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BIOLOGICAL OCEANOGRAPHY CRUISE REPORT

Prof Pearce
Prof McManus

This contains results from a winter cruise at a time of year when most labs make few measurements but when conditions for the following season are, nevertheless, established. There is now a growing body of important time series of winter oceanography in the Irish Sea. The deep intrusion of Atlantic water with its very high DOM values are unexpected & significant. The team deserve much credit for such results.
John H. 2/1

LF 02 2001

8 – 9 January 2001

PERSONNEL

B Stewart	(SIC), SSO, DARDNI.
C Cochrane	ASO, DARDNI
N Golding	RA, QUB

OBJECTIVES

i. To maintain a nutrient monitoring programme at station 38A.

ii. To assess temperature, salinity and nutrient distributions over depth at stations 38A and 47.

iii. To perform an acoustic benthic survey of outer Belfast Lough.

CRUISE NARRATIVE

Sunday 7 January 2001

In preparation for the cruise, all DANI scientific crew were onboard by 2000 hrs when mooring components and the automated sampler were prepared for deployment. Following a talk on ship's safety and a demonstration of personal life saving equipment, the RV Lough Foyle departed Belfast at 2140 hrs and sailed overnight in a light north westerly breeze to the mooring site at station 38A.

Monday 8 January 2001

The vessel arrived on the mooring site at 0700 hrs. The weather was dry and bright with a moderate northwesterly wind. Work for the day commenced after breakfast at 0800 hrs with the recovery of the instrument mooring. The mooring components were inspected for corrosion and replaced where necessary. The thermistor chain was removed from the mooring wire and temperature data downloaded. The automated water sampler was removed and replaced with a similar pre programmed unit. The mooring components and thermistors were then reassembled, the satellite tracking system was confirmed working and the mooring was successfully redeployed at 1021 hrs on position 53^0 46^1.812N 5^0 38^1.051W. Following the deployment of the rosette water sampler, the sediment corer and 3 zooplankton net hauls, the vessel sailed to coastal station 47 close to the Drogheda fore shore where water samples and zooplankton net hauls were taken. Work on the station was completed at 1430 hrs and

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the vessel sailed to the entrance of Belfast Lough where a RoxAnn™ acoustic benthic survey commenced at 2200 hrs and continued overnight.

Tuesday 21 November 2000

The RoxAnn™ survey grid was completed at 0600 hrs and the vessel sailed to dock in Belfast at 0830 hrs. Work commenced at 0830 hrs with scientific crew removing samples, scientific instruments and mooring equipment from the vessel to AESD.

McLane moored water sampler

The McLane automated water sampler recovered from the Irish Sea had operated as programmed. The sampler was removed and replaced by an identical unit previously programmed to sample every third day during the next period of deployment.
Samples analysed from the recovered sampler complete the year 2000 nutrient data set and show the continuation of the annual winter increase in phosphate, inorganic nitrogen and silicate values (Fig. 3).
Nutrient concentrations from the moored automated sampler continue to show good agreement with samples taken at a similar time with the rosette water sampler (Fig. 4)

PARAMETERS MONITORED

The CTD/rosette water sampler was deployed at stations 38A and 47 to acquire nutrient, chlorophyll *a*, temperature, light and salinity data from the depth profile. The Bowers & Connelly mini-corer was deployed at station 38A, where sediment was subsampled for chlorophyll, total carbon and total nitrogen analysis.
Three zooplankton net hauls were taken at both stations 38A & 47.

SUMMARY OF RESULTS

The CTD profile at station 38A show two distinct layers of seawater (Fig.1). An upper 40m layer, typical temperature and salinity 8.1 °C and 34 psu overlies a 45m layer of 10.1 °C and 34.95 psu. While the salinity of the upper layer has remained constant, surface cooling has reduced the temperature by 3.5 °C since the previous cruise in late November. Temperatures in the lower layer have reduced by 2.6 °C while salinity has increased by 0.4 to 34.95 psu. This warmer, more saline and denser lower layer represents a major ingress of Atlantic water to the Irish Sea. Aside from the physical characteristics, nutrient concentrations of this lower layer are not typical of open Irish Sea values. This is illustrated in Table 1 where, between 70 and 80 metres, levels of ammonia, phosphate, inorganic nitrogen, nitrite and dissolved organic nitrogen are well in excess of expected winter nutrient values. Upwelling of deep Atlantic water and movement across the shelf edge during the storms in the latter part of last year, would provide a source for the high salinity, nutrient rich water currently observed in the Irish Sea.
In Dundalk Bay at Station 47 the CTD profile show temperatures generally 2.5 °C lower than the previous cruise(Fig. 2). As frequently observed at this station, the presence of an overlying cooler and less saline layer illustrates the freshwater influence

of the River Boyne. Slurry application on the Boyne catchment during the recent dry, frosty period may explain nutrient enrichment of the surface layers; typically 17 micromoles inorg N l^{-1} (Table 2).

