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CARBON AND OXYGEN PRIMARY PRODUCTION IN BEDFORD BASIN FROM JANUARY TO JUNE 1987

by

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Abstract

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During the period January to June 1987, a series of primary productivity experiments were conducted in Bedford Basin. In this report we make available the raw data and also the fitted light saturation parameters.

Résumé

Irwin, B., J. Anning, C. Caverhill, A. Macdonald, and T. Platt. 1989. Carbon and oxygen primary production in Bedford Basin from January to June 1987. Can. Data Rep. Fish. Aquat. Sci. No. 722: iv + 35 p.

Pendant la période du janvier au juin 1987, une série d'expériences a été effectuée dans le bassin de Bedford. Dans ce rapport nous présentons les données brûtes sur ces expériences ainsi que les paramètres qui furent calculés pour representer les courbes de production primaire en fonction de la lumière.

CONTENTS

Introduction

This is the fourth in a series of data reports which will give the results of experiments designed to closely examine the relationship between carbon and oxygen estimates of phytoplankton primary production. In this report only *in situ* experiments were done.

All samples were collected at a single station in Bedford Basin at 44°31.3'N 63°38.3'W (Fig.1). Water depth at this location was 70 m. This particular site was chosen because there already exists a large body of biological, physical and chemical data on samples collected at this station (Cota and Harrison, 1983; Côté and Platt, 1984; Irwin and Platt, 1978a, 1978b; Irwin et al., 1975, 1983, 1986, 1988a, 1988b; Krauel, 1969; Platt and Irwin, 1971,1972; Platt et al., 1973; Taguchi and Platt, 1978a,1978b; Taguchi et al., 1975).

Sampling

All water samples were collected with 30 *l* Niskin bottles. Sampling depths were 1, 5 and 10 m. Water was carefully siphoned from the Niskin bottles into darkened plastic carboys from which sub samples were dispensed.

Primary Production

Primary productivity was measured using the ^{14}C method, the oxygen evolution method and the ΔCO_2 method. The ^{14}C method was essentially as described in Strickland and Parsons (1972). For *in situ* studies, 40 µci of sodium bicarbonate ^{14}C was added to each of six light and four dark bottles from each depth. Light bottles were incubated *in situ* at their respective sampled depths. Dark bottles were incubated in a darkened temperature controlled tank. All bottles were recovered after 24 hours. 6 light and 3 dark bottles were filtered onto 2.5 cm Whatman GF/F filters. Filters were then fumed over HC1 before counting in a scintillation counter.

The amount of material in the Dissolved Organic Carbon (DOC) pool was estimated by counting aliquots of filtrate from light and dark bottles. Replicate five milliliter aliquots were acidified with 0.5 ml of 6N hydrochloric acid in 20 ml glass scintillation vials. Vials were agitated for one hour on a shaker in a fume hood and then the acid was neutralized with 0.5 ml of 6N sodium hydroxide. 10 ml of a water compatible cocktail (BDH #RO46967) was added to each vial and then counted in the usual way.

The high precision Winkler technique of Williams and Jenkinson (1982) was used to measure oxygen. A total of 15 bottles were filled from each depth. Immediately after filling, five bottles were fixed and were used as T-0 conditions. Four bottles were wrapped in aluminum foil and incubated in the darkened tank as dark bottles. The remaining six bottles were incubated *in situ* at their sampled depth. After 24 hours the light and dark bottles were fixed. All bottles were titrated within 24 hours after fixing.

Primary production was also measured by the ΔCO_2 method. A total of 14 bottles were filled from each depth. 4 bottles were wrapped in aluminum foil and kept in the dark at *in situ* temperatures, 6 were redeployed at sampled depths and 4 were analysed immediately for CO_2 concentration. Light and dark bottles were analysed after 24 hours. The coulometric technique described by Johnson et al. (1985) was used with some modifications. The instruments used were model 5010 coulometer, model 5030 carbonate carbon apparatus, heater coil and starndard glassware manufactured by Coulometrics Inc. (Golden, Co.). Titration currents were 60 and 2 ma for the high and low rates. High pure nitrogen gas was used to strip the CO_2 gas from the acidified sample. The flow rate of the carrier gas was 200 ml min^{-1}. The analog output from the ammeter and % transmission meter were amplified and plotted on a strip chart recorder. The end point of the titration was determined to be the reading when the 2 ma current switched off for the first time. In this manner a typical C.V. for replicate samples was

consistently <0.10%. The instrument was calibrated with samples of anhydrous $CaCO_3$ (Merck cat.# 2059).

