.0	18.9	3.51	11.2	
A3	0	23.6	22.75	3.0	11.5	35.9	4.74	14.4	10.0
	4	23.4	24.29	3.1	11.8	31.7	5.42	14.2	
	10	23.2	25.39	3.5	8.7	28.4	4.07	12.4	
A4	0	-	26.30	6.4	7.2	21.2	3.39	7.2	8.4
	4	-	26.80						
	10	-	28.26	5.8	3.6	8.6	2.15	4.6	
P1	0	21.8	30.09	7.2	1.5	2.4	1.12	3.4	3.5
	6	19.8	31.49	6.2	1.1	4.1	0.97	6.1	
	13	14.2	32.15	4.0	1.5	5.3	1.21	8.9	
B2	0	22.9	30.29	9.5	1.2	1.1	0.80	2.1	4.1
	4	21.0	30.84						
	10	17.8	31.88						
	23	11.9	32.65	5.1	1.8	5.1	1.15	10.0	
B3	0	22.2	30.35	7.8	0.2	0.7	0.66	0.7	1.4
	2	22.1	30.35						
	7	21.3	30.64						
	19	12.3	32.45	4.9	3.1	7.0	1.41	14.7	
B4	0	22.3	30.48	7.9	0.2	0.5	0.54	0.9	1.3
	3	22.3	30.47	7.9	0.6	0.9	0.67	0.9	
	8	18.4	31.47	6.1	0.5	0.8	0.88	3.4	
	17	16.1	32.05	5.1	1.8	3.3	1.24	11.8	
C2	0	22.9	30.59	8.4	0.3	1.2	0.73	1.8	2.0
	5	17.8	31.69						
	10	15.2	30.98						
	15	13.7	32.25						
	31	10.2	32.77	6.1	2.4	3.9	1.11	12.4	
C3	0	21.2	31.07	7.7	0.5	0.7	0.65	1.3	1.8
	3	20.7	31.34	7.6	0.3	0.6	0.41	1.4	
	6	19.1	31.53	6.9	0.3	1.1	0.74	2.6	
	10	15.6	32.38	8.5	0.4	0.6	0.42	3.0	
	23	11.9	32.63	5.4	3.1	5.2	1.44	14.1	

CRUISE XII   DATE 5-7 Aug. 1974

Table AI. Hydrographic Data (cont.)

STA	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
C4	0	21.8	31.16	7.3	0.3	1.1	0.48	0.9	2.9
	5	20.8	31.11						
	10	15.1	32.09						
	18	13.6	32.48						
	23	12.8	32.49	5.0	3.8	6.4	1.28	12.3	
C5	0	21.4	31.21	6.7	0.2	0.6	0.79	2.5	1.0
	3	21.4	31.20	6.7	0.2	0.9	0.63	2.5	
	7	21.2	31.21	6.8	0.3	1.0	0.71	2.5	
	12	21.1	31.22	6.8	0.4	1.5	0.76	2.7	
	24	13.4	32.60	5.7	2.2	2.8	1.15	10.1	
D2	0	21.8	30.73	8.5	0.3	0.6	0.65	2.1	1.4
	3	21.4	30.70						
	7	20.7	30.67						
	12	18.1	31.74						
	22	11.1	32.67	4.9	3.3	7.4	1.55	17.7	
D3	0	22.3	30.97	8.6	0.1	0.4	0.61	1.1	0.8
	2	21.3	31.05	8.9	0.1	0.8	0.31	0.9	
	7	19.3	31.60	6.0	0.7	1.9	1.02	5.8	
	14	15.1	32.13	4.1	1.8	5.1	1.42	10.8	
	22	10.2	32.78	5.5	3.5	4.8	1.44	16.2	
D4	0	21.6	31.37	7.3	0.5	0.8	0.64	1.9	2.0
	2	21.0	31.40						
	6	19.7	31.63						
	11	17.2	31.77						
	20	11.3	32.71	5.0	2.6	6.2	1.36	14.5	
D5	0	23.1	31.10	6.6	0.2	0.6	0.50	1.0	1.6
	3	22.9	31.12	6.8	0.2	0.5	0.35	0.8	
	8	21.2	31.32	6.8	0.3	0.5	0.61	0.8	
	15	14.8	32.32	6.5	0.7	1.0	0.90	5.8	
	25	11.3	32.74	5.3	2.6	3.9	1.06	12.8	

CRUISE NO. I   DATE 28-30 Sept. 1973

Table AII. Suspended Particulate Matter (Volume^{-1})

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	8.0	51.58	6.8	1.24	0.76	1.5	1.51
	2	8.0				0.76		1.77
	6	12.0	41.60	10.5	1.49	0.80		2.18
A2	0	3.7	-	-	1.12	1.29	2.9	0.75
	3	4.4				0.93		0.80
	8	10.0	27.76	18.6	1.79	1.05		1.92
A3	0	3.1	37.87	8.4	-	1.75	-	0.83
	3	3.4	38.47	7.5	0.80	1.63		0.84
	10	3.7	35.46	9.3	1.03	1.40	-	1.08
M4	0	3.5	32.84	7.5	1.10	1.75	4.0	0.93
	5	13.0				1.63		2.13
	10	7.0	49.66	7.8	1.45	1.28		1.89
A4	0	3.0	31.63	8.9	0.94	1.75	4.6	0.93
	5	4.2				1.40		1.97
	8	5.8	41.84	8.8	1.45	1.75		2.41
P1	0	1.8	9.76	12.4	0.49	1.98	10.1	0.79
	6	1.4	9.60	12.2	0.44	0.89		1.15
	12	3.6	18.95	11.9	0.82	1.16		3.59
C2	0	1.4	9.91	23.1	0.72	4.42	15.3	0.52
	2	1.3				3.96		0.79
	6	1.4				3.96		0.59
	14	1.2				2.68		0.29
	20	0.8	8.80	16.1	0.47	0.62		0.55
C3	0	1.2	5.60	31.2	0.54	4.66	21.6	0.59
	2	0.8	10.28	16.7	0.60	6.66		1.26
	6	1.1	9.46	27.8	0.63	7.55		2.64
	13	1.1	6.92	15.5	1.23	1.24		0.34
	20	1.1	9.61	12.7	0.36	1.10		0.48
C4	0	1.1	9.36	27.7	0.73	4.08	14.0	1.17
	2	1.1				4.42		1.22
	6	1.1				4.31		1.33
	14	1.1				1.98		0.79
	20	1.0	8.68	21.9	0.58	1.38		0.85
C5	0	0.7	4.35	45.5	0.54	1.98	9.2	0.40
	2	1.2	6.42	31.3	0.36	2.10		0.28
	4	1.2	7.58	23.4	0.62	2.10		0.28
	7	1.0	11.04	12.1	0.64	1.98		0.40
	18	1.0	10.23	14.0	0.28	1.69		0.46
	25	1.1	9.69	15.0	0.44	1.24		0.61

CRUISE NO. I DATE 28-30 Sept. 1973

Table AII. Suspended Particulate Matter (Volume^{-1}) (cont.)

