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BIOLOGICAL OCEANOGRAPHY OF THE WESTERN IRISH SEA 18-21 NOVEMBER 1991

PERSONNEL

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OBJECTIVES

1. To determine the spatial distribution of dissolved inorganic nutrients (ammonia, nitrate, phosphate and silicate) and chlorophyll related phytoplankton biomass in relation to the hydrography of the western Irish Sea.

2. To undertake primary production experiments using a standard 14C incubation technique.

3. To calibrate the Hydrobios CTD for salinity.

CRUISE NARRATIVE

Lough Foyle left Belfast at 0730 hrs on Tuesday the 19 November and headed for stn 4 (Figure 1). Stations 4 and 6, in the North Channel were not worked (due to a north easterly gale) and the ship proceeded directly to stn 7. After the completion of stn 92A at 1730 hrs the ship steamed for Douglas (Isle of Man) and lay at anchor overnight in Douglas Bay. Lough Foyle left her anchorage at 0700 hrs on the 20 November and headed for stn 94. Stations were worked according to the sequence shown in Figure 1 with the final station of the day (stn 21) being completed by 2030 hrs. The ship remained in the vicinity of stn 21 overnight. The following morning (21 November) the ship steamed to position 54.11N and 5.18.3W to collect samples of bottom sediment and associated benthic infauna. This station was completed by 0800 hrs and stations 16, 13, 6 and 4 were worked before the ship returned to Belfast. During the return to Belfast surface sampling was continued until shortly before the ship docked at approximately 1400 hrs.

METHODS

Stations were positioned to compliment stations worked on previous biological oceanographic cruises and to provide spatial coverage of the Irish Sea. In addition, stations were located close to the entrance of the Solway Firth in order to collect water of reduced salinity for precision salinometer measurements of salinity. The vertical distribution of temperature and salinity were measured at selected stations using the Hydrobios CTD. At these stations water samples were collected from selected depths for, the measurement of dissolved inorganic nutrients, estimation of phytoplankton biomass (chlorophyll) and salinity calibration (Table I). A sub-sample (30 ml) of near surface water from each CTD station was preserved with acidic Lugol's Iodine for phytoplankton species identification and enumeration.

The TrAAks autoanaylser was set up to measure concentrations of dissolved inorganic nutrients in near surface waters at six minute intervals using the ships clean sea water supply. During the periods when the CTD was not used for vertical profiling it was used to map near surface, sea temperature and salinity by placing it in a plastic bin continuously flushed with water from the ships clean sea-water supply.

The attenuation of downwelling photosynthetically active irradiance was measured at selected stations using a Biospherical Instruments Inc. QSP profiling system fitted with a depth sensor . The underwater frame of the profiling system was modified to support two, 2 phi light collectors, mounted to measure downwelling and upwelling irradiance. The output from the light and depth sensors together with surface irradiance was logged onto a computer.

At stations 43 and 46 water from the ships clean sea-water supply was used to estimate carbon fixation by phytoplankton. Water samples (60 ml) were inoculated with 5 u ci of ^{14}C and placed in a chamber providing a light gradient. Following a three hour incubation each sample was fixed with formalin and filtered. The phytoplankton and filter from each sample was stored frozen in glass vials for future analysis.

PRELIMINARY RESULTS AND DISCUSSION

A summary of the hydrographic data collected from those stations at which the vertical distribution of temperature and salinity were recorded is presented in Table II. The data suggest that with the exception of those stations near the entrance to the Solway Firth and stn 46, there was little

vertical structure to the water column in the survey area. The small gradients in temperature and salinity at stn 46 was probably due to reduced tidal mixing in this region of the Irish Sea.

Near surface water of reduced salinity was observed down the east side and to the north west of the Isle of Man. The Solway Firth is the most likely origin of the freshwater. Furthermore, the fact that the influence of freshwater was detected at stations 7, 9 and 93 may have been due to increased inflow of freshwater resulting from high rainfall in the week preceding the cruise combined with strong north easterly winds pushing near surface water out of the Firth.

The dissolved inorganic nutrient data indicate that concentrations of those nutrients measured (nitrate, nitrite, ammonia and phosphate) had reached their winter maxima. Highest concentrations of these nutrients were measured in the low salinity waters of the Solway Firth and Belfast Lough.

The water samples collected for precision salinometer measurement of salinity, provided a sufficiently wide range of salinities to calibrate the Hydrobios CTD.

EQUIPMENT AND SCIENTIFIC PROCEDURES

With the exception of the failure to log the ships position while surface mapping (due to a problem with the original GOP software) there were no major problems with the equipment.

Rather than working a watch system it was decided to work 'long days'. In general this system of working was easier than working shifts, since there were only four scientific staff on board.

ACKNOWLEDGEMENTS

I would like to thank the Captain, Officers and crew of the Loch Foyle for the friendly and cheerful way in which they assisted the scientific staff. I would also like to thank the scientific staff for their support and hard work which ensured that the objectives of the cruise were met.

R. J. Gowen 20th December 1991

TABLE I

Details of the sampling carried out at selected stations.