Chlorophyll

Replicate 100 ml samples were filtered onto 25 mm Whatman GF/F filters or 25 mm 3.0 μm nuclepore filters. Chlorophyll was extracted for 24 hours with 85% acetone at 0°C in the dark. The fluorometric technique of Yentsch and Menzel (1963) as modified by Holm Hansen et al. (1965) was used to estimate chlorophyll concentration.

Organic Particulates

Samples for particulate organic carbon and particulate organic nitrogen were filtered onto 25 mm precombusted Whatman GF/F filters. Filters were analyzed by combustion in a Perkin Elmer model 21- CHN analyzer.

Nutrients

Samples for nitrate, silicate and inorganic phosphate were collected from all sampled depths. Vials were stored frozen at -20°C and later analyzed on a Technicon II autoanalyzer. Nitrate was measured using industrial method 158-71W, silicate with method 186-72W and inorganic phosphate with method 155-71W.

Samples for ammonia analysis were processed immediately after collection. The phenolhypochlorite method as described by Solorzano (1969) was used.

Light Measurements

Total incident radiation was measured with an Eppley 40 Junction black and white pyranometer (Model 8-48) mounted on the roof of the Bedford Institute of Oceanography some 2.5 kilometers south of the sampling station. The output from the pyranometer was integrated hourly and logged on a Licor Li 550 printing integrator.

Extinction coefficients were calculated using submarine light and surface light measurements made with Licor Li 192 SB underwater quantum sensors. Output was measured on a Licor Li 1000 data logger. Measurements were made at 1 m intervals from the surface to 10 m.

Acknowledgements

We wish to thank Mark Hodgson for his assistance in the analysis of samples and the preparation of this report.

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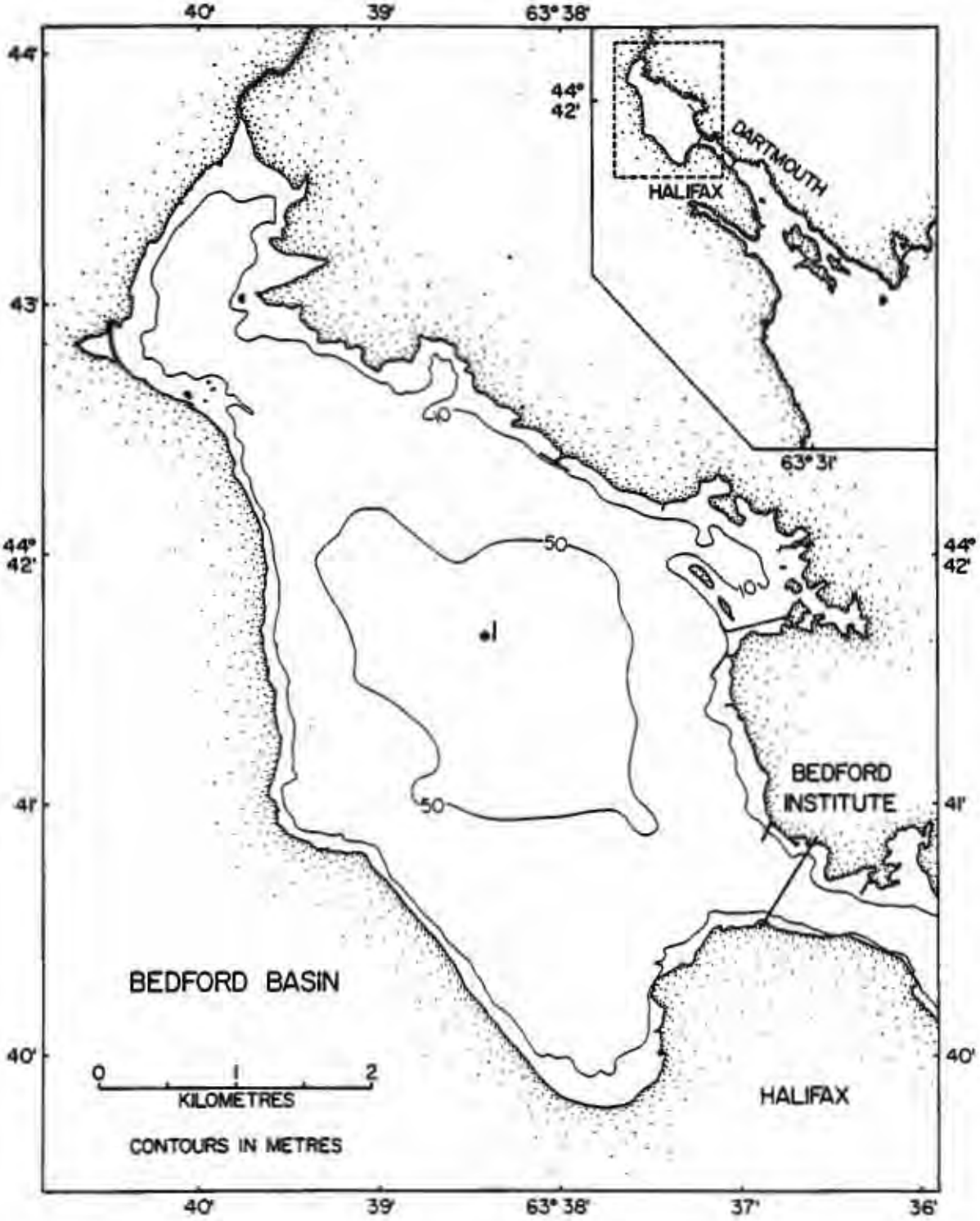
LOCATION OF SAMPLING STATIONS


