Primary productivity and nutrient measurements on the spring phytoplankton bloom in Bedford Basin, 1971

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INTRODUCTION

This is the sixth in a series of data reports on the phytoplankton productivity and nutrients of the coastal inlets of Nova Scotia. Previous reports (Platt and Irwin 1968, 1970, 1971, 1972a, 1972b) dealt with data series extending over several months or years. The present report concerns data collected in Bedford Basin during the spring phytoplankton bloom in March, 1971.

The physical properties of Bedford Basin are described in Platt and Irwin (1971). Observations of hydrography, nutrients and phytoplankton are reported in Krauel (1969) and Platt and Irwin (1971). Some of the results are discussed in Platt et al. (1970) and a detailed analysis of spatial and temporal heterogeneity in phytoplankton and zooplankton are given in Platt and Conover (1971).

The purpose of this report is to present in full the results of measurements of phytoplankton productivity, biomass, nutrients and hydrography made at frequent invervals at one station in Bedford Basin during the spring phytoplankton bloom of 1971. This study provides a comparison to that already published on the spring bloom of another Nova Scotia inlet, St. Margaret's Bay (Platt and Subba Rao, 1970 a,b). A statistical analysis of the Bedford Basin results, similar to that described in Platt and Subba Rao (1970b) will be given in this report, but detailed interpretation of the results will be published elsewhere. The chlorophyll concentration in Bedford

Basin was mapped by *in vivo* fluorescence during the period of the study; the results have been published in Platt and Irwin (1972c).

SAMPLING

All samples were collected from station 1 (fig. 1) where the water is 72 m deep. Routine samples were taken from 1, 5, 10, 15, 25, 30, 40, 50, 60 and 70 m for temperature, salinity, silicate, nitrate, ammonia, inorganic phosphate and chlorophyll. Primary production measurements were made at 1, 5, 10, 15, and 25 m. Water transparency measurements were made to 25 m.

Incident radiation was measured by an Eppley 50 junction pyranometer situated on the roof of the Bedford Institute (fig. 1). All samples were collected from R.V. Navicula.

METHODS

All measurements were made on samples collected by Van Dorn bottles except temperature and salinity which were taken from reversing bottles. All nutrient samples were filtered to remove particulate material prior to freezing and storing. Treatment of samples was as follows:

Primary Productivity

The ^{14}C method was used, essentially as given in

Strickland and Parsons (1968) and further described in Platt and Irwin (1971).

Chlorophyll *a*

The fluorometric method of Yentsch and Menzel (1963) as modified by Holm-Hansen et al. (1965) was used.

Silicate

The method of Mullin and Riley (1955) was used.

Nitrate

Nitrate was measured as the sum of nitrate plus nitrite by reducing the nitrate to nitrite using the Grasshoff modification of the cadmium amalgam column method as described in Strickland and Parsons (1968).

Ammonia

The phenolhypochlorite method of Solorzano (1969) was used.

Inorganic Phosphate

The method of Murphy and Riley (1962) was used.

Productivity, biomass and nutrient values were integrated through the water column. Both the integral and the error of the integral, calculated as described in Platt and Irwin (1968) are presented in the tables, together with the values measured at discrete depths.

Water transparency was measured from 0-25 m using a two-cell hydrophotometer. Peak sensitivity of the system was at 530 mμ with a band width of 70 mμ. Incident radiation during a ^{14}C experiment was calculated as described in Platt and Irwin (1968). The biological extinction coefficient, k_b, was calculated as described in Platt (1969) except that the revised conversion factor of the value 10.4 calories mgC^{-1} was used. (Platt and Irwin, 1973).

Species diversity index was calculated as described in Platt and Subba Rao (1970a). Cell counts were made on sedimented samples preserved in Lugol's solution using the inverted microscope technique.

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LIST OF FIGURES

DATE March 5, 1971

DEPTH METERS	CHLOROPHYLL $mg\ m^{-3}$	PHAEOPHYTIN $mg\ m^{-3}$	PRODUCTION $mg\ C\ m^{-3} Hr^{-1}$	PHYTOPLANKTERS No. of cells L^{-1}
1	1.48	0.00	3.54	186
5	1.55	0.00	3.34	197
10	1.31	0.17	0.87	251
15	0.75	0.09	0.17	72
25	0.37	0.12	0.02	103
INTEGRAL	25.475	2.095	31.38	
ERROR	1.924	0.196	3.11	

DEPTH METERS	RADIATION $Cals\ cm^{-2}\ Hr^{-1}$	SPECIES DIVERISTY	$k_b\ m^{-1}$
1	13.47	0.85	.00027
5	6.12	0.64	.00056
10	2.28	1.61	.00040
15	0.85	1.77	.00021
25	0.11	1.36	.00018

INCIDENT RADIATION ($Cal\ cm^{-2}\ Hr^{-1}$) 16.412

EXTINCTION COEFF. (0-25m) .19 m^{-1} (calc)

DATE March 5, 1971

DEPTH METERS	TEMPERATURE T°c	SALINITY S°/₀₀	DENSITY σ_t
1	0.77	21.642	23.78
5	0.76	29.648	23.79
10	0.80	29.747	23.86
15	0.86	30.247	24.26
25	1.36	30.748	24.64
30	1.50	30.827	24.69
40	1.64	31.030	24.84
50	1.41	31.095	24.91
60	1.42	31.131	24.94
70	1.50	31.162	24.96

DEPTH METERS	NITRATE $mg\ at\ m^{-3}$	AMMONIA $mg\ at\ m^{-3}$	SILICATE $mg\ at\ m^{-3}$	PHOSPHATE $mg\ at\ m^{-3}$
1	7.6	6.61	13.7	1.16
5	6.4	1.63	13.5	1.04
10	6.9	1.01	13.8	0.99
15	7.9	0.97	14.7	1.23
25	8.3	0.62	14.3	1.20
30	10.6	0.03	20.0	1.46
40	9.0	0.70	16.9	0.98
50	8.4	0.68	14.7	1.22
60	5.7	1.19	15.1	0.69
70	8.5	1.03	15.4	1.16
INTEGRAL	562.5	72.98	1086.1	76.925
ERROR	17.2	3.37	18.4	2.592

DATE March 8, 1971

DEPTH METERS	CHLOROPHYLL $mg\ m^{-3}$	PHAEOPHYTIN $mg\ m^{-3}$	PRODUCTION $mg\ C\ m^{-3} Hr^{-1}$	PHYTOPLANKTERS No. of cells L^{-1}
1	1.73	0.00	5.79	239
5	2.23	0.00	4.24	528
10	1.88	0.00	1.27	380
15	1.05	0.00	0.21	370
25	0.40	0.15	0.00	147
INTEGRAL	34.750	0.825	43.66	
ERROR	2.691	0.132	5.29	