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
D2	0	1.0	11.95	20.7	0.64	4.89	19.1	0.95
	2	1.2				5.01		0.83
	6	0.9				4.66		0.79
	14	0.9				3.14		0.72
	22	1.5	8.05	15.5	0.51	0.34		0.37
D3	0	2.0	11.13	27.4	1.15	11.54	25.1	1.29
	2	1.8	8.50	28.6	0.76	7.10		0.82
	4	1.5	7.00	26.8	0.67	4.08		1.57
	8	1.4	7.21	16.7	0.54	0.71		1.33
	18	2.0	10.45	13.6	0.59	0.58		1.16
D4	0	0.8	8.17	22.9	0.57	2.68	11.8	0.88
	2	0.9				2.79		1.16
	6	0.7				3.14		0.91
	14	1.4				0.89		1.15
	18	2.2	7.68	26.7	0.51	0.80		1.92
D5	0	1.4	13.52	26.5	1.14	9.32	20.4	3.13
	1	1.1	12.74	16.9	0.92	3.96		0.59
	3	1.1	11.24	16.7	0.62	1.38		0.62
	5	1.2	7.65	18.6	0.59	0.98		0.53
	12	1.3	9.56	10.5	0.42	0.93		0.65
	20	1.5	5.71	15.4	0.29	0.80		0.56
M15	0	2.5	8.86	36.1	0.73	3.03	10.4	0.54
	2	2.5				2.56		0.60
	4	2.5				2.68		0.88
	11	0.9				1.98		0.30
	18	0.9				0.37		0.40
	28	2.0	8.51	16.9	0.50	0.58		0.67
B4	0	1.4	9.50	25.0	0.70	3.61	12.9	3.14
	2	1.3				4.08		0.87
	5	1.3				3.84		1.80
	13	1.5				0.93		1.03
	17	1.6	9.94	14.5	0.59	0.53		1.09

CRUISE NO. II DATE 27-28 Oct. 1973

Table AII. Suspended Particulate Matter (Volume^{-1})

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	3.6	48.46	6.7	0.82	1.84	5.6	0.60
	3	4.4				1.20		0.92
	8	6.3	43.67	7.3	1.10	1.20		1.10
A2	0	3.7	29.74	10.1	1.05	2.53	6.0	0.60
	3	3.8				1.16		0.70
	7	3.6	35.12	10.8	1.47	0.98		1.67
A3	0	2.6	36.74	6.9	0.77	2.07	6.7	0.47
	4	2.6	36.84	7.2	1.09	2.18		0.84
	9	3.5	40.37	7.2	1.15	2.30		1.61
M4	0	2.4	33.88	7.6	1.28	1.38	2.7	0.77
	5	2.6				1.26		0.98
	10	6.6	46.11	7.1	1.61	2.53		3.62
A4	0	3.2			1.25	1.95	3.9	0.88
	5	7.1				4.44		6.13
	8	9.9	24.98	10.5	2.39	4.89		10.22
P1	0	4.6	39.96	6.5	1.20	5.78	12.0	2.16
	6	4.6	38.78	7.0	1.24	6.67		2.02
	13	2.9	39.81	8.7	1.19	4.36		1.40
C3	0	1.5	10.36	13.5	0.57	1.61	7.1	0.34
	3	1.6	9.42	11.4	0.70	1.61		0.34
	6	1.9	8.75	13.9	0.67	1.84		0.31
	9	1.4	10.36	15.8	0.43	1.84		0.31
	21	1.4	8.47	14.5	0.53	1.61		0.34
C5	0	1.4	9.58	9.1	0.49	1.29	6.6	0.30
	2	1.4	10.33	7.2	0.53	1.07		0.44
	4	1.4	9.27	10.0	0.57	1.20		0.39
	7	1.4	10.55	8.5	0.56	1.16		0.32
	16	1.5	29.74	5.7	0.48	1.20		0.35
	24	1.6	8.24	9.6	0.54	1.24		0.38
D3	0	0.8	10.78	15.7	0.78	6.67	21.4	0.51
	2	1.1	11.70	14.8	0.76	6.67		0.51
	6	0.8	10.49	17.6	0.88	6.22		0.58
	9	0.9	10.04	16.3	0.87	5.78		1.02
	21	4.4	16.38	15.1	0.88	8.67		2.10
D5	0	0.6	6.07	15.8	0.43	0.42	3.4	0.25
	3	0.4	6.56	16.7	0.50	0.45		0.23
	6	0.4	7.55	16.2	0.59	0.46		0.24
	11	0.4	6.83	10.5	0.76	0.42		0.25
	21	0.4	3.77	24.4	0.50	0.48		0.22

CRUISE NO. III DATE 17-19 Nov. 1973

Table AII. Suspended Particulate Matter (Volume^{-1})

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	8.7	46.82	6.6	1.30	4.51	12.1	1.19
	2	8.9				4.51		1.19
	6	8.4	43.02	6.9	1.22	3.93		1.28
A2	0	7.3	39.44	6.8	1.25	3.00	8.4	1.02
	2	7.1				2.77		1.16
	7	8.6	43.21	7.6	1.39	2.08		1.55
A3	0	3.6	35.29	6.4	1.12	1.94	6.1	0.39
	3	3.6	35.56	6.7	1.05	1.76		0.45
	10	6.6	44.14	6.5	1.43	1.59		0.90
M4	0	2.7	33.26	7.6	1.06	1.73	5.7	0.43
	5	3.6				1.39		0.77
	10	5.2	45.67	8.6	1.49	1.39		1.46
A4	0	2.6	-	-	0.70	1.62	8.1	0.54
	5	2.6				1.62		0.64
	10	3.6	12.31	15.6	0.80	1.62		1.33
P1	0	1.6	-	-	0.31	1.63	18.4	0.62
	5	1.6	-	-	0.35	1.68		0.61
	15	1.4	11.61	12.0	0.38	1.59		0.59
C2	0	1.3	10.11	22.2	0.64	2.20	12.0	0.65
	3	1.4				2.20		0.65
	8	1.3				2.20		0.65
	19	1.5				1.50		0.46
	30	1.6	12.22	10.6	0.65	0.24		0.32
C3	0	1.7	7.14	13.4	0.38	2.55	23.5	0.45
	2	1.4	2.33	83.9	0.66	2.60		0.35
	4	1.1	9.41	13.1	0.49	2.62		0.35
	8	1.1	7.67	21.0	0.50	2.31		0.53
	15	1.4	8.69	14.7	0.52	1.58		0.71
C4	0	1.4	9.58	17.6	0.57	2.08	12.8	0.47
	4	1.3				1.96		0.69
	8	1.4				1.96		0.69
	21	1.1				1.23		0.41
	30	1.3	13.15	10.0	0.58	0.16		0.24
C5	0	1.6	8.87	17.4	0.68	2.55	13.1	0.70
	2	1.2	10.05	13.4	0.55	2.51		0.63
	4	1.4	5.11	30.8	0.56	2.60		0.66
	8	1.4	5.24	36.0	0.63	2.62		0.85
	15	1.4	10.10	20.2	0.57	2.60		0.60
	22	1.4	7.13	19.9	0.55	2.47		0.50

CRUISE NO. III DATE 17-19 Nov. 1973

Table AII. Suspended Particulate Matter ($Volume^{-1}$) (cont.)

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
D2	0	1.6	6.09	37.6	0.63	1.68	9.3	0.54
	3	2.1				1.62		0.44
	7	2.2				1.59		0.55
	12	1.6				0.32		0.30
	20	2.4	11.51	10.7	0.62	1.23		0.41
D3	0	1.9	7.13	19.6	0.46	1.23	9.4	0.26
	2	1.4	6.51	26.4	0.53	1.41		0.35
	4	1.5	7.32	18.8	0.51	1.45		0.38
	7	1.6	5.76	22.8	0.54	1.19		0.38
	18	1.6	9.11	16.6	0.48	1.68		0.39
D4	0	1.6	10.94	28.4	0.75	2.20	10.3	0.65
	3	1.6				2.66		0.68
	7	1.4				2.43		0.72
	11	1.3				1.50		0.46
	18	1.4	7.74	14.2	0.55	0.97		0.42
D5	0	1.4	4.23	40.2	0.53	2.16	14.3	0.69
	3	1.5	11.07	12.6	0.48	2.16		0.54
	8	1.5	9.58	26.3	0.61	2.25		0.64
	12	1.2	7.10	23.9	0.55	1.96		0.39
	20	1.5	8.62	18.4	0.52	1.96		0.49
M15	0	1.5	6.29	41.3	0.57	2.31	14.2	0.73
	2	0.6				2.20		0.56
	6	0.9				2.31		0.64
	10	1.1				2.08		0.57
	14	1.1				1.85		0.51
	19	1.1	11.00	12.2	0.57	1.39		0.58
B4	0	2.1	7.08	29.3	0.68	1.73	8.9	0.43
	4	2.1				1.85		0.51
	14	1.6				1.50		0.41
	18	1.6	7.10	19.8	0.71	1.06		0.37