An Acoustic Benthic survey of Outer Belfast Lough.

As part of the "Nearshore Broadscale Mapping Project for Northern Ireland", an acoustic survey was carried out on the RV Lough Foyle from 22:00hrs on 8th January 2001 to 06:00hrs on 9th January 2001. The installed RoxAnn™ equipment and 38kH_z transducer were used. An outline of the track can be seen in figure 1.

RoxAnn™ track in Outer Belfast Lough. Inter-track distance ranged from 650m to 900m.

By connecting RoxAnn™ (a hydro-acoustic processor) to the transducer of a conventional echo-sounder, two parameters of the seabed can be derived and recorded; E_1 and E_2. E_1 is an integration of the tail of the first seabed echo and is taken to indicate seabed roughness. E_2 is an integration of the whole of the second echo and provides an index of seabed hardness. The E_1:E_2 values are plotted on an (x/y) grid, which is partitioned into different coloured regions (boxes), with each colour representing a different 'ground-type'.
A map of 'ground-types' can be seen in figure 5. These ground types need to be ground-truthed using either grab sampling or video sledge. Although no groundtruthing was undertaken on this cruise due to time constraints, preliminary observations regarding the ground-types over the survey area can be deduced, for

example, the high E1/E2 values which were recorded over the area shaded red in figure 2 are indicative of a coarse, hard substrata.