DEPTH METERS	RADIATION $Cals\ cm^{-2}\ Hr^{-1}$	SPECIES DIVERISTY	$k_b\ m^{-1}$
1	9.82	1.14	.00061
5	4.77	1.62	.00092
10	1.68	1.34	.00078
15	0.54	1.36	.00041
25	0.07	1.17	.00000

INCIDENT RADIATION ($Cal\ cm^{-2}\ Hr^{-1}$) 14.559

EXTINCTION COEFF. (0-25m) 0.20 m^{-1}

DATE March 8, 1971

DEPTH METERS	TEMPERATURE T°c	SALINITY S°/oo	DENSITY σ_t
1	0.73	29.652	23.79
5	0.70	29.653	23.79
10	0.74	29.735	23.87
15	0.64	30.420	24.41
25	1.09	30.662	24.58
30	1.25	30.747	24.64
40	1.54	31.057	24.87
50	1.41	31.110	24.92
60	1.46	31.145	24.95
70	1.52	31.176	24.97

DEPTH METERS	NITRATE $mg\ at\ m^{-3}$	AMMONIA $mg\ at\ m^{-3}$	SILICATE $mg\ at\ m^{-3}$	PHOSPHATE $mg\ at\ m^{-3}$
1	7.1	1.01	13.7	0.36
5	3.6	1.52	13.3	0.89
10	4.5	0.95	4.9	0.50
15	4.5	1.11	12.4	0.89
25	2.7	0.60	13.3	1.06
30	11.1	0.76	21.4	2.00
40	9.1	0.41	18.2	1.48
50	8.7	0.66	16.2	0.85
60	7.4	0.85	15.3	1.15
70	8.6	0.83	9.9	1.43
INTEGRAL	501.7	57.01	1026.5	80.675
ERROR	16.5	2.41	18.4	2.895

DATE March 10, 1971

DEPTH METERS	CHLOROPHYLL $mg\ m^{-3}$	PHAEOPHYTIN $mg\ m^{-3}$	PRODUCTION $mg\ C\ m^{-3} Hr^{-1}$	PHYTOPLANKTERS No. of cells L^{-1}
1	3.71	0.00	8.43	474
5	4.18	0.00	8.98	1398
10	1.30	0.03	1.27	180
15	0.81	0.07	0.22	59
25	0.33	0.11	0.00	18
INTEGRAL	44.400	1.210	74.07	
ERROR	3.906	0.123	10.01	

DEPTH METERS	RADIATION $Cals\ cm^{-2}\ Hr^{-1}$	SPECIES DIVERISTY	$k_b\ m^{-1}$
1	16.91	1.19	.00051
5	7.30	0.84	.00127
10	2.43	1.62	.00054
15	0.79	2.71	.00029
25	0.12	1.46	.00005

INCIDENT RADIATION ($Cal\ cm^{-2}\ Hr^{-1}$) 25.849

EXTINCTION COEFF. (0-25m) 0.20 m^{-1}

DATE March 10, 1971

DEPTH METERS	TEMPERATURE T°c	SALINITY S°/oo	DENSITY σ_t
1	0.79	29.424	23.61
5	0.73	29.524	23.69
10	0.62	30.220	24.25
15	0.62	30.335	24.34
25	1.22	30.689	24.60
30	1.33	30.768	24.65
40	1.67	31.039	24.85
50	1.47	31.117	24.92
60	1.44	31.150	24.95
70	1.52	31.168	24.96

DEPTH METERS	NITRATE $mg\ at\ m^{-3}$	AMMONIA $mg\ at\ m^{-3}$	SILICATE $mg\ at\ m^{-3}$	PHOSPHATE $mg\ at\ m^{-3}$
1	6.8	0.50	12.4	0.85
5	6.9	0.64	12.6	0.72
10	7.0	0.83	11.6	0.70
15	7.4	1.40	13.1	0.78
25	6.7	0.74	15.2	1.21
30	10.2	0.03	20.3	1.89
40	6.3	0.56	12.7	1.52
50	8.7	2.97	16.1	1.44
60	4.9	2.32	16.3	1.28
70	8.4	1.46	16.2	1.34
INTEGRAL	513.8	71.00	1050.9	87.425
ERROR	15.6	3.79	18.0	3.153

DATE March 12, 1971

DEPTH METERS	CHLOROPHYLL $mg\ m^{-3}$	PHAEOPHYTIN $mg\ m^{-3}$	PRODUCTION $mg\ C\ m^{-3} Hr^{-1}$	PHYTOPLANKTERS No. of cells L^{-1}
1	5.06	0.00	16.65	566
5	5.26	0.00	10.71	632
10	1.81	0.07	0.65	510
15	1.96	0.11	0.30	319
25	0.60	0.07	0.01	36
INTEGRAL	65.700	1.450	100.80	
ERROR	5.323	0.141	13.59	

DEPTH METERS	RADIATION $Cals\ cm^{-2}\ Hr^{-1}$	SPECIES DIVERISTY	$k_b\ m^{-1}$
1	13.12	1.68	.00132
5	5.02	2.24	.00221
10	1.51	1.71	.00044
15	0.45	1.87	.00069
25	0.06	1.84	.00018

INCIDENT RADIATION ($Cal\ cm^{-2}\ Hr^{-1}$) 20.650

EXTINCTION COEFF. (0-25m) 0.21 m^{-1}

DATE March 12, 1971

DEPTH METERS	TEMPERATURE T°c	SALINITY S°/oo	DENSITY σ_t
1	1.19	28.673	22.98
5	0.98	29.353	23.54
10	0.72	30.231	24.26
15	0.56	30.383	24.39
25	0.91	30.752	24.66
30	0.66	30.820	24.73
40	1.56	31.033	24.85
50	1.44	31.086	24.90
60	1.46	31.118	24.93
70	1.52	31.141	24.94

DEPTH METERS	NITRATE $mg\ at\ m^{-3}$	AMMONIA $mg\ at\ m^{-3}$	SILICATE $mg\ at\ m^{-3}$	PHOSPHATE $mg\ at\ m^{-3}$
1	5.6	0.52	12.9	0.60
5	5.7	0.33	11.7	0.72
10	6.5	0.68	12.0	0.79
15	6.8	1.01	12.1	0.67
25	6.4	0.83	11.2	0.86
30	8.5	0.68	16.1	1.19
40	9.8	0.50	19.0	1.69
50	7.6	1.03	16.3	1.34
60	7.8	1.32	15.8	1.52
70	8.6	1.42	16.9	1.39
INTEGRAL	536.7	61.21	1044.9	81.900
ERROR	16.7	2.83	18.2	3.036