CRUISE NO. IV DATE 15-16 Dec. 1973

Table AII. Suspended Particulate Matter ($Volume^{-1}$)

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	12.0	25.57	7.1	0.93	2.66	10.0	1.96
	3	15.0				2.66		2.25
	6	21.0	47.18	7.7	1.75	3.00		3.48
A2	0	10.0	18.37	8.3	0.83	1.62	6.8	1.33
	3	11.0				1.39		1.46
	7	26.0	76.35	8.4	3.16	1.50		3.70
A3	0	5.6	11.14	20.8	0.82	1.13	4.8	0.92
	4	5.6	16.86	13.2	1.03	0.71		0.97
	11	9.1	32.52	13.4	1.81	1.41		2.64
M4	0	6.1	13.01	12.5	1.06	0.84	2.8	0.85
	4	5.3				1.06		0.96
	12	6.2	14.46	11.3	1.09	1.16		1.20
A4	0	5.2	11.23	15.3	0.90	1.19	4.6	0.83
	4	4.6				1.15		0.88
	9	6.2	19.45	12.2	1.08	1.62		1.72
P1	0	3.6	9.27	17.3	1.14	1.98	6.1	0.90
	6	3.5	9.07	17.7	1.17	2.07		0.93
	12	4.7	11.56	13.7	1.15	2.56		1.01
C3	0	3.4	3.95	20.9	0.67	3.76	19.6	0.42
	3	2.9	7.04	19.3	0.54	4.29		0.38
	6	3.3	4.48	23.7	0.81	3.93		0.51
	13	3.4	5.38	23.5	0.73	3.55		0.33
	20	5.6	7.65	24.6	0.81	3.19		0.65
C5	0	4.4	3.42	24.2	0.49	4.29	30.6	0.86
	3	3.3	4.89	26.1	0.53	4.26		1.04
	7	2.9	4.53	26.7	0.53	4.44		0.94
	15	2.7	7.13	22.9	0.56	4.07		0.80
	21	3.2	5.36	25.2	0.61	3.91		0.85
D3	0	0.8	5.86	19.6	0.63	2.68	14.9	0.52
	3	1.3	4.08	24.4	0.60	3.18		0.61
	6	1.1	4.72	22.2	0.53	2.98		0.66
	14	1.1	5.26	22.0	0.61	2.72		0.48
	17	1.3	5.59	18.5	0.57	2.50		0.71
D5	0	3.4	4.42	26.0	0.59	3.11	18.4	0.63
	3	2.9	7.52	21.6	0.55	2.95		0.85
	7	3.1	4.47	24.5	0.56	2.98		0.68
	13	2.2	3.49	23.8	0.52	2.61		0.71
	22	2.1	5.31	22.5	0.49	2.86		0.63

CRUISE NO. V DATE 26-28 Jan. 1974

Table AII. Suspended Particulate Matter (Volume^{-1})

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	18.0	33.31	10.3	1.30	0.57	1.1	1.94
	2	17.0				0.57		2.20
	8	41.0	88.88	10.3	3.22	0.49		5.02
A2	0	10.1	17.18	14.5	0.85	0.31	0.9	1.04
	3	10.3				0.35		1.22
	7	60.0	158.47	12.0	6.44	1.73		6.81
A3	0	34.0	7.78	26.4	0.86	0.72	2.1	0.64
	5	5.0	13.40	21.9	1.00	0.93		0.69
	9	5.0	13.55	20.5	1.02	1.76		0.96
M4	0	6.1	9.57	23.2	0.86	0.84	2.4	0.57
	4	5.4				0.97		0.64
	8	8.1	14.73	19.6	1.15	1.39		1.86
A4	0	4.6	9.12	23.7	0.76	0.84	2.8	0.51
	2	5.4				1.50		0.95
	5	5.8	16.34	17.4	1.06	1.73		1.51
P1	0	3.6	6.25	23.0	0.52	2.20	10.6	0.64
	5	3.1	8.34	20.6	0.48	2.64		0.65
	12	2.4	7.63	22.6	0.35	1.54		0.48
C2	0	3.6	4.71	29.2	0.54	4.74	21.9	0.57
	4	3.4				6.24		0.24
	12	3.0				1.72		0.19
	20	1.9				0.66		0.31
	27	2.1	5.83	19.4	0.27	0.62		0.36
C3	0	3.1	4.93	27.0	0.60	4.01	16.7	0.56
	2	3.9	6.61	26.1	0.42	3.87		0.62
	4	3.4	4.90	28.0	0.42	3.83		0.78
	10	3.1	4.77	27.4	0.44	4.16		0.28
	20	1.4	4.74	21.4	0.24	1.13		0.33
C4	0	4.9	5.39	42.4	0.92	3.93	10.7	1.08
	4	3.8				6.01		0.47
	9	2.7				4.28		0.73
	15	2.5				1.28		0.22
	29	2.6	6.86	18.6	0.27	0.49		0.23
C5	0	1.7	2.66	27.4	0.40	1.72	10.8	0.34
	4	2.4	5.14	22.6	0.44	1.73		0.40
	8	1.9	2.81	26.4	0.33	1.83		0.37
	15	2.1	5.00	23.9	0.34	2.32		0.48
	23	2.5	4.42	22.5	0.31	1.80		0.79

CRUISE NO. V DATE 26-28 Jan. 1974

Table AII. Suspended Particulate Matter (Volume^{-1}) (cont.)

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
D2	0	2.4	6.97	24.6	0.37	2.66	18.0	0.88
	3	2.2				2.89		0.55
	8	2.3				1.96		0.39
	15	2.3				1.06		0.37
	20	2.8	8.13	16.8	0.40	1.23		0.68
D3	0	3.1	4.50	31.5	0.48	3.80	19.8	0.92
	2	2.2	7.35	24.3	0.47	4.09		0.72
	6	2.4	5.37	25.9	0.44	3.61		0.89
	12	2.4	4.78	20.8	0.29	0.78		0.43
	17	2.4	4.82	19.2	0.42	0.97		0.62
D4	0	3.1	5.09	29.5	0.46	4.39	23.8	1.01
	5	3.4				4.74		0.86
	10	2.5				3.24		0.60
	15	2.5				1.41		0.28
	35	2.3	4.42	22.1	0.20	0.62		0.32
D5	0	2.7	4.80	32.3	0.44	5.23	29.7	1.15
	3	3.0	4.55	36.4	0.44	5.62		0.76
	8	2.8	4.56	29.7	0.31	4.49		0.73
	15	2.4	3.25	26.5	0.20	1.26		0.29
	21	2.6	4.29	23.7	0.21	1.22		0.43

CRUISE NO. VI DATE 16-18 Feb. 1974

Table AII. Suspended Particulate Matter ($Volume^{-1}$)