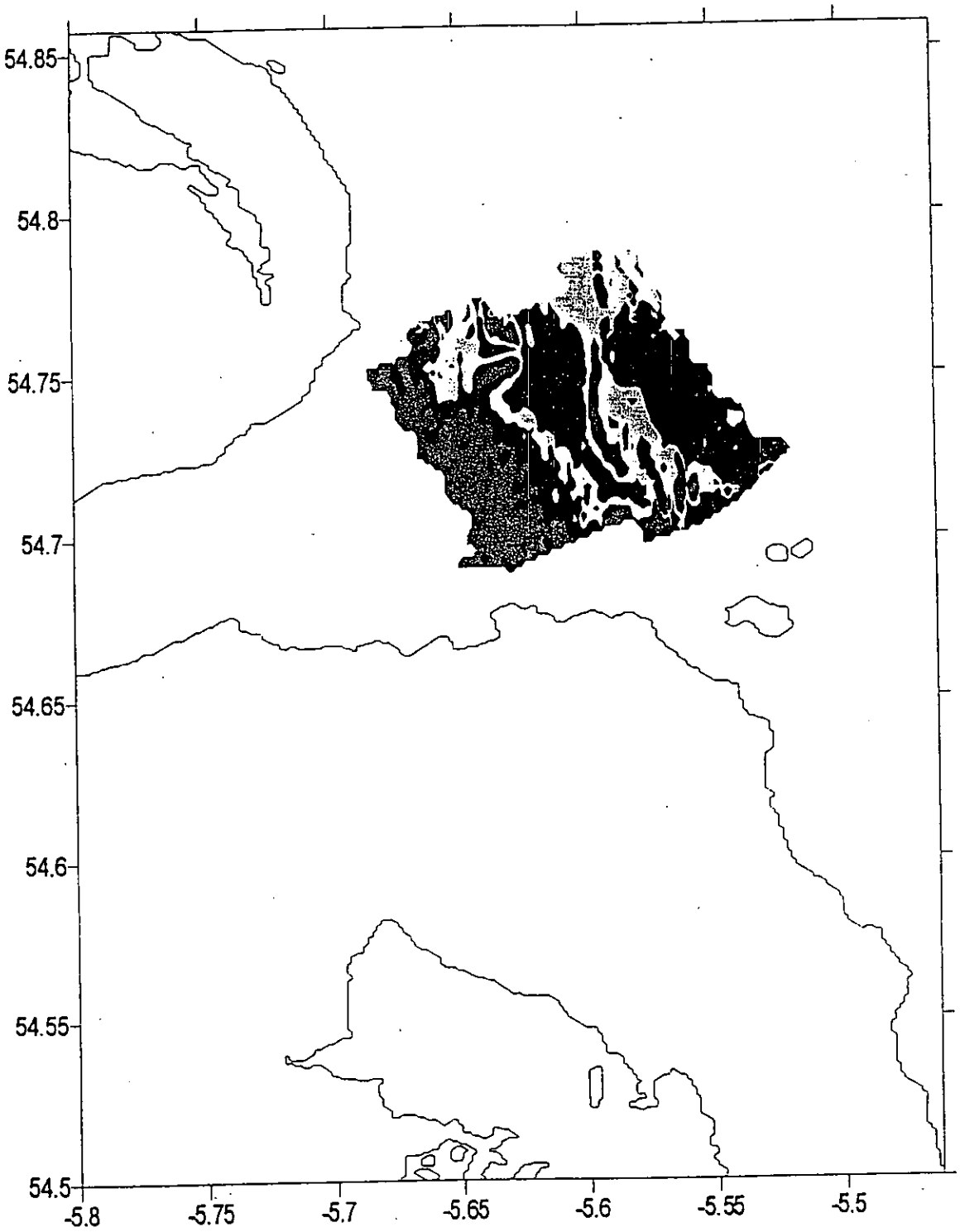


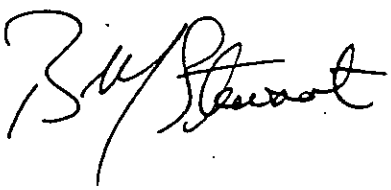
Figure 5: Map showing acoustic 'ground types' interpolated using Nearest Neighbour

HOTEL REPORT & OPERATIONAL ASPECTS OF THE SHIP

During the cruise the A-frame, main trawl winches, both hydrographic winches and the ship's clean seawater supply were used. No problems were encountered with any of the ship's equipment nor indeed with any of the scientific equipment. The hotel and catering service was of the usual high standard and there was a good working relationship between the scientists and the ship's crew. Prior to the ship departing Belfast a comprehensive and detailed safety briefing was delivered to the scientific crew.

ACKNOWLEDGEMENTS

I am indebted the deck crew of the RV Lough Foyle for their co-operation and assistance during the mooring recovery and deployment operation. The ship's master, officers, engineers and catering staff are also thanked for their co-operation during this cruise.