DATE March 15, 1971

DEPTH METERS	CHLOROPHYLL $mg\ m^{-3}$	PHAEOPHYTIN $mg\ m^{-3}$	PRODUCTION $mg\ C\ m^{-3} Hr^{-1}$	PHYTOPLANKTERS No. of cells L^{-1}
1	13.74	0.00	45.31	524
5	26.31	0.00	7.42	604
10	1.65	0.00	0.16	28
15	1.06	0.04	0.05	56
25	1.03	0.00	0.02	111
INTEGRAL	187.250	0.260	151.76	
ERROR	21.840	0.042	23.84	

DEPTH METERS	RADIATION $Cals\ cm^{-2}\ Hr^{-1}$	SPECIES DIVERISTY	$k_b\ m^{-1}$
1	4.64	1.92	.01014
5	0.51	2.33	.01500
10	0.12	1.40	.00137
15	0.05	2.05	.00104
25	0.00	1.50	.00312

INCIDENT RADIATION ($Cal\ cm^{-2}\ Hr^{-1}$) 9.954

EXTINCTION COEFF. (0-25m) 0.27 m^{-1}

DATE March 15, 1971

DEPTH METERS	TEMPERATURE T°c	SALINITY S°/oo	DENSITY σ_t
1	1.69	28.852	23.10
5	1.00	29.773	23.88
10	0.60	30.465	24.45
15	0.92	30.719	24.64
25	1.16	30.968	24.82
30	1.12	30.967	24.82
40	1.44	31.063	24.88
50	1.01	31.081	24.92
60	1.08	31.182	24.96
70	1.10	31.131	24.96

DEPTH METERS	NITRATE *mg at* m^{-3}	AMMONIA *mg at* m^{-3}	SILICATE *mg at* m^{-3}	PHOSPHATE *mg at* m^{-3}
1	1.1	0.62	8.8	0.41
5	2.0	0.52	9.0	0.46
10	6.9	0.95	0.3	0.67
15	6.6	0.99	13.2	0.91
25	7.1	0.68	13.3	1.10
30	8.3	0.66	14.7	1.18
40	3.5	0.50	10.8	1.02
50	3.7	0.89	13.0	2.31
60	8.3	0.95	10.0	1.11
70	6.7	1.15	10.7	0.34
INTEGRAL	405.0	55.88	807.2	64.700
ERROR	13.1	2.44	13.7	2.301

DATE March 17, 1971

DEPTH METERS	CHLOROPHYLL $mg\ m^{-3}$	PHAEOPHYTIN $mg\ m^{-3}$	PRODUCTION $mg\ C\ m^{-3} Hr^{-1}$	PHYTOPLANKTERS No. of cells L^{-1}
1	9.22	0.00	51.08	817
5	38.45	0.00	9.31	78
10	5.73	0.00	0.39	1422
15	0.90	0.05	0.03	225
25	0.33	0.15	0.01	75
INTEGRAL	252.350	1.150	176.60	
ERROR	31.333	0.142	27.19	

DEPTH METERS	RADIATION $Cals\ cm^{-2}\ Hr^{-1}$	SPECIES DIVERISTY	$k_b\ m^{-1}$
1	6.86	2.01	.00774
5	0.55	2.14	.01746
10	0.18	2.09	.00226
15	0.66	0.70	.00056
25	0.01	1.62	.00104

INCIDENT RADIATION ($Cal\ cm^{-2}\ Hr^{-1}$) 15.970

EXTINCTION COEFF. (0-25m) 0.28 m^{-1}

DATE March 17, 1971

DEPTH METERS	TEMPERATURE T°c	SALINITY S°/oo	DENSITY σ_t
1	3.42	23.482	18.72
5	1.42	29.974	24.02
10	1.05	30.475	24.44
15	0.98	30.764	24.67
25	1.42	30.980	24.82
30	1.50	31.019	24.84
40	1.11	31.064	24.90
50	1.12	31.101	24.93
60	1.10	31.121	24.95
70	1.09	31.140	24.96

DEPTH METERS	NITRATE *mg at* m^{-3}	AMMONIA *mg at* m^{-3}	SILICATE *mg at* m^{-3}	PHOSPHATE *mg at* m^{-3}
1	4.0	2.34	16.0	0.21
5	0.2	0.76	3.1	0.22
10	3.3	1.01	11.6	0.62
15	8.0	0.85	26.7	1.23
25	8.0	0.87	17.9	1.50
30	8.6	1.03	15.6	1.37
40	7.6	0.56	9.9	1.23
50	7.6	1.07	15.5	1.34
60	5.1	1.61	14.0	1.38
70	6.4	1.01	12.2	1.08
INTEGRAL	451.3	73.15	1023.7	80.375
ERROR	14.8	3.24	18.3	2.964

DATE March 19, 1971

DEPTH METERS	CHLOROPHYLL $mg\ m^{-3}$	PHAEOPHYTIN $mg\ m^{-3}$	PRODUCTION $mg\ C\ m^{-3} Hr^{-1}$	PHYTOPLANKTERS No. of cells L^{-1}
1	17.29	0.00	40.17	595
5	18.12	0.00	22.95	316
10	1.83	0.00	0.67	81
15	0.48	0.16	0.09	74
25	0.38	0.06	0.03	142
INTEGRAL	148.475	1.370	220.80	
ERROR	16.139	0.175	30.50	

DEPTH METERS	RADIATION $Cals\ cm^{-2}\ Hr^{-1}$	SPECIES DIVERISTY	$k_b\ m^{-1}$
1	11.28	2.24	.00370
5	1.24	2.04	.01914
10	0.15	0.78	.00449
15	0.02	0.26	.00217
25	0.00	0.94	.91872

INCIDENT RADIATION ($Cal\ cm^{-2}\ Hr^{-1}$) 27.558

EXTINCTION COEFF. (0-25m) 0.44 m^{-1}

DATE March 19, 1971

DEPTH METERS	TEMPERATURE T°c	SALINITY S°/₀₀	DENSITY σ_t
1	1.19	29.121	23.34
5	1.11	30.287	24.28
10	1.00	30.847	24.74
15	1.16	30.953	24.81
25	1.13	31.066	24.90
30	1.12	31.083	24.92
40	1.09	31.137	24.96
50	1.08	31.192	25.01
60	1.13	31.234	25.08
70	1.14	31.392	25.16

DEPTH METERS	NITRATE *mg at* m^{-3}	AMMONIA *mg at* m^{-3}	SILICATE *mg at* m^{-3}	PHOSPHATE *mg at* m^{-3}
1	2.8	0.66	9.0	0.70
5	1.8	0.76	6.3	0.61
10	7.9	1.13	13.4	0.97
15	8.1	1.22	14.4	1.41
25	6.2	0.78	14.2	1.32
30	4.9	1.19	11.5	1.34
40	7.0	0.21	5.3	1.07
50	6.6	0.44	6.4	1.04
60	6.4	0.07	6.3	1.15
70	6.3	0.00	6.9	0.99
INTEGRAL	435.6	42.53	640.9	77.725
ERROR	13.8	2.10	11.0	2.695

