P.O.L.

RRS CHALLENGER
CRUISE 37/88

1 October - 14 October 1988

NORTH SEA SURVEY

CRUISE REPORT No. 2
1988

NATURAL ENVIRONMENT RESEARCH COUNCIL
PROUDMAN OCEANOGRAPHIC LABORATORY

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North Sea Survey

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ABSTRACT

This report describes RRS CHALLENGER cruise 37/88, from 1st October to 14th October 1988, one of the survey cruises for the North Sea Project.

The first four days and last four days proceeded roughly according to plan around the set track, but the middle four days were completely disrupted by a prolonged storm when work was not possible and the ship, in keeping hove to, crept slowly westwards from north of Holland to just off NE England. Thus:

about 500 miles or 30% of the set track - in the German Bight, off Denmark and along 55½°N to mooring site A - was lost together with associated underway measurements, stations, samples and trawls;

one (B) of six mooring sites was not serviced;

one of six core sites was missed.

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CONTRACT

PROJECT CN-21

PRICE

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Scientific Personnel

J. Huthnance	POL	Principal Scientist
K. Black	Swansea	
G. Bradshaw	Liverpool	
H. Edmunds (Miss)	UEA	
D. Flatt	POL	
A. Lord	RVS	
J. Merrett (Miss)	Liverpool	
D. Mills	UCNW	
P. Taylor	RVS	
D. Teare	RVS	
A. Upton	Essex	
S. Vaughan (Miss)	SMBA	
J. Watson	SMBA	
H. Witte	NIOZ	

Ship's Officers

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T. Dowell	C/O
T. Morse	2/O
S. Bagshaw	3/O
D. Rowlands	C/EO
N. Wilson Deroze	2/EO
C. Melrose	3/EO
P. Edgell	E/E
D. Wiseman	Bos'n

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CRUISE OBJECTIVES

1) To make underway measurements of air/sea fluxes, surface-sampled variables (temperature, salinity, transmittance, fluorescence, irradiances) and Acoustic Doppler current profiles, around a set track covering the southern North Sea.

2) To make CTD stations (recording temperature, conductivity for salinity, transmittance, fluorescence, dissolved oxygen, up- and down-welling irradiance as functions of depth) at 120 sites along the track, also taking water samples for calibration and productivity measurements.

3) To take zooplankton samples at about 60 of the CTD sites.

4) To recover and redeploy current meter moorings at sites A,B,C,D,E and F.

5) To recover and redeploy thermistor chain moorings at sites A,B,C and D (if temperature structure warrants redeployment at D).

6) To take multiple cores from sites 1 to 6 and carry out benthic flux analyses thereon.

NARRATIVE

RRS Challenger departed Great Yarmouth at 2315 GMT on 1st October (all dates hereafter refer to October). Conditions were fine and calm. After dropping the pilot logging commenced, the Simrad echo-sounder pole was put out, the ADCP switched on and course was made for CTD stations AA and AB which were completed by 0615 of 2nd.

The single-strand mooring E was released and brought inboard, also the adjacent guard buoy mooring. These were combined in redeployment of a U-shaped mooring, completed by 1015. Conditions remained fine and calm.

Course was made to mooring F via CTD stations AC and AD where plankton samples were also taken. Advantage of daylight and good conditions was taken to recover the single-strand mooring F, without difficulty, but a pellet snagging the SIMRAD pole, and breakage of a supporting rope when the spar buoy was nearly

inboard, made for a difficult recovery of the guard mooring. With favourable conditions in prospect for redeployment 1½ - 2 days later, the track was resumed with CTD and plankton stations at AE,AF,AG. The track was continued with CTD and plankton stations through 3rd (with about 2 hrs delay from fog and shipping in the late afternoon) until stations AR and AS in the morning of 4th (when about 4 hrs more delay occurred through fog). Then cores were taken at core site 1 (AS) with four lowerings of the SMBA multicorer in good conditions.

The track was continued with more CTD and plankton stations on the 4th until reoccupation of station AE. Then mooring F was redeployed as a U-shape, in the late evening. Overnight, seas increased to moderate as more CTD and plankton stations were occupied up to core site 6. Here sufficient cores were obtained, with just two lowerings of the corer, at dawn on 5th.