B M STEWART

24 January 2001

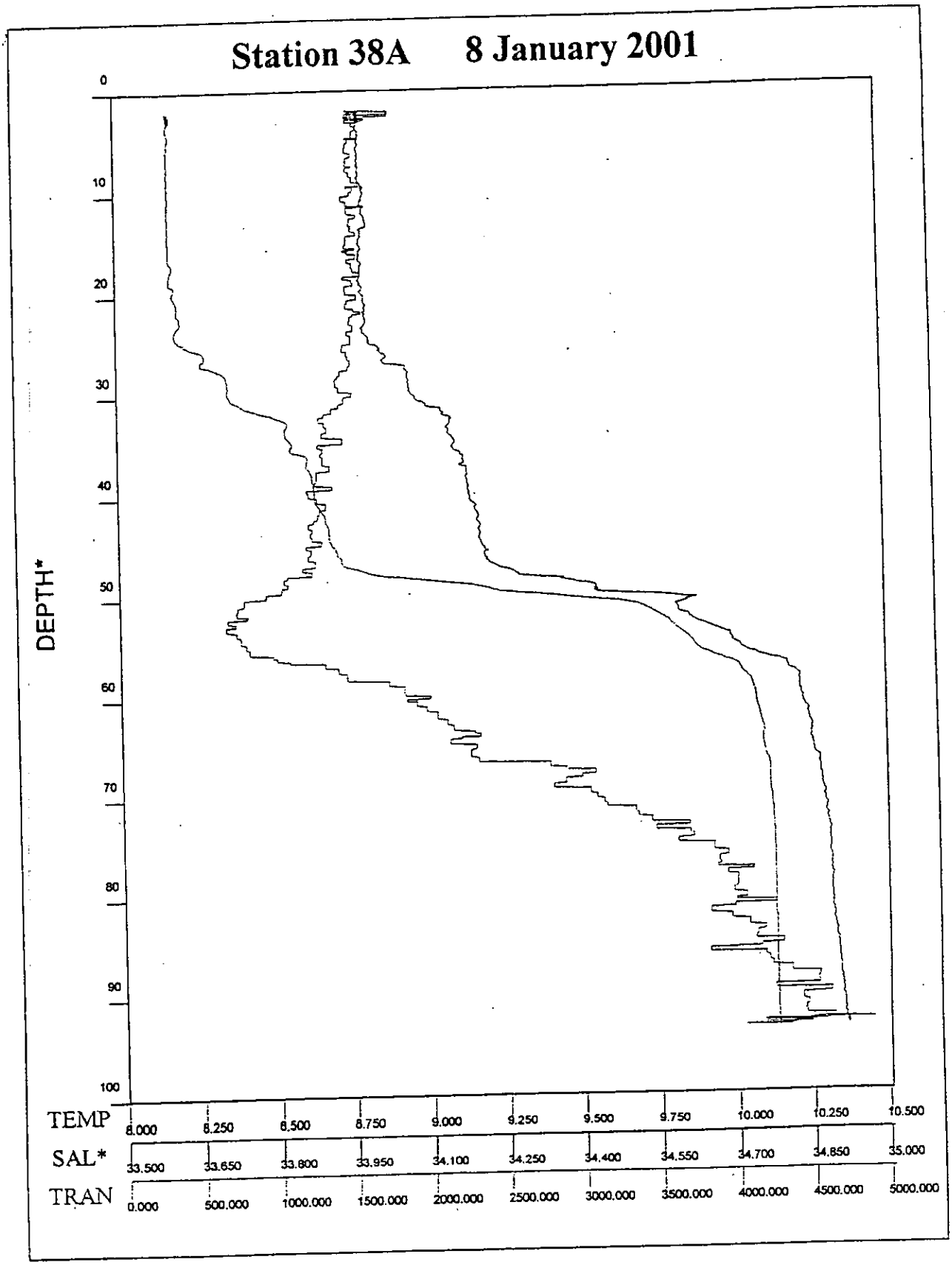
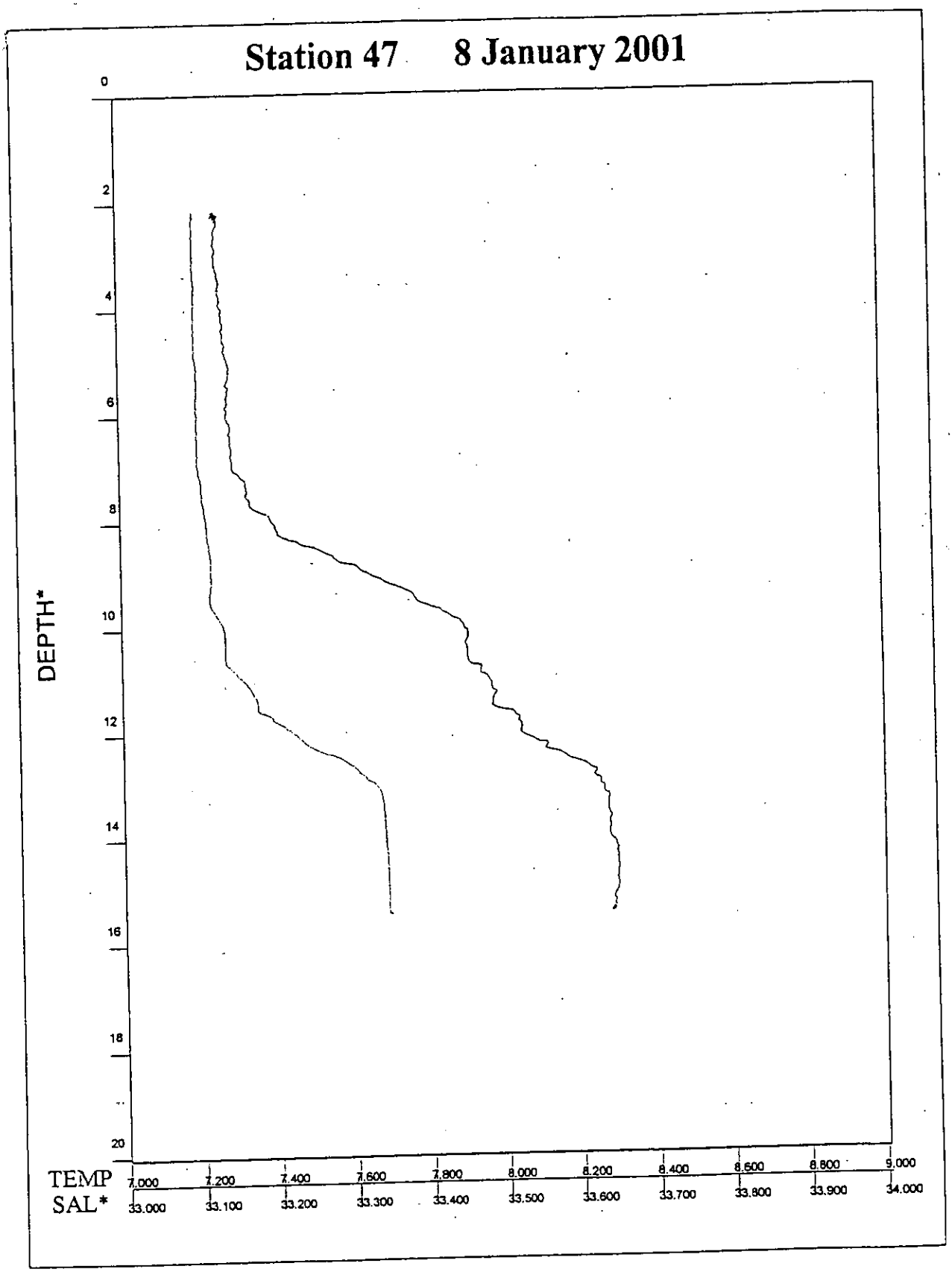