DATE March 22, 1971

DEPTH METERS	CHLOROPHYLL $mg\ m^{-3}$	PHAEOPHYTIN $mg\ m^{-3}$	PRODUCTION $mg\ C\ m^{-3} Hr^{-1}$	PHYTOPLANKTERS No. of cells L^{-1}
1	33.06	0.00	80.33	402
5	36.43	0.00	8.78	103
10	6.68	0.00	0.45	426
15	1.18	0.04	0.09	192
25	0.81	0.07	0.00	107
INTEGRAL	311.100	0.645	247.67	
ERROR	32.478	0.074	41.11	

DEPTH METERS	RADIATION $Cals\ cm^{-2}\ Hr^{-1}$	SPECIES DIVERISTY	$k_b\ m^{-1}$
1	6.12	2.10	.01363
5	0.53	1.77	.01694
10	0.18	1.98	.00255
15	0.06	0.39	.00155
25	0.01	1.39	.00000

INCIDENT RADIATION ($Cal\ cm^{-2}\ Hr^{-1}$) 12.256

EXTINCTION COEFF. (0-25m) .30 m^{-1} (calc)

DATE March 22, 1971

DEPTH METERS	TEMPERATURE T°c	SALINITY S°/oo	DENSITY σ_t
1	1.80	29.569	23.67
5	1.58	29.970	24.00
10	1.16	30.789	24.68
15	1.20	31.027	24.87
25	1.24	31.125	24.94
30	1.14	31.117	24.94
40	1.12	31.210	25.02
50	1.15	31.272	25.07
60	1.19	31.346	25.12
70	1.27	31.387	25.15

DEPTH METERS	NITRATE $mg\ at\ m^{-3}$	AMMONIA $mg\ at\ m^{-3}$	SILICATE $mg\ at\ m^{-3}$	PHOSPHATE $mg\ at\ m^{-3}$
1	0.3	0.00	0.9	0.47
5	0.4	0.00	0.7	1.36
10	4.9	0.00	3.3	1.00
15	7.8	0.21	5.8	1.44
25	7.4	0.17	8.3	1.30
30	7.4	0.42	7.2	1.27
40	5.4	0.09	2.9	1.07
50	6.6	0.03	7.1	1.02
60	7.0	1.07	5.5	0.89
70	7.1	0.42	9.2	1.06
INTEGRAL	427.6	20.39	389.8	73.800
ERROR	13.9	1.47	7.1	2.570

DATE March 25, 1971

DEPTH METERS	CHLOROPHYLL $mg\ m^{-3}$	PHAEOPHYTIN $mg\ m^{-3}$	PRODUCTION $mg\ C\ m^{-3} Hr^{-1}$	PHYTOPLANKTERS No. of cells L^{-1}
1	16.96	0.00	43.33	391
5	19.78	0.00	16.82	561
10	5.13	0.00	0.80	272
15	2.90	0.00	0.14	384
25	2.16	0.00	0.03	386
INTEGRAL	199.500	0.000	202.75	
ERROR	18.055	0.000	27.44	

DEPTH METERS	RADIATION $Cals\ cm^{-2}\ Hr^{-1}$	SPECIES DIVERISTY	$k_b\ m^{-1}$
1	5.21	2.18	.00864
5	1.27	2.37	.01375
10	0.42	1.71	.00196
15	0.14	2.12	.00101
25	0.02	1.91	.00158

INCIDENT RADIATION ($Cal\ cm^{-2}\ Hr^{-1}$) 14.187

EXTINCTION COEFF. (0-25m) 0.25 m^{-1}

DATE March 25, 1971

DEPTH METERS	TEMPERATURE T°c	SALINITY S°/oo	DENSITY σ_t
1	1.65	29.371	23.52
5	1.32	30.673	24.58
10	1.28	31.015	24.85
15	1.18	31.081	24.92
25	1.22	31.180	24.99
30	1.18	31.234	25.04
40	1.22	31.275	25.07
50	1.26	31.313	25.09
60	1.20	36.360	25.14
70	1.32	31.374	25.14

DEPTH METERS	NITRATE $mg\ at\ m^{-3}$	AMMONIA $mg\ at\ m^{-3}$	SILICATE $mg\ at\ m^{-3}$	PHOSPHATE $mg\ at\ m^{-3}$
1	0.2	0.21	1.2	0.43
5	0.6	0.42	1.6	0.53
10	6.3	0.66	10.0	1.38
15	8.8	0.56	14.2	1.40
25	6.8	0.80	10.9	1.09
30	5.9	0.97	6.1	0.70
40	5.6	0.68	6.8	1.06
50	5.3	1.24	10.9	0.97
60	6.8	1.60	10.8	1.07
70	5.9	1.42	10.1	1.12
INTEGRAL	407.4	65.98	634.5	71.150
ERROR	13.2	3.19	11.6	2.475

DATE March 29, 1971

DEPTH METERS	CHLOROPHYLL $mg\ m^{-3}$	PHAEOPHYTIN $mg\ m^{-3}$	PRODUCTION $mg\ C\ m^{-3} Hr^{-1}$	PHYTOPLANKTERS No. of cells L^{-1}
1	6.95	0.00	14.51	518
5	8.37	0.00	20.73	488
10	6.47	0.00	5.32	276
15	5.60	0.00	1.90	729
25	2.70	0.00	0.15	128
INTEGRAL	147.125	0.000	184.13	
ERROR	10.905	0.000	22.74	

DEPTH METERS	RADIATION $Cals\ cm^{-2}\ Hr^{-1}$	SPECIES DIVERISTY	$k_b\ m^{-1}$
1	45.91	1.44	.00127
5	4.70	1.65	.00458
10	1.01	1.81	.00543
15	0.32	1.29	.00610
25	0.04	2.21	.00370

INCIDENT RADIATION ($Cal\ cm^{-2}\ Hr^{-1}$) 26.741

EXTINCTION COEFF. (0-25m) 0.22 m^{-1}

DATE March 29, 1971

DEPTH METERS	TEMPERATURE T°c	SALINITY S°/oo	DENSITY σ_t
1	1.28	30.305	24.29
5	1.20	30.411	24.38
10	1.18	30.764	24.66
15	1.19	30.920	24.78
25	1.32	31.176	24.98
30	1.25	31.362	25.05
40	1.24	31.301	25.08
50	1.29	31.329	25.10
60	1.28	31.343	25.12
70	1.32	31.364	25.13