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A-1	0	7.9	10.03	14.0	0.64	0.93	3.6	0.76
	2	7.0				1.50		0.56
	5	9.9	30.15	14.2	1.69	4.39		1.50
A-2	0	8.6	12.47	13.6	0.91	1.19	3.3	0.87
	3	4.3				3.47		0.95
	7	3.7	17.74	19.5	1.13	4.51		1.29
A-3	0	4.9	9.98	19.9	0.99	2.88	7.3	1.01
	2	4.9	15.49	18.8	1.08	3.66		1.12
	12	3.4	16.85	17.1	1.10	7.49		2.16
A-4	0	4.1	9.95	21.6	0.87	3.24	9.3	1.18
	4	4.1				6.47		1.78
	9	3.7	17.31	18.5	0.97	8.79		2.02
P-1	0	2.3	6.61	24.8	0.60	8.66	36.1	1.21
	4	2.4	7.57	24.0	0.65	8.57		1.42
	10	3.4	10.10	19.6	0.80	10.68		2.37
B-2	0	1.5	5.04	29.6	0.52	9.25	44.5	1.17
	5	1.6				9.25		2.15
	15	1.6				9.71		1.30
	20	1.1	4.97	19.3	0.28	1.32		0.74
B-3	0	2.5	7.65	22.6	0.48	5.32	27.7	1.95
	4	2.6				5.09		2.18
	10	2.5				6.24		1.62
	17	2.5	6.53	22.4	0.56	5.32		1.76
B-4	0	3.1	6.82	17.80	0.45	2.07	11.5	1.56
	4	3.1	6.38	18.07	0.43	1.94		2.07
	11	3.2	6.87	16.71	0.40	2.69		2.24
	15	2.5	7.03	17.42	0.40	2.07		2.01
C-2	0	2.1	4.93	32.9	0.66	6.94	26.3	0.92
	3	2.4				7.40		1.44
	8	2.4				8.09		1.34
	15	2.3				8.32		0.32
	25	1.4	5.17	18.2	0.28	1.63		0.50
C-3	0	1.6	4.96	29.6	0.55	5.51	25.0	1.50
	2	1.9	4.91	30.8	0.44	6.48		1.72
	4	1.7	2.82	32.2	0.54	4.76		4.37
	12	1.7	4.27	27.6	0.48	3.18		0.72
	23	0.9	4.32	23.7	0.34	1.41		0.70

CRUISE NO. VI   DATE 16-18 Feb. 1974

Table AII. Suspended Particulate Matter (Volume^{-1}) (cont.)

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
C-4	0	1.9	6.15	24.4	0.46	6.70	36.4	1.16
	3	2.7				5.78		1.49
	7	2.2				7.17		0.89
	12	2.0				6.70		0.76
	20	2.9	7.64	20.9	0.64	6.24		1.62
C-5	0	1.5	4.40	26.9	0.47	2.68	14.2	1.22
	3	1.6	4.59	28.8	0.35	2.54		0.97
	8	1.3	4.49	26.2	0.37	2.54		1.24
	21	1.3	7.58	20.4	0.46	2.48		1.46
	25	1.4	5.12	22.7	0.41	2.82		1.40
D-2	0	1.9	4.81	29.5	ND	2.08		0.87
	3	1.5				5.78		1.10
	6	1.9				6.70		0.76
	15	1.7				5.32		1.17
	20	1.5	5.15	20.4		6.94		1.51
D-3	0	1.6	4.89	28.1	0.58	5.28	22.8	1.06
	3	1.5	4.63	27.2	ND	5.52		0.95
	7	1.5	7.08	24.9	0.56	6.44		0.85
	12	1.8	7.81	29.0	0.41	6.35		1.38
	20	1.5	5.56	18.2	0.31	2.07		0.65
D-4	0	2.2	5.00	29.6	0.61	7.17	29.4	0.69
	3	1.4				8.09		1.14
	7	1.4				7.86		0.98
	12	1.3				8.79		0.00
	18	1.6	4.80	18.5	0.39	2.08		0.67
D-5	0	1.3	4.00	29.9	0.58	4.62	19.9	1.21
	3	1.3	4.82	28.7	0.49	4.73		0.99
	6	1.4	4.83	29.3	0.52	4.97		1.03
	16	1.1	7.07	18.9	0.33	2.26		0.52
	22	0.9	4.23	20.4	0.30	1.81		0.63

CRUISE NO. VII DATE 10-11 Apr. 1974

Table AII. Suspended Particulate Matter ($Volume^{-1}$)

STA	Z	TURB.	TMS	% CMS	POC	CHL	% PHYTO-C	PHAEO
A3	0	-	13.29	16.5	1.05	1.19	2.8	1.45
	3	-	13.60	18.9	1.08	1.54		1.98
	12	-	18.07	19.7	1.10	2.59		2.41
P1	0	-	5.40	20.8	0.57	1.85	8.1	1.39
	3	-	7.48	21.3	0.43	1.96		1.19
	12	-	8.47	19.1	0.54	2.19		1.37
B4	0	-	4.36	25.7	0.51	0.64	3.1	0.64
	4	-	4.72	21.4	0.31	0.73		0.74
	10	-	4.45	21.4	0.29	0.84		0.72
	19	-	4.66	21.2	0.38	1.15		0.84
C3	0	1.6	3.72	28.4	0.47	1.57	8.4	0.91
	4	2.4	3.42	28.8	0.37	1.52		0.88
	8	2.1	3.06	29.1	0.33	1.53		0.58
	21	1.9	4.12	28.4	0.39	1.68		1.27
	23	1.9	5.92	28.2	0.47	1.88		2.02
C5	0	2.4	2.45	29.8	0.38	0.89	5.8	0.63
	4	1.6	3.79	26.6	0.31	0.91		0.71
	9	2.1	3.09	28.5	0.26	0.79		0.39
	15	1.9	2.81	29.6	0.29	0.78		0.43
	23	2.0	6.14	21.3	0.36	1.06		1.21
D3	0	1.9	3.05	26.4	0.51	1.63	11.2	0.66
	3	1.6	4.14	22.8	0.38	1.61		0.85
	6	1.6	3.78	25.2	0.32	1.30		1.19
	15	1.6	3.23	28.3	0.41	1.61		0.68
	21	1.5	4.38	27.0	0.48	1.94		0.89
D5	0	2.4	3.51	31.1	0.66	1.81	9.6	0.59
	3	1.5	4.11	28.4	0.39	1.88		0.51
	6	2.0	3.37	28.1	0.45	1.54		0.61
	15	2.6	3.21	33.4	0.45	1.79		0.74
	23	1.6	3.99	26.8	0.39	2.06		1.01

CRUISE NO. VIII DATE 27-29 Apr. 1974

Table AII. Suspended Particulate Matter (Volume^{-1})

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	16.0	26.49	13.2	1.25	0.64	1.3	1.50
	2	30.0				1.33		3.29
	6	47.0	122.80	11.4	4.74	1.85		5.08
A2	0	34.0	73.46	10.9	2.76	1.16	1.0	3.02
	2	50.0				1.50		4.69
	6	69.0	197.28	10.7	7.58	2.54		9.74
A3	0	9.9	18.47	19.1	1.15	3.74	8.1	1.34
	5	7.6	16.61	19.6	1.29	4.28		1.37
	9	7.7	21.36	14.7	1.41	3.87		2.27
A4	0	5.4	15.69	14.9	0.89	4.28	12.0	0.64
	5	5.1				7.74		1.30
	9	5.3	11.83	24.2	0.99	7.17		1.28
P1	0	2.9	5.40	31.0	0.73	3.41	11.7	0.82
	3	2.4	4.37	34.3	0.60	3.04		0.94
	13	3.4	4.19	30.7	0.40	2.41		1.55
B2	0	3.2	5.01	33.4	0.58	3.35	14.4	0.78
	3	3.6				3.41		0.77
	14	3.4				1.27		1.19
	25	3.4	5.33	26.4	0.42	1.56		1.24
B3	0	5.1	4.91	33.8	0.46	2.49	13.5	1.45
	3	4.9				2.72		1.31
	13	4.9				0.84		1.15
	17	5.8	5.16	28.3	0.38	1.15		1.25
B4	0	6.8	3.73	36.6	0.60	3.33	13.9	0.72
	3	4.1	4.10	37.6	0.52	3.64		1.08
	15	5.1	4.87	25.4	0.38	1.17		1.76
	17	4.6	4.57	26.5	0.37	1.08		1.56
C2	0	4.1	5.31	32.3	0.60	3.18	18.6	0.85
	3	3.5				3.76		0.67
	6	2.6				3.58		0.54
	14	2.1				1.52		0.71
	30	2.0	5.07	24.8	0.28	0.62		0.62
C3	0	2.6	4.44	29.2	0.80	2.96	13.0	0.38
	3	2.5	2.51	55.8	0.59	2.89		0.52
	6	2.1	4.67	29.5	0.52	2.93		0.50
	10	3.1	5.00	23.3	0.41	2.10		0.92
	13	3.1	5.44	23.6	0.43	1.43		0.84
C4	0	3.8	4.64	37.1	0.62	2.89	16.3	0.55
	3	3.2				3.01		0.48
	6	3.3				2.60		0.45
	14	2.7				0.93		1.02
	21	3.8	4.86	27.2	0.38	0.87		1.59

CRUISE NO. VIII DATE 27-29 Apr. 1974

Table AII. Suspended Particulate Matter ($Volume^{-1}$) (cont.)