Station	Sampling carried out
7	CTD profile; water samples from 5, 10, 20, 45 m.
9	CTD profile; water samples from 5, 12, 25, 40 m.
92	CTD profile; water samples from 1, 5, 10, 14, 20 m.
92A	CTD profile; water samples from 1, 2, 6, 9, 12 m.
94	CTD profile; water samples from 5, 15, 25, 40 m.
43	CTD profile; water samples from 5, 10, 20, 40 m; light profile; Water sample for productivity.
50	CTD profile; water samples from 5, 25, 50, 100 m; light profile.
46	CTD profile; water samples from 3, 10, 20, 50 m; light profile; water sample for productivity.
31	CTD profile; water samples from 5, 20, 40, 90 m.
21	CTD profile; water samples from 5, 20, 40, 90 m.
16	CTD profile; water samples from 5, 25, 60, 125 m.
4	CTD profile; water samples from 5, 25, 50, 130 m.

TABLE II

Surface to bottom differences in temperature and salinity from those stations at which vertical profiles of temperature and salinity were measured. Negative temperature differences indicate near surface water temperature lower than the temperature of deep water.

Station	T (c)	S (ppt)	depth interval (m)
4	0.00	0.00	125
7	0.00	0.11	55
9	- 0.20	0.16	40
16	0.00	0.00	120
21	0.00	0.03	100
31	0.02	0.03	90
43	- 0.01	0.00	40
46	- 0.71	0.13	95
92	- 0.24	0.31	20
92A	0.00	0.10	12

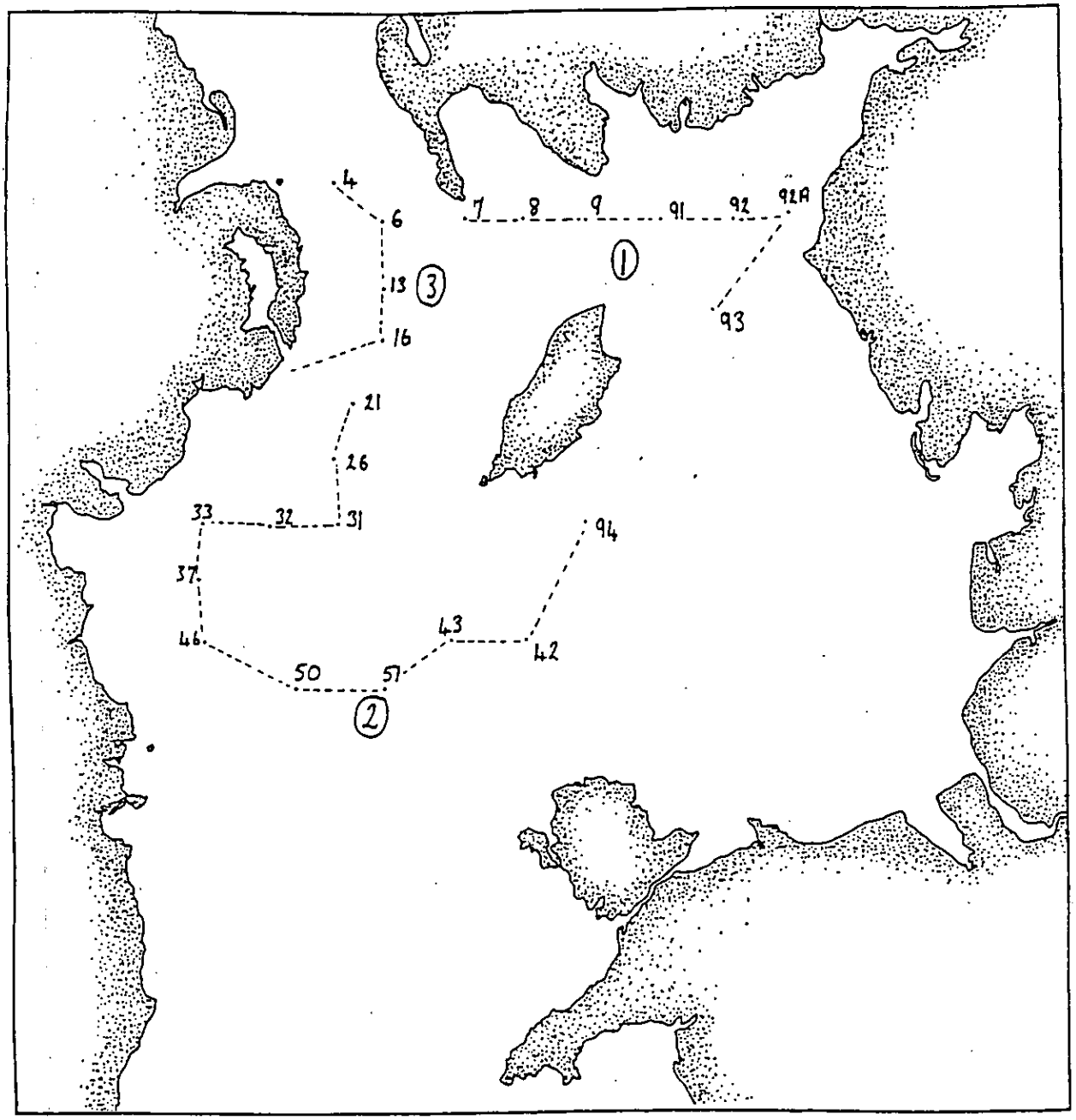

FIGURE 1. A map of the Irish Sea showing the location of sampling stations. The cruise track is shown by the dotted line. Track 1 was completed on the 18 November, track 2 on the 20 and track 3 on the 21 November.