DEPTH METERS	NITRATE $mg\ at\ m^{-3}$	AMMONIA $mg\ at\ m^{-3}$	SILICATE $mg\ at\ m^{-3}$	PHOSPHATE $mg\ at\ m^{-3}$
1	2.5	0.78	3.9	0.79
5	3.1	2.59	5.1	0.79
10	5.4	1.11	8.0	0.99
15	2.9	1.54	8.5	0.98
25	6.1	1.15	9.0	0.98
30	6.6	1.36	5.9	0.96
40	6.0	1.60	9.0	1.03
50	6.2	1.79	9.1	0.99
60	6.7	2.22	8.9	1.01
70	6.5	1.28	9.1	0.97
INTEGRAL	389.8	113.55	569.3	67.925
ERROR	12.4	5.12	9.9	2.310

DATE March 5, 1971 DEPTH	1	5	10	15	25
Amphidinium sp.					
Biidulphia mobiliensis					
Chaetoceros affinae					
Chaetoceros debile	2230				
Chaetoceros decipiens	2230	446			
Chaetoceros lascinosum					
Chaetoceros septentrionale	4460	22300	31200	15600	4460
Cylindropyxis sp.		223	147000	11100	40000
Fragilaria sp.					
Gymnodinium sp.	165000	171000	62400	40100	55700
Gyrosigma sp.					
Hantzschia sp.					
Leptocylindrus danicus	446				
Licmophora abbreviata		2230		2230	
Navicula sp.			2230	2230	2230
Nitzschia seriata			4460		
Oxytoxum sp.	4460		2230		446
Peridinium sp.					
Phaeodactylum tricornutum	4460	223	2230	446	
Pleurosigma aestuarii					
Prorocentrum micans	2230				
Rhizosolenia setigera					
Schroderella sp.					
Silicoflagellate					
Skeletonema costatum	446				
Thalassionema nitzschioides					
Thalassiosira nordenskioldi	892			446	
Thalassiothrix frauenfeldii					
Total No. of organisms L^{-1}	186000	197000	251000	72200	103000
No. of sps.	10	6	7	7	5

DATE March 8, 1971 DEPTH	1	5	10	15	25
Amphidinium sp.					
Biidulphia mobiliensis					
Chaetoceros affinae					
Chaetoceros debile	446	4460			
Chaetoceros decipiens	2230	8920	2230	2230	
Chaetoceros lascinosum			446		
Chaetoceros septentrionale	2230	136000	22300	17800	8920
Cylindropyxis sp.	41900	51200	209000	196000	111000
Fragilaria sp.					223
Gymnodinium sp.	182000	314000	144000	151000	22300
Gyrosigma sp.	2230				2230
Hantzschia sp.			223		
Leptocylindrus danicus					
Licmophora abbreviata					
Navicula sp.	223	4460	223	2230	2230
Nitzschia seriata					
Oxytoxum sp.	2230	2230	223		
Peridinium sp.	446		446		
Phaeodactylum tricornutum	4460	4460	223	223	223
Pleurosigma aestuarii					
Prorocentrum micans					
Rhizosolenia setigera					
Schroderella sp.					
Silicoflagellate					
Skeletonema costatum					
Thalassionema nitzschioides					
Thalassiosira nordenskioldi		2230		2230	
Thalassiothrix frauenfeldii					
Total No. of organisms L^{-1}	239000	528000	380000	370000	147000
No. of sps.	10	9	10	7	7

DATE March 10, 1971 DEPTH	1	5	10	15	25
Amphidinium sp.	3060	3060	6130		
Biidulphia mobiliensis		3060			
Chaetoceros affinae	6130	3060			
Chaetoceros debile	3060	3060		3060	
Chaetoceros decipiens			3060	3060	
Chaetoceros lascinosum	26700	70500	9190	9190	
Chaetoceros septentrionale	1530	12200	12200	9190	3060
Cylindropyxis sp.			12200	9190	
Fragilaria sp.					
Gymnodinium sp.	383000	1220000	128000	15300	9190
Gyrosigma sp.					
Hantzschia sp.					
Leptocylindrus danicus					
Licmophora abbreviata					
Navicula sp.				383	
Nitzschia seriata	3060				
Oxytoxum sp.	6130	9190			
Peridinium sp.					
Phaeodactylum tricornutum	6130	12200	6130	383	6130
Pleurosigma aestuarii			3060		
Prorocentrum micans					
Rhizosolenia setigera					
Schroderella sp.					
Silicoflagellate					
Skeletonema costatum					
Thalassionema nitzschioides		12200			
Thalassiosira nordenskioldi	33700	42900		9190	
Thalassiothrix frauenfeldii	1530				
Total No. of organisms L^{-1}	474000	1390000	180000	59000	18300
No. of sps.	11	11	8	9	3

DATE March 12, 1971 DEPTH	1	5	10	15	25
Amphidinium sp.					
Biidulphia mobiliensis	6130				
Chaetoceros affinae	3060				
Chaetoceros debile	3060	12200		306	306
Chaetoceros decipiens	12200	15300	306		306
Chaetoceros lascinosum	24500	49000	6130	613	
Chaetoceros septentrionale	110000	147000	58200	39800	
Cylindropyxis sp.			294000	101000	
Fragilaria sp.					
Gymnodinium sp.	367000	257000	122000	153000	12200
Gyrosigma sp.					
Hantzschia sp.			385		
Leptocylindrus danicus					
Licmophora abbreviata					306
Navicula sp.					306
Nitzschia seriata					
Oxytoxum sp.	1530	15300	3060	6130	1220
Peridinium sp.					
Phaeodactylum tricornutum	12200	9190	12200	6130	18300
Pleurosigma aestuarii	613	613	383		
Prorocentrum micans					
Rhizosolenia setigera					
Schroderella sp.		383			
Silicoflagellate					306
Skeletonema costatum					306
Thalassionema nitzschioides				6130	
Thalassiosira nordenskioldi	24500	125000	12200	6130	3060
Thalassiothrix frauenfeldii					
Total No. of organisms L^{-1}	566000	632000	510000	319000	36700
No. of sps.	11	10	10	9	10

DATE March 15, 1971 DEPTH	1	5	10	15	25
Amphidinium sp.					
Biidulphia mobiliensis					
Chaetoceros affinae					
Chaetoceros debile	12200	3060			3060
Chaetoceros decipiens	6130	3060			3060
Chaetoceros lascinosum	55100	36700	3060	3060	3060
Chaetoceros septentrionale	202000	147000			
Cylindropyxis sp.		85800		18300	73500
Fragilaria sp.					383
Gymnodinium sp.	490000	196000	6130	24500	24500
Gyrosigma sp.					
Hantzschia sp.					
Leptocylindrus danicus					
Licmophora abbreviata					
Navicula sp.					
Nitzschia seriata					
Oxytoxum sp.	6130	3060	383	383	
Peridinium sp.					
Phaeodactylum tricornutum	15300	6130	383	383	383
Pleurosigma aestuarii				383	
Prorocentrum micans					
Rhizosolenia setigera					
Schroderella sp.					
Silicoflagellate				383	
Skeletonema costatum					3060
Thalassionema nitzschioides		383			
Thalassiosira nordenskioldi	177000	122000	18300	3060	
Thalassiothrix frauenfeldii				6130	
Total No. of organisms L^{-1}	524000	604000	28300	56700	111000
No. of sps.	8	10	5	9	8