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
C5	0	2.3	3.78	30.3	0.58	2.18	13.2	0.19
	3	2.0	4.15	36.1	0.50	1.99		0.22
	9	1.8	2.57	32.9	0.37	1.08		0.29
	21	2.0	3.94	21.7	0.34	-		-
	28	1.9	4.41	19.5	0.28	0.53		0.68
D2	0	3.3	3.91	32.2	0.56	3.01	13.4	1.12
	3	2.7				2.77		1.16
	6	3.0				2.83		1.10
	14	3.0				1.79		0.86
	23	4.2	8.61	20.2	0.57	5.66		2.30
D3	0	3.6	4.36	29.0	0.68	3.45	12.7	1.33
	3	3.5	5.41	30.1	0.48	3.41		1.31
	6	2.9	4.12	29.5	0.46	2.15		1.53
	14	2.5	3.92	23.3	0.30	1.39		1.01
	23	4.3	10.62	17.9	0.55	2.84		1.42
D4	0	2.3	4.81	27.5	0.52	3.12	15.0	0.76
	3	2.4				3.58		0.54
	6	2.5				4.51		0.90
	15	2.6				1.32		0.63
	17	4.6	5.13	23.6	0.36	1.50		1.10
D5	0	2.0	4.17	35.3	0.70	2.01	10.0	0.30
	3	2.1	5.06	38.1	0.70	2.32		0.37
	8	2.0	4.45	30.1	0.46	1.85		0.10
	18	2.1	3.77	24.3	0.37	1.02		0.41
	25	2.3	3.02	21.4	0.30	0.57		0.50

CRUISE NO. IX DATE 25-27 May 1974

Table AII. Suspended Particulate Matter (Volume^{-1})

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	20.0	42.06	12.1	1.79	13.62	19.0	4.68
	2	21.1				11.42		4.64
	5	25.0	58.90	12.2	2.29	6.15		6.55
A2	0	20.0	39.91	12.6	1.60	3.93	6.1	2.99
	2	25.0				5.27		4.44
	6	24.0	50.17	14.1	2.05	2.67		4.50
A3	0	8.1	21.51	23.1	0.96	2.16	5.6	1.56
	4	7.2	19.08	24.1	1.18	2.01		2.24
	10	10.0	34.94	15.5	2.05	2.19		5.45
A4	0	5.2	10.30	26.9	1.03	3.11	7.5	1.88
	4	5.2				2.30		3.08
	8	7.4	15.02	19.1	0.97	2.19		3.78
P1	0	3.7	5.39	56.6	1.19	2.88	6.0	0.42
	5	3.7	7.12	54.6	1.26	4.96		0.62
	12	4.3	5.50	31.5	0.38	0.61		0.77
B2	0	4.5	4.63	43.4	0.58	1.67	7.2	0.12
	4	4.6				3.57		0.35
	15	4.6				0.75		0.30
	22	4.6	4.69	29.7	0.40	0.57		0.62
B3	0	1.4	4.98	41.0	0.59	1.84	7.8	0.12
	4	1.4				1.84		0.12
	10	1.7				2.07		0.00
	17	1.8	5.02	45.2	0.65	1.19		0.31
B4	0	4.1	3.98	53.1	0.41	2.07	12.6	0.40
	5	3.1	4.12	49.0	0.67	1.89		0.43
	10	3.1	5.48	44.2	0.61	1.89		0.46
	17	2.8	5.74	31.6	0.35	0.71		0.97
C2	0	5.6	4.71	43.8	0.58	2.19	13.2	0.16
	5	5.5				5.41		0.00
	12	4.4				1.54		0.22
	18	4.4				1.27		0.33
	28	4.4	4.82	29.2	0.33	0.44		0.49
C3	0	3.6	3.68	39.9	0.51	1.41	9.7	0.13
	2	3.1	4.35	38.3	0.37	1.32		0.18
	5	2.1	6.89	38.4	0.59	1.63		0.24
	8	1.8	4.30	44.1	0.60	1.41		0.20
	21	2.5	5.42	40.8	0.55	1.19		0.38
C4	0	6.2	4.65	47.6	0.67	1.67	8.7	0.01
	3	6.2				1.85		0.13
	7	7.0				2.07		0.08
	16	5.4				1.96		0.00
	21	6.1	6.11	32.9	0.39	0.75		0.93

CRUISE NO. IX DATE 25-27 May 1974

Table AII. Suspended Particulate Matter (Volume^{-1}) (cont.)

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
C5	0	2.4	6.93	31.9	0.56	0.61	2.7	0.20
	2	2.6	4.28	40.7	0.53	1.76		0.30
	6	2.5	3.20	41.9	0.43	1.45		0.20
	9	4.	4.59	33.6	0.39	0.88		0.21
	24	3.6	5.50	31.6	0.30	0.22		0.21
D2	0	2.6	7.77	40.7	0.76	2.65	8.7	0.58
	2	3.1				2.53		0.31
	6	3.5				2.53		0.60
	12	3.1				0.92		0.76
	20	3.1	5.89	28.9	0.34	0.66		1.06
D3	0	4.4	8.08	42.5	1.04	3.13	7.5	0.86
	2	3.6	4.19	55.1	0.84	3.13		0.76
	4	3.5	4.77	44.3	0.60	1.93		1.32
	10	2.6	4.66	33.9	0.38	1.01		0.71
	20	3.0	5.49	27.5	0.36	0.27		1.26
D4	0	3.2	4.59	43.9	0.71	2.07	7.3	0.47
	2	3.5				2.53		0.40
	5	2.7				2.99		0.82
	10	3.8				1.38		1.16
	20	4.6	4.91	29.4	0.36	0.70		1.02
D5	0	3.1	4.14	26.9	0.35	0.24	1.7	0.13
	3	2.5	2.95	32.4	0.27	0.59		0.12
	7	2.5	4.08	45.4	0.65	1.33		0.22
	11	3.1	4.20	37.4	0.41	0.44		1.02
	24	4.4	4.99	28.6	0.30	0.18		0.67

CRUISE NO. X   DATE 22-24 June 1974

Table AII. Suspended Particulate Matter (Volume^{-1})