At the adjacent mooring site D, the acoustic doppler current profiler's rig pinger only gave weak signals, and contact was uncertain, but after a period of attempts to fire the release mechanism the rig was spotted floating close to starboard. Both the ADCP and the thermistor chain rig were quickly recovered and another ADCP quickly deployed - time was then taken to check its acoustics in the water with a satisfactory result, albeit limited range. The track continued with CTD and plankton stations towards Texel (Netherlands) and then northwards to core site 2 on the evening of the 5th. Again, two lowerings of the SMBA multicorer yielded sufficient samples. CTD and plankton stations continued through the early morning of 6th, to BJ at an apex of the intended survey track. However, worsening conditions with storm-force winds from the south-east, south-west and west caused RRS Challenger to heave to from late morning on 6th until 1300 on 8th. During this period damage was sustained by Go-flo bottles on the CTD, aerosol sampling equipment and fittings on the ship's mast. Additionally, the non-toxic supply repeatedly lost suction (due to air in the water) and had to be turned off.

With strong westerlies and severe conditions in the eastern half of the North Sea still forecast, it was decided on 8th that there was no prospect of covering the eastern portion of survey track, and that the best procedure was to head for mooring site C as permitted by continuing rough conditions. (C was the nearest mooring site and gave the best prospect of sheltered passage for the next two days).

Reaching mooring site C on 9th at midday, conditions had eased (and continued to do so) sufficiently for a CTD station and plankton trawl. The ADCP was recovered straightforwardly and another rig immediately redeployed. The thermistor chain (whose toroid buoy had been visible throughout) was recovered (less pellets and acoustics which were missing) but not redeployed, no stratification of significance remaining. One set of 12 cores from site 5 was obtained in the evening, for first-stage processing, en route to core site 4 and mooring site A.

In the early morning of 10th, cores were obtained at site 4, two drops of the corer again providing sufficient. After the pre-dawn CTD cast had established the continuing presence of stratification, recoveries and redeployments of the ADCP and thermistor chain at A were carried out - in fine conditions except for a swell from the north. However, the fluorimeter was missing from the recovered thermistor mooring. At 0940 of 10th, mooring work at A being completed, course was set to follow the original track off the Tyne and Tees estuaries.

This track was followed, with CTD and plankton casts, until station DL at 1930 on 11th, after which course was made for core site 5. A single corer drop sufficed for 12 cores (more than enough to complement the earlier set) but in worsening conditions a leg of the corer hit the stern and was bent on deployment, and CTD casts for bottom water (for core analysis) had to be abandoned after the first of the three intended.

On 12th the track was resumed at DN in improving conditions (after passage via EG where conditions prevented a CTD cast). CTD and plankton stations continued to DQ (1230h) off the Humber, around a loop bounded by DS and EJ back to DQ (0200h on 13th), and so along the remainder of the track into the Wash and around Norfolk to AA which was completed at 1420. The Simrad pole was then brought in and all logging ceased.

RRS Challenger proceeded to await the pilot and finally entered the river at Great Yarmouth, docking at 0100h on 14th.

INDIVIDUAL PROJECT REPORTS

Moorings - currents (P. Taylor)

Only moorings E and F were serviced. Bad weather prevented the ship from reaching station B. The instrumentation on mooring B should continue to record data and provided that it is serviced during the next survey cruise no data loss should occur.

All hardware was successfully recovered from sites E and F. Conventional U-shape moorings were then deployed as replacements. Command beacons were included in the instrument lines to provide navigational backup. To improve the mooring characteristics at station E, 100 lb of extra in-line buoyancy was added. This was included just above the bottom S4.

Data was retrieved and subsequently transferred to floppy disc from all instruments recovered. No instrument faults were apparent.

Thermistor Chains (D. Flatt)

The three thermistor moorings at stations A,C and D were successfully recovered. The fourth at station B was not visited by the ship due to bad weather and lack of time.

There was no visible damage to any of the thermistor loggers, chains or moorings. However a spherical pinger was lost at C and a fluorimeter at A, both

without any apparent damage to their mounting brackets.

A thermistor mooring was redeployed at A. At stations C and D the sea was well mixed, so the moorings here were not redeployed.

Acoustic Doppler Current Profiler, deployments (D. Flatt)

All three ADCPs at stations A,C and D were successfully recovered and redeployed. The acoustics on these rigs did not switch on until the ship was within one to two cables. On redeployment the acoustic units were raised in their mountings to try to stop any masking effects from the rest of the rig and thus increase the range.