DATE March 17, 1971 DEPTH	1	5	10	15	25
Amphidinium sp.					
Biidulphia mobiliensis		383			383
Chaetoceros affinae					
Chaetoceros debile	6130	383	6130		383
Chaetoceros decipiens	6130		6130		3060
Chaetoceros lascinosum	9190	9190	24500	383	3060
Chaetoceros septentrionale	196000	15300	312000		
Cylindropyxis sp.			269000	190000	18300
Fragilaria sp.	383			383	
Gymnodinium sp.	220000	15300	637000	33700	49000
Gyrosigma sp.					
Hantzschia sp.					
Leptocylindrus danicus					
Licmophora abbreviata					
Navicula sp.					
Nitzschia seriata					
Oxytoxum sp.	613	383	12200	383	3060
Peridinium sp.		383			
Phaeodactylum tricornutum	49000	3060	21400	383	383
Pleurosigma aestuarii	3060				
Prorocentrum micans					
Rhizosolenia setigera	383				
Schroderella sp.					
Silicoflagellate					
Skeletonema costatum					
Thalassionema nitzschioides	383				
Thalassiosira nordenskioldi	324000	33700	128000	383	383
Thalassiothrix frauenfeldii					
Total No. of organisms L^{-1}	817000	78100	1420000	225000	75100
No. of sps.	12	9	9	7	9

DATE March 19, 1971 DEPTH	1	5	10	15	25
Amphidinium sp.					
Biidulphia mobiliensis					
Chaetoceros affinae		2230			
Chaetoceros debile	6690	6690	2230		
Chaetoceros decipiens	2230	11100	4460		
Chaetoceros lascinosum	11100	11100	2230	557	
Chaetoceros septentrionale	160000	33400			
Cylindropyxis sp.	182000				49000
Fragilaria sp.		2230			
Gymnodinium sp.	147000	71300	71300	71300	93600
Gyrosigma sp.					
Hantzschia sp.					
Leptocylindrus danicus					
Licmophora abbreviata					
Navicula sp.					
Nitzschia seriata					
Oxytoxum sp.	2230	2230	557	2230	
Peridinium sp.					
Phaeodactylum tricornutum	4460	6690	557		202
Pleurosigma aestuarii	2230				
Prorocentrum micans					
Rhizosolenia setigera					
Schroderella sp.					
Silicoflagellate	223				
Skeletonema costatum					
Thalassionema nitzschioides					
Thalassiosira nordenskioldi	75800	169000			
Thalassiothrix frauenfeldii					
Total No. of organisms L^{-1}	595000	316000	81300	74100	142000
No. of sps.	11	10	6	3	3

DATE March 22, 1971 DEPTH	1	5	10	15	25
Amphidinium sp.					
Biidulphia mobiliensis					
Chaetoceros affinae	2230				
Chaetoceros debile	6690	20000	223		
Chaetoceros decipiens	4460	4460		223	202
Chaetoceros lascinosum	11100	4460	223	2230	202
Chaetoceros septentrionale	182000	218000	124000		
Cylindropyxis sp.			73500		55700
Fragilaria sp.	2230				
Gymnodinium sp.	55700	588000	178000	182000	44600
Gyrosigma sp.					
Hantzschia sp.					
Leptocylindrus danicus					
Licmophora abbreviata					
Navicula sp.					
Nitzschia seriata					
Oxytoxum sp.	4460	8920	2230	557	202
Peridinium sp.					
Phaeodactylum tricornutum	15600	40100	6690	2230	4460
Pleurosigma aestuarii	557	2230	2230	202	202
Prorocentrum micans					
Rhizosolenia setigera					
Schroderella sp.					
Silicoflagellate					
Skeletonema costatum	223				
Thalassionema nitzschioides					
Thalassiosira nordenskioldi	115000	142000	37900	4460	2230
Thalassiothrix frauenfeldii					
Total No. of organisms L^{-1}	402000	1030000	426000	192000	107000
No. of sps.	12	9	9	7	8

DATE March 25, 1971 DEPTH	1	5	10	15	25
Amphidinium sp.					
Biidulphia mobiliensis					
Chaetoceros affinae	2230				
Chaetoceros debile	24500	4460			
Chaetoceros decipiens	6690	4460		2230	2230
Chaetoceros lascinosum	4460	8920	2230	6690	2230
Chaetoceros septentrionale	147000	151000	4460	71300	93600
Cylindropyxis sp.		107000	160000	107000	187000
Fragilaria sp.					
Gymnodinium sp.	49000	33700	30600	147000	71300
Gyrosigma sp.					
Hantzschia sp.					557
Leptocylindrus danicus					
Licmophora abbreviata	202				
Navicula sp.					
Nitzschia seriata					
Oxytoxum sp.	2230	2230	2230		
Peridinium sp.	202				
Phaeodactylum tricornutum	13300	71300	13300	8920	4460
Pleurosigma aestuarii		1110	2230	446	2230
Prorocentrum micans					
Rhizosolenia setigera					
Schroderella sp.					
Silicoflagellate					
Skeletonema costatum	2230		557		
Thalassionema nitzschioides	557				
Thalassiosira nordenskioldi	138000	176000	55700	40100	22300
Thalassiothrix frauenfeldii					
Total No. of organisms L^{-1}	391000	561000	272000	384000	386000
No. of sps.	13	10	9	8	9

DATE March 27, 1971 DEPTH	1	5	10	15	25
Amphidinium sp.					
Biidulphia mobiliensis	202				
Chaetoceros affinae					
Chaetoceros debile	2230		4460	4460	4460
Chaetoceros decipiens	4460	4460	2230	2230	
Chaetoceros lascinosum	2230	557	2230	2230	202
Chaetoceros septentrionale	35600	17800	8920	8920	4460
Cylindropyxis sp.				196000	7136
Fragilaria sp.			2230		2230
Gymnodinium sp.	367000	318000	171000	490000	66900
Gyrosigma sp.		2230		2230	
Hantzschia sp.					
Leptocylindrus danicus					
Licmophora abbreviata					
Navicula sp.					
Nitzschia seriata					
Oxytoxum sp.	6690	11100	6690	8920	4460
Peridinium sp.					1115
Phaeodactylum tricornutum	20000	53500	17800	13300	17800
Pleurosigma aestuarii	202	2230	446		
Prorocentrum micans					
Rhizosolenia setigera					
Schroderella sp.	557	2230			
Silicoflagellate					
Skeletonema costatum			4460	557	
Thalassionema nitzschioides					
Thalassiosira nordenskioldi	78000	75800	55700		20000
Thalassiothrix frauenfeldii					
Total No. of organisms L^{-1}	518000	488000	276000	729000	128000
No. of sps.	11	10	11	10	10