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	14.0	29.39	12.9	1.21	3.22	6.6	2.94
	2	15.1				3.46		2.81
	5	15.1	41.39	15.3	1.53	3.11		2.47
A2	0	9.3	17.50	17.3	0.92	2.65	7.2	1.56
	2	9.9				2.53		1.68
	6	14.0	30.26	13.6	1.47	2.07		2.14
A3	0	5.6	10.0	29.3	1.06	2.69	6.3	1.11
	5	6.3	13.78	32.5	1.05	2.41		0.99
	10	8.0	19.13	24.3	1.30	2.26		1.59
A4	0	7.5	9.07	30.7	0.72	4.49	15.6	1.48
	7	5.7				4.72		1.64
	17	5.0	11.80	24.1	0.84	3.92		2.45
P1	0	5.2	8.57	40.0	1.02	12.19	29.9	1.23
	6	4.6	9.76	35.5	0.92	11.71		0.70
	12	3.5	8.86	28.8	0.56	1.36		0.69
B2	0	4.3	4.78	57.3	0.97	14.50	37.4	2.68
	5	4.5				14.94		2.24
	12	5.1				1.23		0.64
	25	5.4	4.57	31.6	0.25	0.35		0.47
B3	0	3.5	4.60	58.3	0.86	7.03	20.4	1.19
	4	3.3				7.03		0.81
	10	4.9				0.88		0.80
	19	4.9	4.16	33.9	0.27	0.53		0.52
B4	0	3.5	4.70	57.0	0.97	4.66	12.0	0.89
	4	3.4	4.13	62.0	0.85	4.98		0.57
	10	3.6	4.70	44.9	0.60	2.50		0.75
	15	3.8	3.15	34.3	0.32	0.78		0.66
C2	0	5.1	5.48	45.9	0.76	14.06	46.2	1.25
	2	4.8				14.94		1.49
	4	5.1				15.38		1.43
	8	4.6				9.23		1.60
	29	4.5	5.13	25.9	0.27	0.44		0.53
C3	0	3.0	7.66	47.5	1.20	14.50	30.2	2.31
	2	2.2	8.39	46.0	0.86	10.79		2.76
	6	2.5	4.80	45.9	0.55	2.97		1.20
	12	1.9	5.40	43.0	0.52	2.62		0.64
	22	3.2	4.55	39.5	0.42	1.41		0.84
C4	0	3.4	4.02	52.4	0.83	4.38	13.2	0.23
	2	4.4				4.38		0.52
	4	3.6				4.38		0.32
	10	3.4				2.19		0.16
	21	5.6	4.85	33.5	0.42	1.01		0.67

CRUISE NO. X DATE 22-24 June 1974

Table AII. Suspended Particulate Matter ($Volume^{-1}$) (cont.)

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
C5	0	2.8	3.42	56.1	0.82	2.79	8.5	0.60
	3	2.5	3.29	60.2	0.66	2.85		0.52
	9	2.4	4.10	46.2	0.45	1.54		0.48
	15	-	4.23	37.4	0.33	0.73		0.23
	28	3.1	4.06	33.5	0.27	0.37		0.24
D2	0	3.4	6.04	58.0	1.18	15.82	33.5	3.60
	4	3.0				19.58		0.98
	9	2.1				2.99		0.73
	15	2.5				1.41		0.65
	21	4.5	11.08		0.49	0.62		0.92
D3	0	5.0	5.02	65.8	1.54	6.10	9.9	2.12
	3	3.6	4.66	57.4	0.91	4.38		1.20
	8	3.3	4.43	43.1	0.56	2.29		0.52
	14	3.7	3.49	40.6	0.49	2.05		0.67
	21	4.6	7.26	26.4	0.36	0.49		0.58
D4	0	2.6	3.93	44.7	0.56	1.84	8.2	0.90
	3	2.8				3.22		0.50
	6	3.0				2.07		0.47
	15	2.9				1.23		0.71
	20	3.5	4.56	28.1	0.29	0.44		0.83
D5	0	2.4	3.09	31.9	0.41	1.19	7.2	0.14
	5	2.4	16.67	37.1	0.82	2.78		0.34
	10	2.6	5.30	48.3	0 94	2.75		0.39
	18	3.6	5.49	66.4	1.33	7.21		0.21
	23	2.6	5.53	31.6	0.28	0.59		0.33

CRUISE NO. XI DATE 15-17 July 1974

Table AII. Suspended Particulate Matter (Volume^{-1})

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0		14.36	26.9	1.49	16.70		2.72
	2					13.62		3.19
	5		22.20	17.2	1.44	6.15		2.44
A2	0		15.08	24.7	1.36	16.26		3.54
	3					16.26		2.42
	6		26.04	15.1	1.31	3.93		2.16
A3	0		15.94	24.7	1.10	9.08		1.94
	4		14.35	22.8	0.99	3.69		3.43
	8		13.43	25.4	1.13	4.15		3.79
A4	0		8.14	31.1	0.96	8.35		4.35
	5					5.71		5.12
	10		11.04	25.2	1.04	5.27		6.31
P1	0		8.47	42.9	1.23	12.04		6.64
	5		7.49	30.7	0.75	4.02		3.32
	13		9.46	28.4	0.55	0.63		0.62
B2	0		6.62	53.2	1.39	10.98		8.81
	2					5.71		7.73
	8					1.41		0.84
	22		4.79	29.8	0.38	0.53		0.59
B3	0		3.48	42.8	0.57	3.69		0.52
	4					2.76		0.47
	10					2.07		0.28
	16		4.07	29.6	0.36	1.10		0.81
B4	0		3.78	31.2	0.31	0.59		0.21
	3		3.88	29.0	0.39	0.65		0.13
	10		4.61	44.1	0.73	3.03		0.48
	18		4.14	27.6	0.35	0.95		0.82
C2	0		6.48	51.0	1.35	5.71		6.61
	3					2.88		2.21
	8					1.96		0.78
	15					1.06		0.59
	29		3.54	30.5	0.29	0.23		0.21
C3	0		7.40	38.3	0.83	3.79		2.30
	2		7.26	39.4	0.72	3.82		2.44
	5		6.98	39.4	0.68	3.41		2.02
	10		4.08	46.4	0.58	2.00		0.89
	21		3.90	33.0	0.35	0.59		0.38
C4	0		3.17	43.8	0.46	0.92		0.98
	3					0.97		0.83
	8					1.23		0.60
	12					1.73		0.23
	21		4.47	30.4	0.30	0.39		0.26

CRUISE NO. XI DATE 15-17 July 1974

Table AII. Suspended Particulate Matter (Volume^{-1}) (cont.)

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
C5	0		8.04	31.5	0.61	0.58		0.28
	2		6.07	31.9	0.41	0.55		0.25
	6		3.80	40.4	0.53	0.65		0.25
	15		3.92	40.4	0.52	1.10		0.35
	22		2.77	38.7	0.85	0.70		0.13
D2	0		15.33	53.8	2.01	12.74		3.32
	2					1.96		0.98
	7					1.01		0.56
	13					1.19		0.57
	20		6.16	24.2	0.33	0.66		0.50
D3	0		2.49	50.8	0.67	0.90		0.56
	2		3.03	43.3	0.50	1.28		0.47
	5		3.07	43.6	0.46	1.23		0.64
	9		3.54	26.7	0.39	1.11		0.35
	19		7.29	22.3	0.41	0.55		0.46
D4	0		3.47	40.5	0.93	0.75		0.41
	3					0.79		0.63
	8					0.66		0.39
	12					1.50		0.56
	18		5.61	30.5	0.41	0.79		0.70
D5	0		4.00	25.8	0.43	0.25		0.15
	3		3.27	27.8	0.32	0.32		0.08
	9		4.70	25.8	0.36	0.34		0.15
	15		3.66	41.7	0.56	1.71		0.51
	21		3.98	28.6	0.29	0.50		0.26

CRUISE XII DATE 5-7 Aug. 1974

Table AII. Suspended Particulate Matter (Volume^{-1})