40'
39'
63° 38'
44'
43'
44°
42'
41'
40'
37'
36'
63° 31'
DARTMOUTH
HALIFAX
40
50
10
BEDFORD
INSTITUTE
BEDFORD BASIN
0
1
2
KILOMETRES
CONTOURS IN METRES
HALIFAX

IN SITU PROFILES, PARTICULATES AND INORGANIC NUTRIENTS

UNITS

Z	=	depth in meters
Temp	=	water temperature °C
O_2	=	oxygen concentration mg l^{-1}
NO_3	=	nitrate concentration mg at m^{-3}
SiO_3	=	silicate concentration mg at m^{-3}
PO_4	=	phosphate concentration mg at m^{-3}
NH_3	=	ammonia concentration mg at m^{-3}
% light	=	light penetration to depth Z m
Chl	=	chlorophyll concentration mg m^{-3}
POC	=	particulate organic carbon mg m^{-3}
PON	=	particulate organic nitrogen mg m^{-2}
PC	=	primary production mg C m^{-3} h^{-1}
C:N	=	carbon, nitrogen ratio
CO_2	=	carbon dioxide concentration mg C m^{-3}
PDOC	=	dissolved organic carbon production mg C m^{-3} h^{-1}
PG	=	gross oxygen production mg O_2 m^{-3} h^{-1}
PN	=	net oxygen production mg O_2 m^{-3} h^{-1}
PR	=	oxygen respiration mg O_2 m^{-3} h^{-1}
$\%\frac{PDOC}{PTOT}$	=	percent dissolved organic carbon production of total particulate and dissolved carbon production
PQ	=	photosynthetic quotient
PG CO_2	=	gross CO_2 production mg C $m^{-3}h^{-1}$
PN CO_2	=	net CO_2 production mg C $m^{-3}h^{-1}$
PR CO_2	=	CO_2 respiration mg C $m^{-3}h^{-1}$

BEDFORD BASIN 1987

DATE 06/01/1987 JULIAN DAY 6

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	1.50	10.38	3.73	4.11	0.72	3.43
5	1.50	10.40	3.66	5.72	0.74	3.15
10	2.00	10.17	4.97	5.98	0.84	3.05