TABLES OF COMPUTED RESULTS

Table 1. PARTIAL CORRELATION COEFFICIENTS AMONG THE VARIOUS QUANTITITES MEASURED IN THE STUDY

Each coefficient based on 30 degrees of freedom

	Depth	PO_4	NO_3	Chl*a*	Ratio	NH_3	Cell number	Spp. Diversity	Age
PO_4	.604*								
NO_3	.523*	.664*							
Chl*a*	-.465*	-.577*	-.821*						
Ratio	-.675*	-.551*	-.702*	.669*					
NH_3	-.110	.169	.233	-.283	-.120				
Cell number	-.290	-.285	-.256	.032	.467*	-.075			
Spp. diversity	-.184	-.505*	-.521*	.459*	.425†	-.251	.157		
Age	.000	.060	-.402†	.360†	.390†	-.257	.089	.176	
kb	-.371†	-.542*	-.790*	.905*	.619*	-.229	.009	.411†	.403†

* Exceeds value expected at 1 per cent probability level.
† Exceeds value expected at 5 per cent probability level, but less than 1 per cent.

Table 2. Summary of stepwise linear regression analysis

	Regression coefficient	s.e. of regression coeff	R	ΔR^2
Chl$a$	.00040	.00008	.9045	.8182
NO_3	-.00033	.00033	.9083	.0068
Depth	.00019	.00012	.9120	.0067
NH_3	.00035	.00042	.9136	.0030
Age	.00006	.00007	.9151	.0028
PO_4	-.00244	.00213	.9172	.0039
Sp. div.	-.00070	.00084	.9186	.0025
Cell no.	-.00016	.00017	.9193	.0019
Ratio	.00337	.00436	.9213	.0030
Constant term	-.00445			

Analysis of Variance

	d.f.	Sum of squares	F ratio
Regression	9	0.001	18.704
Residual	30	0.000	

Dependent variable is k_b. Quantity R is the multiple correlation coefficient. ΔR^2 is the increase in the amount of variance of k_b which is explained by including a particular variable in the regression. The standard error of the estimate is .0025.

Table 3. Partial correlation coefficients between various measures of *P/B* and some observed quantitites

Each coefficient is based on 30 degrees of freedom

	k_b/chl*a*	k_b/cell numbers
Depth	.315	-.132
PO_4	.308	-.363†
NO_3	.197	-.454*
Ratio	-.355†	.403†
Spp. diversity	-.424†	.152

* Exceeds value expected at 1 per cent probability level
† Exceeds value expected at 5 per cent probability level, but less than 1 per cent.

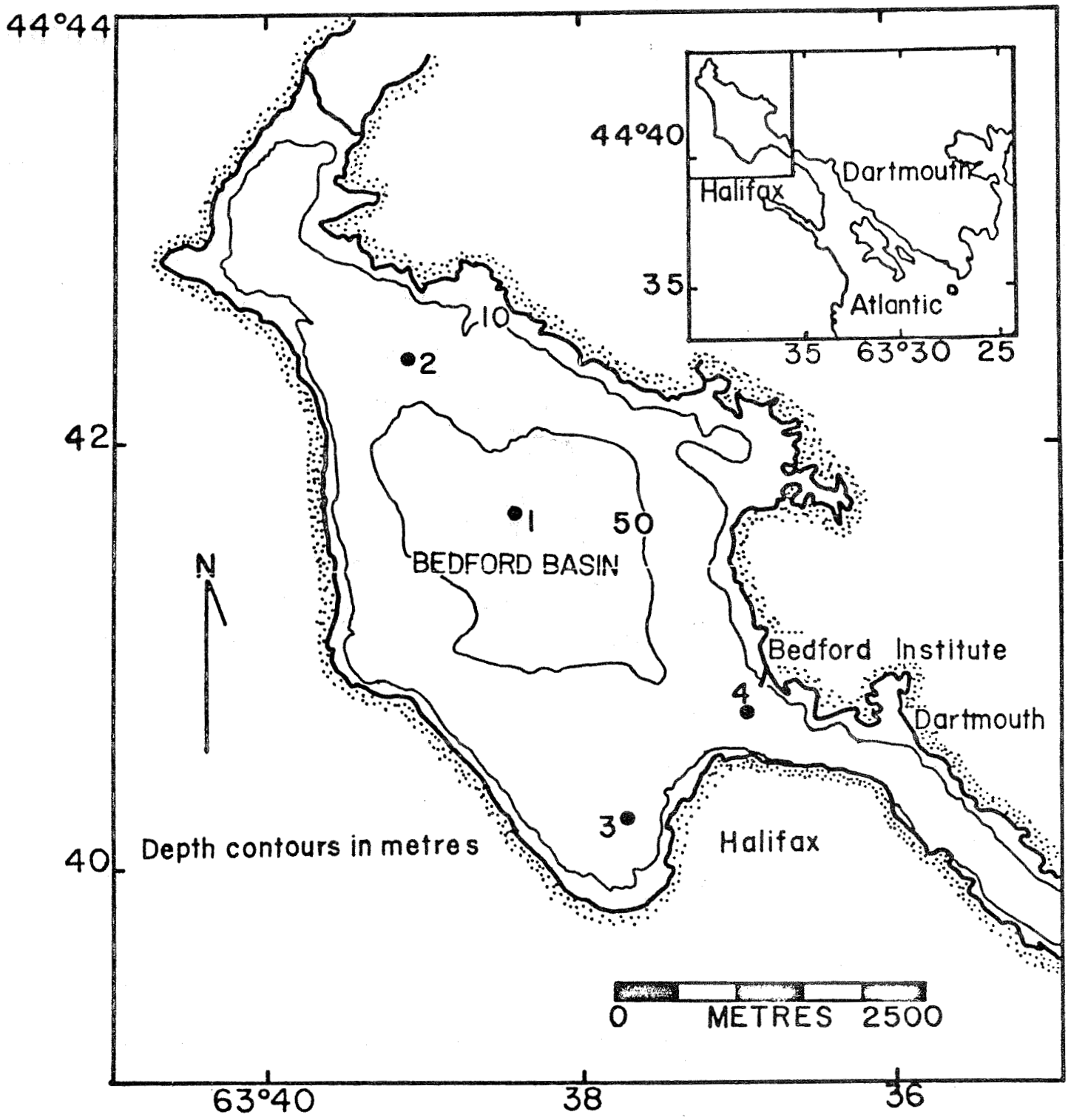

Fig. 1. Showing sampling station in Bedford Basin.