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	9.8	18.14	3.5	1.06	3.34	7.9	3.51
	3	10.1				2.65		3.22
	6	10.1	26.11	4.5	1.21	2.30		3.18
A2	0	8.9	16.46	21.4	1.05	2.65	6.3	2.74
	3	9.9				1.96		2.74
	7	16.0	40.41	15.7	1.95	1.73		3.26
A3	0	3.5	16.44	36.9	0.97	3.00	7.7	2.00
	4	3.2	18.67	36.0	1.20	2.53		2.06
	10	5.3	20.89	27.7	1.38	2.65		4.29
A4	0	4.2	20.87	42.3	1.76	21.88	31.1	4.55
	4	3.9				17.27		1.32
	10	3.4	20.19	37.0	1.24	10.54		3.65
P1	0	2.5	8.42	44.8	0.80	6.07	15.2	1.55
	6	2.8	10.82	35.0	0.57	1.63		0.94
	13	4.0	14.17	36.9	0.60	0.86		1.54
B2	0	2.3	9.78	49.8	1.22	10.98	22.5	3.21
	4	2.2				9.67		1.91
	10	2.8				2.07		0.96
	23	1.8	6.53	35.1	0.35	0.44		0.53
B3	0	1.6	8.06	34.9	0.66	1.14	4.3	1.10
	2	1.8				1.32		1.26
	7	2.1				1.38		1.85
	19	3.1	8.42	33.8	0.60	1.27		2.06
B4	0	2.1	6.18	41.6	0.55	1.58	7.2	1.07
	3	2.1	7.83	36.8	0.59	1.45		1.01
	8	2.2	7.09	36.0	0.45	1.70		2.22
	17	3.5	9.53	34.5	0.81	2.21		2.88
C2	0	2.2	4.19	62.7	0.84	4.61	13.7	1.07
	5	2.5				2.07		0.86
	10	3.0				1.73		0.82
	15	3.6				0.79		0.70
	31	4.6	8.73	35.4	-	0.28		0.32
C3	0	2.4	7.54	42.8	0.45	1.63	9.1	0.65
	3	2.1	7.94	41.6	0.43	1.67		0.42
	6	1.6	4.43	48.5	0.46	2.55		0.50
	10	2.0	5.36	46.1	0.35	1.08		0.42
	23	3.2	5.06	45.2	0.38	0.67		0.29

CRUISE XII DATE 5-7 Aug. 1974

Table AII. Suspended Particulate Matter (Volume^{-1}) (cont.)

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
C4	0	1.5	5.96	48.7	0.47	1.73	9.2	0.23
	5	2.1				2.30		0.73
	10	2.5				1.38		0.67
	18	3.0				1.05		0.44
	23	4.0	6.60	40.5	0.50	1.14		0.99
C5	0	2.1	3.16	30.1	0.29	0.82	7.0	0.21
	3	1.7	3.98	30.4	0.26	0.80		0.18
	7	2.2	6.53	29.4	0.35	0.80		0.23
	12	1.8	6.13	44.6	0.35	0.90		0.22
	24	2.4	3.86	46.9	0.32	1.06		0.42
D2	0	3.4	7.62	43.4	0.97	5.06	13.0	1.75
	3	2.5				5.76		1.40
	7	2.4				10.54		1.78
	12	2.1				1.19		0.76
	22	3.1	7.33	22.7	0.38	0.48		0.64
D3	0	4.1	26.73	28.4	0.61	2.02	8.3	0.82
	2	3.8	6.38	40.5	2.06	3.69		1.01
	7	3.4	4.01	28.3	0.31	1.80		0.66
	14	3.9	4.61	26.0	0.33	0.96		0.97
	22	5.1	6.18	21.3	0.33	0.58		0.61
D4	0	2.5	6.62	29.1	0.41	1.32	8.0	0.29
	2	2.6				1.54		0.59
	6	3.1				1.84		0.70
	11	4.0				2.53		0.79
	20	5.5	4.88	24.1	0.34	0.48		0.64
D5	0	2.6	3.42	27.3	0.32	0.36	2.8	0.13
	3	2.4	4.00	30.6	0.31	0.36		0.11
	8	2.5	3.75	29.8	0.27	0.38		0.12
	15	2.2	4.36	30.5	0.35	0.97		0.44
	25	4.0	3.32	28.1	0.39	0.68		0.60

CRUISE NO. I DATE 28-30 Sept. 1973

Table AIII. Suspended Particulate Matter ($Area^{-1}$)

STA.	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD.
A1	8	1.7					3.84		
A2	10	1.1					8.28		
A3	12	1.0	1.21	373.3	8.3	8.80	15.66	0.39	214
M4	12	0.8					15.72		
A4	9	0.8					12.57		
P1	13	0.6	0.22	143.7	12.2	6.57	14.76	0.37	
C2	33	0.7					60.66		
C3	23	0.4	0.25	170.6	19.4	15.69	78.74	1.97	1630
C4	24	0.4					61.17		
C5	28	0.3	0.17	239.4	17.2	11.36	44.80	1.12	1601
D2	25	0.3					74.35		
D3	22	0.5	0.26	151.9	19.4	11.44	45.83	1.14	
D4	22	0.3					36.84		
D5	24	0.4	0.19	177.3	14.8	10.14	27.93	0.70	
M15	32	0.5					40.07		
B4	20	0.4					41.59		

CRUISE NO. II DATE 27-28 Oct. 1973

Table AIII. Suspended Particulate Matter (Area^{-1})

STA.	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	16	1.0					10.56		
A2	9	1.0					9.79		
A3	11	0.6	0.88	340.2	7.1	9.33	19.69	0.49	214
M4	13	0.6					16.08		
A4	10	0.6					29.99		
P1	16	1.0	1.45	511.3	7.3	15.84	75.94	1.90	
C3	24	0.2	0.24	198.6	14.4	11.37	36.16	0.90	354
C5	28	0.3	0.27	402.5	7.8	12.55	28.54	0.71	107
D3	23	0.2	0.21	256.2	15.9	17.91	143.78	3.60	
D5	24	0.2	0.16	129.1	16.2	12.71	9.39	0.33	

CRUISE NO. III DATE 17-19 Nov. 1973

Table AIII. Suspended Particulate Matter ($Area^{-1}$)

STA.	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	9	2.3					25.89		
A2	10	2.3					17.91		
A3	12	0.8	0.7	385.3	6.5	11.92	17.28	0.60	225
M4	15	0.8					14.74		
A4	13	0.7					16.18		
P1	18	0.4	0.3	-	-	5.30	24.58	0.86	
C2	34	0.3					47.48		
C3	18	0.2	0.1	112.6	25.8	7.73	33.86	1.18	959
C4	37	0.2					42.98		
C5	28	0.2	0.2	168.8	24.8	12.87	56.62	1.98	844
D2	24	0.3					22.36		
D3	26	0.3	0.2	128.9	20.6	9.17	25.23	0.88	
D4	23	0.3					33.96		
D5	25	0.2	0.2	170.8	22.3	10.83	41.63	1.46	
M15	23	0.3					38.25		
B4	23	0.4					29.01		

CRUISE NO. IV DATE 15-16 Dec. 1973

Table AIII. Suspended Particulate Matter ($Area^{-1}$)

STA.	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	9	1.7					16.5		
A2	10	1.7					10.3		
A3	14	1.1	1.1	229	14.0	13.9	11.1	0.39	14
M4	16	1.1					12.6		
A4	13	1.1					11.6		
P1	15	0.7	-	117	16.4	13.9	26.1	0.91	
C3	24	0.4	0.3	114	22.9	14.6	58.0	2.03	257
C5	27	0.3	0.3	116	24.5	11.5	88.2	3.09	316
D3	21	0.3	0.2	84	21.9	9.9	48.6	1.70	
D5	26	0.3	0.2	105	23.4	11.7	62.4	2.18	

CRUISE NO. V   DATE 26-28 Jan. 1974

Table AIII. Suspended Particulate Matter (Area^{-1})