Station 38A 8 January 2001
DEPTH*
0
10
20
30
40
50
60
70
80
90
100
TEMP
8.000
8.250
8.500
8.750
9.000
9.250
9.500
9.750
10.000
10.250
10.500
SAL*
33.500
33.650
33.800
33.950
34.100
34.250
34.400
34.550
34.700
34.850
35.000
TRAN
0.000
500.000
1000.000
1500.000
2000.000
2500.000
3000.000
3500.000
4000.000
4500.000
5000.000

Figure 1.


Station 47 8 January 2001
DEPTH*
0
2
4
6
8
10
12
14
16
18
20
TEMP
SAL*
7.000
7.200
7.400
7.600
7.800
8.000
8.200
8.400
8.600
8.800
9.000
33.000
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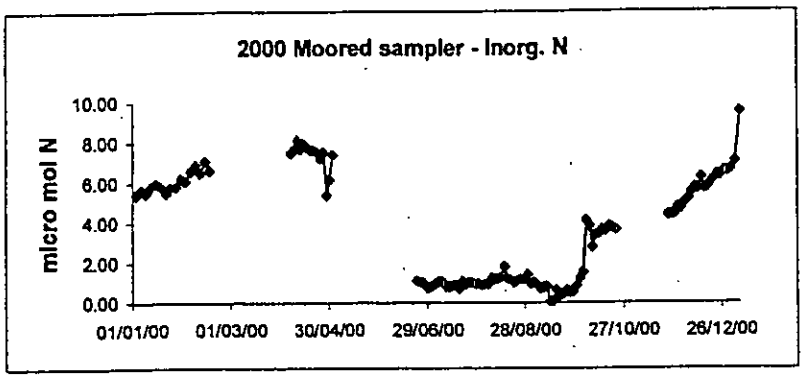
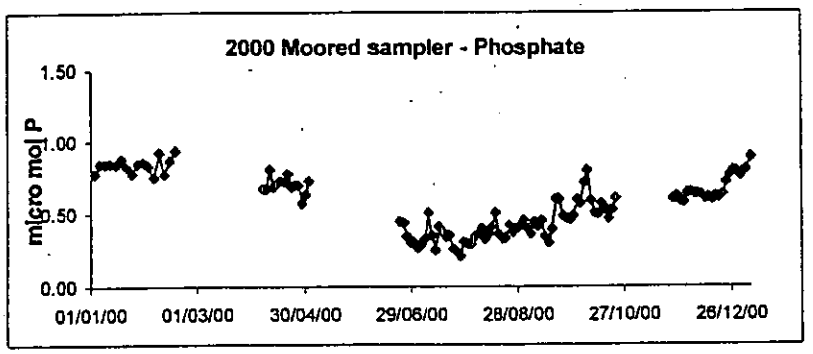
33.500
33.600
33.700
33.800
33.900
34.000