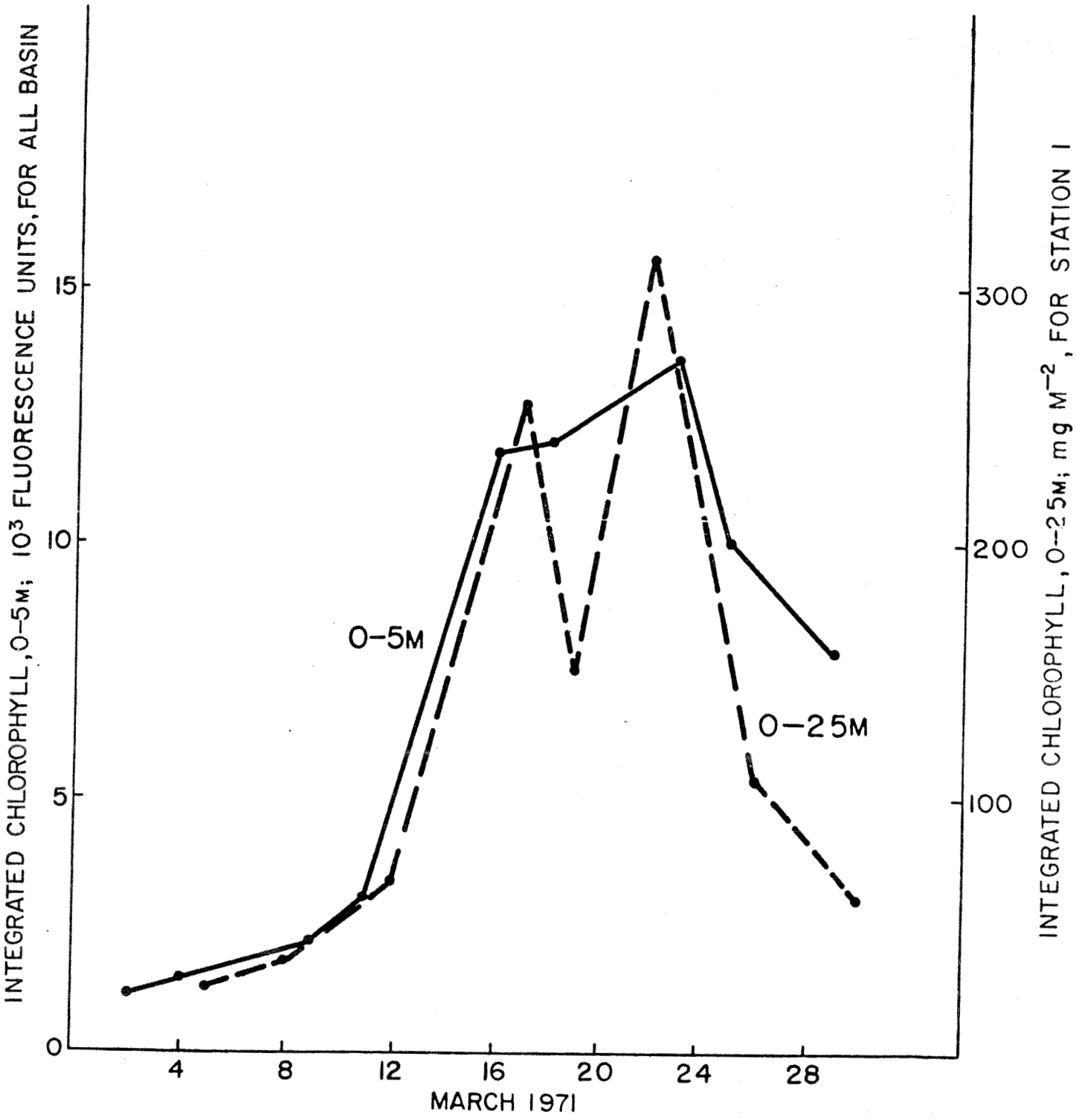

Fig. 2 Chlorophyll survey, spring bloom, composing depth integral of chlorophyll obtained by survey with that obtained at Station 1 by conventional methods.

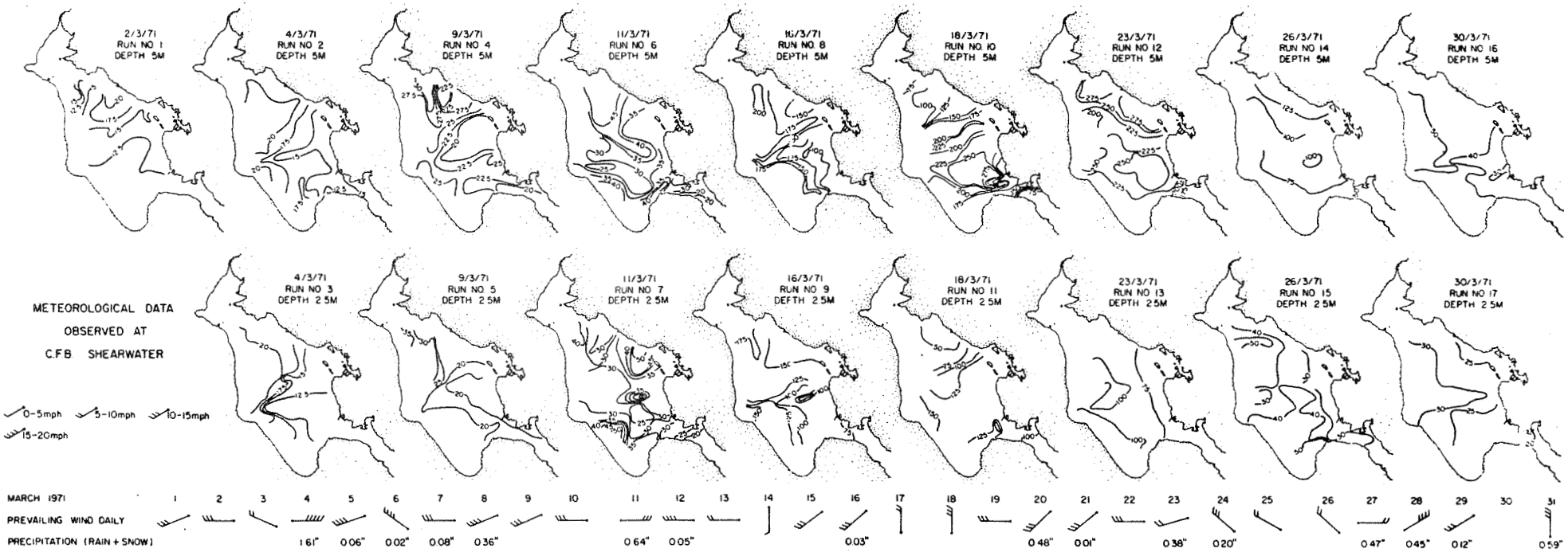

Fig. 3. Chlorophyll survey, spring bloom. Composite of 17 runs showing daily winds and precipitation.