STA.	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD.
A1	8	3.4					3.3		
A2	9	1.7					5.2		
A3	11	1.0	0.40	106.8	22.4	8.7	9.5	0.24	84
A4	6	1.0					7.2		
P1	15	0.4	0.20	92.4	21.5	5.4	26.8	0.67	
B2									
B3									
B4									
C2	30	0.4					67.8		
C3	23	0.6	0.22	99.6	25.9	7.8	66.0	1.65	963
C4	32	0.6					74.6		
C5	27	0.2	0.10	96.3	24.0	8.1	45.0	1.12	
D2	23	0.4					36.8		
D3	21	0.3	0.15	86.7	29.6	6.7	40.8	1.02	
D4	39	0.3					74.6		
D5	26	0.3	0.18	91.7	23.5	6.2	69.1	1.73	

CRUISE NO. VI DATE 16-18 Feb. 1974

Table AIII. Suspended Particulate Matter ($Area^{-1}$)

STA.	Z_{wc}	K_d	K_p	TMS	%OMS	POC	CHL	PHYTO-C	PROD.
A1	7	1.1					11.3		
A2	9	1.7					23.0		
A3	16	1.1	1.01	187.2	18.1	12.96	62.3	1.56	269
A4	13	0.8					57.6		
P1	13	0.5	0.31	81.3	22.5	6.86	92.2	2.30	
B2	24	0.3					168.6		
B3	20	0.4					95.3		
B4	18	0.5	0.30	100.6	17.4	6.26	33.7	0.84	
C2	31	0.7					167.4		
C3	24	0.4	0.51	93.2	28.8	10.54	80.2	2.00	1160
C4	24	0.4					131.1		
C5	28	0.2	0.24	140.0	23.3	10.14	63.8	1.60	1023
D2	25	0.4					115.2		
D3	23	0.3	0.32	128.4	25.8	9.36	105.8	2.64	
D4	21	0.3					129.0		
D5	25	0.3	0.29	121.1	23.5	9.22	76.9	1.92	

CRUISE NO. VII DATE 10-11 Apr. 1974

Table AIII. Suspended Particulate Matter ($Area^{-1}$)

STA	Z_{wc}	K_d	K_p	TMS	%OMS	POC	CHL	PHYTO-C	PROD
A3	14	1.70	1.71	182.8	19.0	13.03	22.7	0.57	
P1	14	0.43	0.39	91.1	20.3	5.84	24.4	0.61	
B4	21	0.28	0.35	86.6	21.8	6.49	16.4	0.41	
C3	27	0.24	0.20	84.0	28.7	8.62	36.7	0.92	1305
C5	25	0.23	0.22	83.2	26.3	7.07	19.9	0.50	772
D3	23	0.34	0.29	77.0	26.2	8.33	33.0	1.16	
D5	25	0.34	-	81.1	29.9	10.23	41.1	1.44	

CRUISE NO. VIII DATE 27-29 Apr. 1974

Table AIII. Suspended Particulate Matter ($Area^{-1}$)

STA	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	8	3.4					8.3		
A2	8	3.4					10.7		
A3	11	1.1	1.16	163.6	18.2	11.50	36.4	0.91	368
A4	11	1.1					59.9		
P1	15	0.4	0.26	57.5	32.5	6.97	36.9	0.92	
B2	27	0.4					51.5		
B3	19	0.4					29.6		
B4	19	0.3	0.33	75.0	31.3	7.82	41.6		
C2	32	0.4					58.9		
C3	15	0.3	0.36	56.2	30.2	6.86	32.9	1.15	1248
C4	24	0.4					37.7		
C5	30	0.2	0.26	100.4	27.1	10.74	30.8	1.08	625
D2	25	0.4					69.1		
D3	25	0.4	0.46	126.6	23.5	10.06	51.8	1.30	
D4	20	0.3					51.2		
D5	27	0.3	0.21	102.4	29.3	11.43	36.8	1.29	

CRUISE NO. IX DATE 25-27 May 1974

Table AIII. Suspended Particulate Matter (Area^{-1})

STA	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	7	3.40					51.4		
A2	8	3.40					25.1		
A3	12	1.70	1.57	243.3	20.2	14.00	20.9	0.52	186
A4	10	0.97					19.8		
P1	14	0.36	0.26	75.4	49.1	11.86	39.1	0.98	
B2	24	0.34					38.8		
B3	19	0.23					30.5		
B4	20	0.34	0.25	83.5	43.4	9.24	28.4	0.71	
C2	32	0.38					60.3		
C3	23	0.24	0.19	104.8	41.1	11.60	28.5	1.00	603
C4	23	0.31					38.0		
C5	31	0.23	0.17	113.5	34.4	9.39	20.5	0.51	631
D2	23	0.40					32.0		
D3	23	0.49	0.22	100.2	36.6	9.93	26.5	0.66	
D4	24	0.36					34.3		
D5	26	0.16	0.19	101.0	34.7	9.53	12.6	0.32	

CRUISE NO. X DATE 22-24 June 1974

Table AIII. Suspended Particulate Matter (Area^{-1})

STA	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	7	3.4					16.5	0.41	
A2	8	2.3					14.4	0.36	
A3	14	0.9	0.81	141.7	29.2	11.1	26.8	0.67	425
A4	20	0.8					75.4	1.88	
P1	15	0.7	0.45	110.8	34.9	10.2	110.9	2.77	
B2	29	0.7					140.5	3.51	
B3	22	0.6					58.2	1.46	
B4	18	0.5	0.29	63.8	50.9	10.3	49.9	1.25	
C2	32	0.6					210.0	5.25	
C3	25	0.9	0.76	122.8	43.8	12.8	89.7	2.24	3128
C4	24	0.5					54.8	1.37	
C5	31	0.6	0.21	111.1	42.3	11.9	35.5	0.89	544
D2	24	1.1					146.5	3.66	
D3	24	0.7	0.38	98.6	42.6	13.5	54.3	1.36	
D4	24	0.3					34.6	0.86	
D5	26	0.3	0.23	175.0	44.6	20.6	80.9	2.02	

CRUISE NO. XI DATE 15-17 July 1974

Table AIII. Suspended Particulate Matter (Area^{-1})

STA	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	7	2.27					60.0		
A2	8	2.27					79.1		
A3	10	1.36	0.92	116.1	23.9	8.4	41.2	1.0	2218
A4	12	0.97					62.6		
P1	15	0.97	0.49	107.7	32.3	10.1	58.8	1.5	
B2	25	0.76					51.6		
B3	18	0.49					36.9		
B4	20	0.24	0.21	76.2	35.7	9.3	30.7	0.8	
C2	32	0.68					44.5		
C3	23	0.52	0.33	107.6	40.1	11.9	46.2	1.2	3319
C4	24	0.38					23.8		
C5	25	0.34	0.24	92.0	37.8	12.5	17.7	0.4	435
D2	23	0.76					35.2		
D3	21	0.57	0.24	82.0	29.3	8.3	18.9	0.5	
D4	21	0.38					17.1		
D5	25	0.20	0.17	82.8	30.8	8.5	15.6	0.4	

CRUISE XII DATE 5-7 Aug. 1974

Table AIII. Suspended Particulate Matter (Area^{-1})

STA	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	9	2.3					16.4		
A2	9	2.3					14.3		
A3	12	0.8	0.91	188.9	33.4	12.07	26.6	0.66	2022
A4	12	1.1					161.8		
P1	16	0.6	0.44	145.2	37.4	8.25	31.8	0.80	
B2	26	0.6					92.8		
B3	23	0.3					25.1		
B4	20	0.3	0.30	133.1	36.1	9.99	30.0	0.75	
C2	34	0.3					41.1		
C3	26	0.2	0.19	129.1	45.1	9.01	29.8	0.74	1529
C4	26	0.3					34.5		
C5	27	0.2	0.11	123.3	39.2	7.81	21.6	0.69	680
D2	25	0.5					86.5		
D3	26	0.3	0.23	132.4	28.5	13.45	35.3	0.88	
D4	24	0.3					34.1		
D5	28	0.1	0.15	97.2	29.8	8.28	15.9	0.48	