Figure 2


2000 Moored sampler - Inorg. N
micro mol N
10.00
8.00
6.00
4.00
2.00
0.00
01/01/00
01/03/00
30/04/00
29/06/00
28/08/00
27/10/00
26/12/00


2000 Moored sampler - Phosphate
micro mol P
1.50
1.00
0.50
0.00
01/01/00
01/03/00
30/04/00
29/06/00
28/08/00
27/10/00
26/12/00

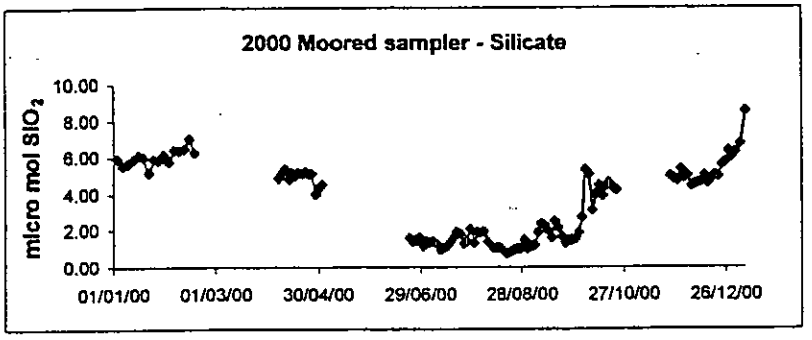
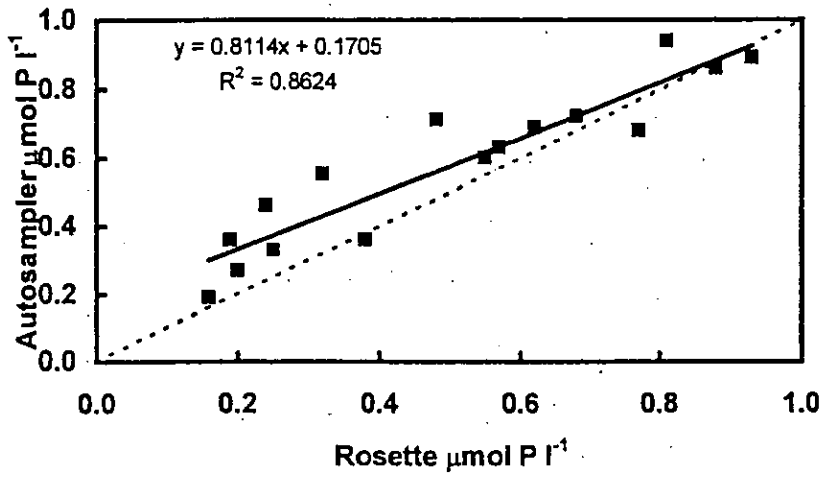
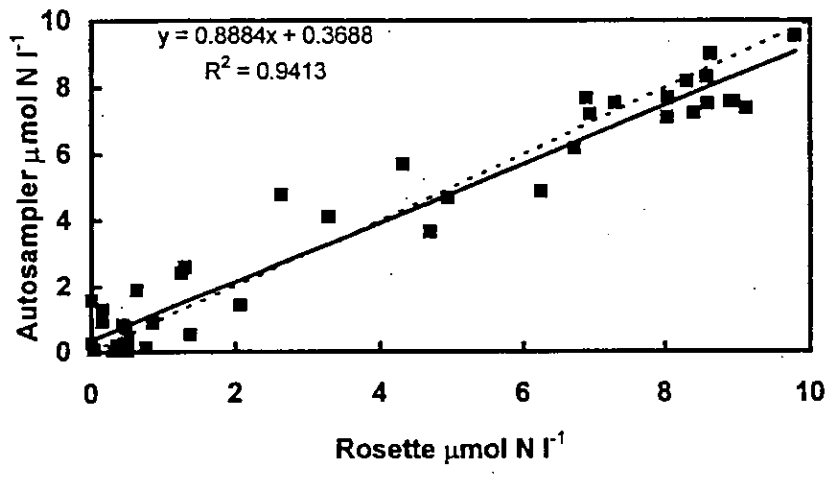

2000 Moored sampler - Silicate
micro mol SiO2
10.00
8.00
6.00
4.00
2.00
0.00
01/01/00
01/03/00
30/04/00
29/06/00
28/08/00
27/10/00
26/12/00

Figure 3.