Ship-borne Acoustic Doppler Current Profiler (D. Teare)

The A.D.C.P. failed on 8 occasions during the cruise, the failures being

(a) "Disk error" 1

(b) "Built in test" 1

(c) "Profiler not connected" 6

"Disk error" - This was found to be a damaged disc. The disc was changed and the system re-started.

"Built in test" - The system failed due to continuous B.I.T. errors, a diagnostic check was run and the errors printed out. The system was then re-initialised, and ran without further B.I.T. errors.

"Profiler not connected" - This is a long-standing problem with the system, but one which is easily rectified. By pressing the "P to Ping" command the system then continues to function without further problem. Although 8 system failures appears to be rather high, none of the faults were of a 'hard' nature, the system being re-started by either pressing the "P to Ping" command or by re-initialising the A.D.C.P. programme.

CTD/Rosette System (P. Taylor)

The CDT system worked well. Temperature and salinity calibrations were done at each station and produced consistent results. Temperature indicates a

correct reading (within the limit of shipborne calibration) whilst salinity is about .01 low. The pressure sensor has a 1.9m offset which has not been entered into the cruise calibration file. The fluorimeter, transmissometer and light meters all worked satisfactorily.

The rosette system worked well and gave no problems. The 10 l Go-Flo bottles produced their usual teething problems, occasionally failing to close properly. These were changed or serviced as required. Three bottles were damaged during force 10 gales when they became detached from the CTD frame. In future it will be essential to remove and store these bottles during heavy weather.

Suspended Sediments (K. Black)

Objectives

1. To make surface and water column measurements of beam transmittance.

2. To calibrate the transmittance data in terms of suspended material concentrations by filtration of water samples.

Data Acquisition

Transmittance: continuous surface profiles of transmittance were obtained along the survey track using two deck-mounted transmissometers (in water jackets) plumbed into the flow of the non-toxic water supply. Flow rates through the water jackets of 20-25 litres/min were maintained for most of the cruise except during more stormy conditions, when the rates were reduced to ca. 10 l/min to reduce aeration effects in the water supply.

Vertical (continuous) profiles of transmittance were obtained at all CTD stations using a transmissometer mounted horizontally on the CTD rig. These profiles approached to within 1-2m of the seabed.

Calibration samples: water samples were taken at surface, mid- and bottom depth intervals using the rosette sampler at the CTD stations 740-814 (inclusive) except at stations 774, 779, 788, 796, 805. For each sample, ca. 2 l

of sea water were filtered through pre-weighed 0.45μm membrane filters. Filters were then rinsed with distilled water, dried and stored cool in individual petri dishes.

Samples were also taken at intervals from the 'RVS' and 'PPIMS' water jacket transmissometers.

Biology (D.K. Mills)

The biologist was responsible for a range of different measurements as described below:-

Chlorophyll. Samples were collected from 3 depths (surface, mid and bottom) from all CTD stations for determination of extracted chlorophyll.

Phytoplankton. Surface samples from alternate CTD stations were collected and preserved for analysis of phytoplankton species composition.

Water column dissolved oxygen. Water was collected from surface, mid and bottom bottles at least once a day for the determination of dissolved oxygen. Samples were analysed on board using a semi-automatic micro winkler technique.

Underway surface oxygen. Dissolved oxygen was monitored using a pulsed oxygen electrode system. Samples were collected on a daily basis for oxygen measurements using the micro winkler technique.

Moored fluorimeter. A submersible fluorimeter and associated battery logger device deployed at mooring A on cruise 35 was recovered minus the fluorimeter. Samples were collected prior to recovery for determination of chlorophyll and phytoplankton species analysis. On board the logged data was downloaded to disc for subsequent analysis. The data was found to be corrupted.

Nutrients (H. Edmunds)

As for the previous survey cruises, four nutrients were analysed - nitrate, nitrite, silicate and phosphate - at each of the 75 CTD stations at 3 or 4 depths. Ammonia was, again, not analysed. It is hoped that while the ship is in Yarmouth for its refit, work will be carried out on the ammonia method.

Air/Sea Fluxes (J. Merrett and G. Bradshaw)

Aim: To collect high volume and cascade impactor samples for subsequent analyses at Liverpool University (trace metal and organic). Also to collect cascade impactor samples (for C. Ottley, Essex University) and rain water samples (for A. Rendell, UEA).

Report: Seven pairs of inorganic/organic high volume filters were collected. Seven sets of rainwater samples were also collected in addition to one cascade impactor sample of 100hrs duration.