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	72.0	0.51	248	32	7.75	23.44
5	19.0	0.68	260	34	7.65	23.39
10	4.0	0.08	260	35	7.43	24.30

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	0.31	0.04	0.35	11	0.20	-0.90
5	0.20	0.02	0.22	9	0.30	-1.40
10	0.10	0.00	0.10	0	0.00	-2.20

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	1.1	-	-	-	-
5	1.6	-	-	-	-
10	2.2	-	-	-	-

BEDFORD BASIN 1987

DATE 20/01/1987 JULIAN DAY 20

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	1.00	10.82	2.95	4.64	0.73	3.26
5	1.00	10.66	3.62	4.67	0.94	2.87
10	1.00	10.43	3.49	5.27	0.86	3.09

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	80.0	0.70	334	43	7.77	23.75
5	36.0	0.59	238	32	7.44	23.75
10	11.0	0.64	260	36	7.22	23.77

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	0.36	0.03	0.39	8	1.70	-0.50
5	0.18	0.02	0.20	10	1.40	-2.40
10	0.06	0.01	0.07	14	-0.10	-1.60

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	2.2	-	-	-	-
5	3.8	-	-	-	-
10	1.5	-	-	-	-

BEDFORD BASIN 1987

DATE 03/02/1987 JULIAN DAY 34

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	0.50	10.75	4.66	6.43	0.90	2.88
5	0.50	10.99	4.53	5.62	0.81	2.95
10	0.50	10.62	4.43	6.10	0.90	2.93

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	59.0	0.48	274	28	9.79	23.19
5	11.0	0.74	311	39	7.97	24.06
10	3.0	0.56	297	37	8.03	23.37

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	0.26	0.02	0.28	7	1.90	-0.40
5	0.19	0.03	0.22	14	1.80	-0.60
10	0.05	0.00	0.05	0	0.60	-1.20

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	2.4	-	-	-	-
5	2.4	-	-	-	-
10	1.9	-	-	-	-

BEDFORD BASIN 1987

DATE 17/02/1987 JULIAN DAY 48

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	0.00	10.84	4.87	5.75	1.20	4.03
5	-0.50	10.72	4.80	6.05	0.99	4.16
10	-1.00	10.89	4.64	5.50	0.94	3.34

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	76.0	0.33	170	22	7.73	24.44
5	26.0	0.44	211	26	8.13	24.55
10	7.0	0.62	245	29	8.45	24.49

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	0.15	0.04	19.00	21	1.60	-1.00
5	0.19	0.04	0.23	17	1.80	0.70
10	0.11	0.02	0.13	15	1.10	-1.40

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	2.7	-	0.20	-4.40	4.60
5	1.1	-	0.40	-3.40	3.80
10	2.5	-	-	-	-

BEDFORD BASIN 1987

DATE 24/02/1987 JULIAN DAY 55

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	-0.80	11.18	5.59	10.16	1.25	1.96
5	-0.50	11.12	4.51	10.47	1.00	2.00
10	0.00	10.91	6.22	11.48	1.14	2.17

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	71.0	0.84	253	34	7.36	24.64
5	23.0	0.75	233	31	7.52	24.53
10	8.0	0.92	245	35	6.98	24.74

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	0.42	0.02	0.44	5	28.00	0.50
5	0.31	0.04	0.35	11	2.10	0.50
10	0.14	0.02	0.16	13	2.00	-0.30

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	2.4	-	0.20	-2.40	2.60
5	1.6	-	0.00	-0.50	0.50
10	2.3	-	-	-	-

BEDFORD BASIN 1987

DATE 03/03/1987 JULIAN DAY 62

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	-0.11	11.35	6.52	9.23	1.34	1.17
5	-0.11	11.34	6.45	9.15	1.43	1.33
10	-0.09	11.21	3.68	6.47	1.13	1.05

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	71.0	1.96	253	50	5.10	24.77
5	25.0	1.61	332	47	6.99	24.78
10	10.0	1.69	221	31	7.21	24.77

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	1.18	0.06	1.24	5	6.00	3.40
5	1.01	0.09	1.10	8	5.40	1.80
10	0.44	0.05	0.49	10	0.50	-1.20