y = 0.8114x + 0.1705
R^2 = 0.8624
Autosampler µmol P l^{-1}
Rosette µmol P l^{-1}
0.0
0.2
0.4
0.6
0.8
1.0


y = 0.8884x + 0.3688
R^2 = 0.9413
Autosampler µmol N l^{-1}
Rosette µmol N l^{-1}
0
2
4
6
8
10

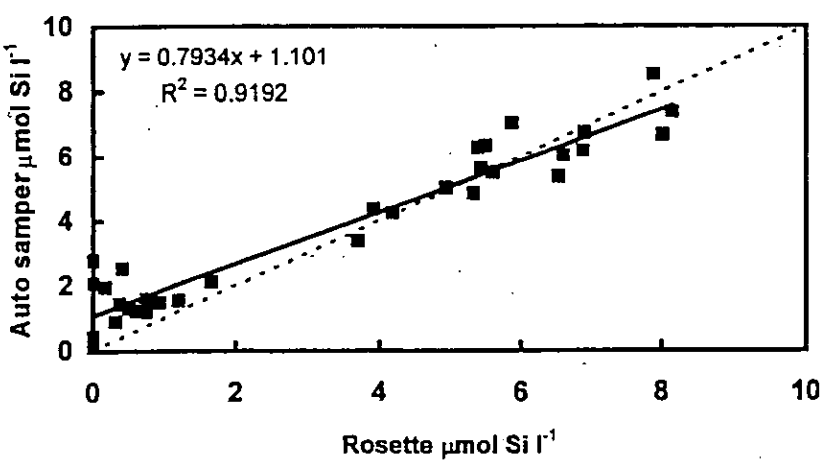

y = 0.7934x + 1.101
R^2 = 0.9192
Auto samper µmol Si l^{-1}
Rosette µmol Si l^{-1}
0
2
4
6
8
10

Figure 4

IRISH SEA OCEANOGRAPHY 2000

Depth profile samples (8 January 2001)

STATION	DATE	DEPTH M	AMMONIA $\mu m\ N\ l^{-1}$	PHOSPHATE $\mu m\ P\ l^{-1}$	INORG N $\mu m\ N\ l^{-1}$	SILICA $\mu m\ SiO_2\ l^{-1}$	DON $\mu m\ N\ l^{-1}$	NITRITE $\mu m\ N\ l^{-1}$	CHL	PHAEO	ACID RATIO
38A	08/01/01	2.7	1.32	0.84	9.45	7.87	11.99	0.16	0.28	0.21	1.55
38A	08/01/01	10.0	1.04	0.66	9.06	7.51	7.94	0.07	0.25	0.18	1.56
38A	08/01/01	19.9	1.80	0.93	9.79	7.89	12.33	0.21	0.25	0.17	1.58
38A	08/01/01	30.3	0.96	0.68	9.58	7.21	3.96	0.05	0.20	0.10	1.65
38A	08/01/01	39.9	0.91	0.66	10.35	6.92	5.90	0.08	0.27	0.07	1.77
38A	08/01/01	50.8	0.75	0.57	8.97	5.37	6.04	0.06	0.41	0.05	1.86
38A	08/01/01	60.5	1.34	0.62	9.11	5.42	2.95	0.11	0.41	0.09	1.79
38A	08/01/01	70.7	2.71	1.14	8.40	6.08	26.99	0.42	0.49	0.10	1.80
38A	08/01/01	79.9	4.34	1.29	11.46	6.32	45.74	0.45	0.47	0.08	1.83
38A	08/01/01	93.9	2.24	0.53	7.43	5.56	8.90	0.08	0.49	0.11	1.80

Table 1.

IRISH SEA OCEANOGRAPHY 2000

Depth profile samples (8 January 2001)

STATION	DATE	DEPTH M	AMMONIA µm N l^{-1}	PHOSPHATE µm P l^{-1}	INORG N µm N l^{-1}	SILICA µm SiO_2 l^{-1}	UREA µm N l^{-1}	NITRITE µm N l^{-1}	CHL	PHAEO	ACID RATIO
47	08/01/01	2.5	0.83	0.80	17.05	11.28		0.23	0.17	0.04	1.79
47	08/01/01	5.4	0.93	0.80	17.32	11.20		0.23	0.17	0.06	1.72
47	08/01/01	10.2	0.92	0.78	14.76	10.10		0.20	0.16	0.06	1.71
47	08/01/01	15.5	0.93	0.78	14.43	9.67		0.21	0.15	0.09	1.62

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Table 2.