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	2.6	1.91	1.21	-0.71	1.92
5	3.6	2.00	1.40	0.67	0.73
10	1.7	-	0.83	-1.99	2.82

BEDFORD BASIN 1987

DATE 10/03/1987 JULIAN DAY 69

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	-0.05	11.16	5.93	8.92	1.19	1.88
5	-0.05	11.13	6.52	9.57	1.22	1.79
10	-0.02	11.07	4.23	6.33	1.05	1.81

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	73.0	2.82	312	51	6.07	24.64
5	22.0	3.15	376	66	5.64	24.70
10	6.0	3.21	310	71	4.38	24.67

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	1.20	0.06	1.26	5	-	-
5	1.02	0.03	1.05	3	-	-
10	0.68	0.03	0.71	4	-	-

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	1.9	-	1.21	-	-
5	1.4	-	1.40	-	-
10	1.4	-	0.83	-	-

BEDFORD BASIN 1987

DATE 16/03/1987 JULIAN DAY 75

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	0.02	11.22	6.21	8.81	1.25	0.46
5	0.01	11.21	8.88	11.51	1.71	0.22
10	0.01	11.17	9.60	13.11	1.83	0.36

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	73.0	6.59	395	70	5.62	24.86
5	23.0	7.11	387	72	5.38	24.85
10	8.0	7.04	424	71	5.95	24.92

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	6.14	0.10	6.24	2	21.70	19.20
5	2.39	0.07	2.46	3	10.50	8.40
10	0.64	0.02	0.66	3	4.20	1.80

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	2.4	1.32	5.47	3.02	2.45
5	2.2	1.65	2.17	-1.00	3.16
10	2.4	2.46	3.75	2.92	0.84

BEDFORD BASIN 1987

DATE 19/03/1987 JULIAN DAY 78

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	0.13	11.97	3.04	5.53	0.83	0.44
5	0.07	11.96	3.19	5.53	0.82	0.34
10	0.05	11.85	3.25	5.49	0.89	0.38

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	71.0	14.04	1347	252	5.35	24.48
5	18.0	13.84	1205	232	5.20	24.50
10	3.0	14.84	1382	252	5.49	24.56

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	10.25	0.26	10.51	2	38.60	31.40
5	3.21	0.07	3.28	2	11.70	7.10
10	0.67	0.03	1.70	4	4.10	-1.30

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	7.3	1.41	12.80	6.60	6.20
5	4.6	1.37	4.20	0.00	4.20
10	5.3	2.29	2.30	-2.80	5.10

BEDFORD BASIN 1987

DATE 23/03/1987 JULIAN DAY 82

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	0.67	13.34	0.34	0.37	0.61	0.12
5	0.60	13.47	0.36	0.44	0.68	0.12
10	0.40	13.35	0.36	0.39	0.75	0.09

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	62.0	24.07	-99	-99	-	23.80
5	9.0	24.47	-99	-99	-	23.84
10	1.1	24.87	-99	-99	-	23.91

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	24.90	0.57	25.47	2	78.60	67.40
5	3.67	0.09	3.76	2	19.90	6.10
10	0.52	0.04	0.56	7	6.70	-3.40

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	11.2	1.18	27.11	22.25	4.86
5	13.8	2.03	4.73	1.96	2.78
10	10.2	-	-1.97	-2.09	0.12

BEDFORD BASIN 1987

DATE 26/03/1987 JULIAN DAY 85

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	2.94	14.81	2.48	2.01	-	0.79
5	1.03	14.82	2.13	2.90	1.28	0.94
10	0.34	14.11	1.42	1.02	0.80	0.49

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	61.0	11.43	1352	160	8.45	21.08
5	8.6	11.43	1411	160	8.82	21.39
10	0.6	19.45	1452	180	8.07	22.58

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	11.02	0.25	11.27	2	39.60	21.40
5	2.26	0.07	2.33	3	12.40	-1.10
10	0.30	0.00	0.30	0	5.50	-5.80

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	18.2	1.35	9.25	4.45	4.80
5	13.6	2.06	0.81	-1.94	2.75
10	11.2	-	-2.39	-3.17	0.78

BEDFORD BASIN 1987

DATE 30/03/1987 JULIAN DAY 89

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	3.25	14.19	1.22	3.01	0.88	0.07
5	1.26	14.41	1.81	3.09	1.08	0.09
10	0.50	13.73	1.97	2.20	1.04	0.10

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	56.0	9.23	787	126	6.25	20.24
5	8.3	9.23	1170	127	9.21	20.74
10	1.2	12.13	799	132	6.05	22.76

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	8.40	0.40	8.80	5	30.80	16.60
5	3.01	0.16	3.17	5	13.50	0.50
10	0.52	0.07	0.59	12	5.10	-5.40

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	14.2	1.38	10.50	3.53	6.98
5	13.0	1.68	2.97	-2.10	5.07
10	10.5	-	1.20	-2.75	3.95

BEDFORD BASIN 1987

DATE 06/04/1987 JULIAN DAY 96

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	4.32	12.23	3.77	5.62	0.22	3.12
5	1.42	12.99	2.64	5.54	0.38	1.57
10	0.58	12.52	3.47	3.06	0.95	1.38

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	52.0	2.66	699	138	5.07	14.04
5	5.5	2.54	625	135	4.63	17.60
10	1.6	5.23	626	118	5.31	22.15

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	0.52	0.02	0.54	4	3.90	-15.90
5	0.06	0.01	0.07	14	2.10	-12.50
10	0.02	0.00	0.02	0	1.60	-6.60

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	19.8	2.81	3.59	0.65	2.94
5	14.6	-	2.35	0.34	2.01
10	8.3	-	0.08	-5.05	5.13

BEDFORD BASIN 1987

DATE 14/04/1987 JULIAN DAY 104

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	3.42	12.25	1.10	1.79	0.25	1.42
5	1.42	12.28	1.48	1.70	0.30	1.36
10	0.36	12.17	1.23	1.38	0.37	1.78

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	58.0	7.59	896	96	6.69	18.66
5	7.5	6.36	632	103	6.14	20.58
10	1.9	4.55	613	104	6.39	21.73

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	7.28	0.19	7.47	2	27.30	18.40
5	0.92	0.04	0.96	4	5.80	-1.00
10	0.18	0.00	0.18	0	1.50	-3.70

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	8.8	1.41	10.30	8.61	1.83
5	6.9	2.36	1.34	-0.59	1.93
10	5.2	-	1.09	-6.93	8.02

BEDFORD BASIN 1987

DATE 21/04/1987 JULIAN DAY 111

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	9.26	13.22	0.39	0.48	0.18	0.04
5	1.75	13.18	0.58	0.51	0.30	0.01
10	0.83	12.55	0.97	0.11	0.35	0.64

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	62.0	4.49	855	120	7.13	19.27
5	4.4	4.49	817	120	6.81	20.92
10	1.7	6.14	778	112	6.95	22.62

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	8.31	0.36	8.67	4	36.60	13.90
5	1.78	0.08	1.86	4	7.90	-1.10
10	0.30	0.02	0.32	6	0.90	-4.60

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	22.7	1.65	8.89	6.50	2.40
5	9.0	1.66	3.12	0.86	2.25
10	5.6	-	-	-	-

BEDFORD BASIN 1987

DATE 28/04/1987 JULIAN DAY 118

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	5.21	11.69	0.59	0.51	0.18	0.14
5	3.08	11.85	0.58	0.44	0.24	0.24
10	1.11	11.72	0.83	0.38	0.25	0.46

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	70.0	4.07	675	106	6.57	21.76
5	20.0	3.81	717	104	6.90	22.11
10	4.8	4.19	645	100	6.09	23.14

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	4.17	0.19	4.36	4	18.40	9.80
5	1.28	0.06	1.34	4	8.00	-1.40
10	0.27	0.01	0.28	4	3.10	-5.30

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	8.7	1.65	6.24	6.16	0.08
5	9.4	2.34	1.66	-0.36	2.02
10	8.4	-	-	-	-

BEDFORD BASIN 1987

DATE 05/05/1987 JULIAN DAY 125

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	6.00	11.71	0.13	0.34	0.26	0.05
5	4.20	11.74	0.56	0.23	0.35	0.08
10	3.50	11.27	0.88	0.23	0.30	0.69

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	-99.0	7.17	849	104	6.20	20.32
5	-99.0	4.65	722	128	5.64	22.22
10	-99.0	4.33	579	137	5.57	23.03

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	9.25	0.62	9.87	6	25.40	10.90
5	0.84	0.08	0.92	9	4.60	-4.90
10	0.11	0.02	0.13	15	1.60	-5.40

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	14.5	1.03	6.50	6.99	-0.50
5	9.5	2.05	3.23	3.44	-0.20
10	7.0	-	0.43	-2.20	2.63

BEDFORD BASIN 1987

DATE 12/15/1987 JULIAN DAY 132

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	8.00	10.63	0.87	0.98	0.35	1.08
5	7.00	10.82	0.90	0.69	0.38	1.41
10	5.00	10.70	1.21	0.73	0.40	1.93

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	66.0	2.84	495	86	5.75	21.66
5	16.0	2.75	617	102	6.05	22.08
10	3.6	2.44	467	85	5.49	23.55

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	4.00	0.59	4.59	13	28.40	9.20
5	1.44	0.35	1.79	20	12.80	2.20
10	0.27	0.06	0.33	18	2.60	-3.80

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	11.3	1.91	5.41	1.05	4.35
5	10.6	3.33	2.58	-1.72	4.30
10	6.4	-	2.18	-5.30	7.48

BEDFORD BASIN 1987

DATE 19/05/1987 JULIAN DAY 139

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	7.00	10.92	0.82	0.91	0.30	1.03
5	6.00	10.97	1.06	0.74	0.29	0.62
10	4.50	10.53	1.79	1.15	0.38	1.77

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	68.0	4.72	508	88	5.77	22.75
5	14.0	6.33	763	121	6.31	23.28
10	2.4	4.88	619	110	5.63	24.03

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	6.25	0.92	7.17	13	27.80	16.90
5	2.20	0.45	2.65	17	15.40	2.40
10	0.30	0.05	0.35	14	5.70	-3.70

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	10.9	1.67	8.10	7.65	0.45
5	13.0	2.62	4.38	2.57	1.81
10	9.4	-	1.40	-3.86	5.25

BEDFORD BASIN 1987

DATE 26/05/1987 JULIAN DAY 146

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	8.50	10.82	2.03	0.39	0.34	0.30
5	7.20	10.92	1.53	0.63	0.32	0.62
10	5.00	10.48	2.20	1.14	0.39	0.74

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	64.0	3.98	661	108	6.11	23.01
5	13.0	4.32	757	136	5.57	23.37
10	2.9	4.94	662	114	5.81	24.06

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	4.90	1.75	5.65	13	23.10	10.00
5	3.06	0.48	3.54	14	14.40	5.30
10	0.71	0.12	0.83	14	9.40	-4.70

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	13.1	1.76	7.09	4.78	2.31
5	9.0	1.76	5.18	2.39	2.79
10	14.1	-	1.33	-2.19	3.54

BEDFORD BASIN 1987

DATE 02/06/1987 JULIAN DAY 153

Z	TEMP	O2	NO3	SIO3	PO4	NH3
1	10.50	10.86	0.54	0.29	0.26	0.48
5	9.00	11.11	0.54	0.53	0.46	0.51
10	6.50	10.81	0.81	0.74	0.39	1.31

Z	% LIGHT	CHL	POC	PON	C:N	CO2
1	71.0	4.53	609	98	6.21	22.94
5	17.0	4.66	662	112	5.91	23.39
10	2.9	6.45	689	103	6.69	24.06

Z	PC	PDOC	PTOT	% DOC/TOT	PG	PN
1	11.53	0.81	12.34	6	44.50	29.00
5	4.67	0.38	5.05	8	29.80	13.20
10	1.24	0.26	1.50	17	15.70	-0.70

Z	PR	PQ	PGCO2	PNCO2	PRCO2
1	15.5	1.45	12.37	7.95	4.41
5	16.5	2.39	4.40	2.02	2.38
10	16.4	4.75	2.51	-1.91	4.42