Problems: Breakage of the wind vane occurred in bad weather (being repaired at Liverpool). The midship exhaust pipe lacked a tight fit with the aperture on the flow monitor, preventing an accurate estimate of pressure difference and hence flow rate. A blackout on the foredeck (for safe navigation from the bridge) made night work difficult, and the deck surface was rather slippery when wet.

Rain sampling report: Several problems became apparent during this survey. When a rain event occurred, it was often too dangerous to attend the sampling equipment. As a result of this the equipment was uncovered before a rain event. However, in some cases, after rain occurred, considerable time elapsed before recovery of the samples was allowed. During this time period high seas led to waves breaking over the bridge which unfortunately will have contaminated the samples; this has been detailed in the log book.

Benthic Fluxes (A. Upton, J. Watson and S. Vaughan)

Objectives:

1) To sample the selected 6 sites for benthic flux studies. The sampling of site number 6, which had not been sampled on cruise 35, was to be assigned a high priority to ensure that an initial data set from all 6 sites had been collected.

2) To make a range of measurements on the above samples, including incubation experiments to determine the rate of oxygen uptake and the rate of sulphate reduction by the sediment; and the fluxes across the sediment/water interface.

3) To continue testing the oxygen macro- and micro-electrodes after continued development between cruise 35 and the present cruise.

1) and 2) Five sites, including station 6, were satisfactorily sampled and all measurements completed with the exception of oxygen uptake on the sediment from station 2. Additional sulphate reduction experiments were carried out for a comparison of methods.

The positions of the selected sampling sites that were requested and the positions obtained on this cruise are listed below:

Site	Selected Position from Cruise 35	Position Obtained on Present Cruise
1	51° 45.36'N, 02° 59.96'E	51° 45.4'N, 03° 00.2'E
2	53° 37.10'N, 04° 35.70'E	53° 37.1'N, 04° 35.7'E
3	55° 30.00'N, 06° 06.10'E	NOT SAMPLED
4	55° 29.90'N, 00° 54.50'E	55° 29.9'E, 00° 54.5'E
5	54° 39.16'N, 00° 31.06'E	54° 38.9'N, 00° 31.4'E
6	53° 30.78'N, 02° 59.33'E	53° 31.0'N, 02° 59.0'E

The accuracy to which the sample sites were returned is indicated by comparing the positions above. It is important in future cruises that this very high level of accuracy of station keeping is maintained.

3) Two oxygen micro-electrodes were tested and although a response was obtained the readings were not stable. The oxygen macro-electrodes were not used and all oxygen uptake measurements were made by chemical determination.

Plankton (H. Witte)

The start of the cruise was characterised by good weather conditions, so it was possible to sample zooplankton on all stations in the southern North Sea,

but because of some gales it was impossible to collect zooplankton samples in rather interesting areas such as the German Bight, and the east side of the Dogger bank. On the other hand, the west side of the Dogger bank was sampled intensively.

The zooplankton was sampled with a vertical trawl (mesh size 300μ, diameter of the mouth 70cm) and with a small vertical trawl (300μ, diameter 20cm).

Computing (A. Lord)

During the course of the cruise, the ship-borne computing system and data logging worked well, with only minor faults of little consequence. CTD profile plots, daily time series and ship's track charts, and transects from time to time, were produced without excessive effort, aided by the ability to program the production of a series of plots on the faster Nicolet drum plotter.

At the end of the cruise, data transfer from the autonomous logging systems (for e.g. nutrients) was completed, and GF3 tapes for all data were produced as required. Station lists, final track charts and charts of station positions were also sucessfully produced.

The main outstanding requirement was the production of contour plots, prevented by a combination of lack of time, the need to use the slower flat-bed plotter for compatibility with contouring software, and lack of final success in attempting to include the land outline and to mask overland contours. Lack of time was particularly acute with the need to clear RRS Challenger for refit, but the present demand for final contour plots (which can only be commenced at the end of the survey) exceeds the usual plotting capacity in port before the next cruise, and should be reviewed. Compatibility with the faster Nicolet plotter, and inclusion of the land, should be soon resolved.

CTD Station List

Stn No.	Code	Yr	Start Day	Start Time	Start Latitude	Start Longitude	Start Depth	End Day	End Time	End Latitude	End Longitude	End Depth	Comment
740	AAA	88	276	0245	52 43.0N	1 56.2E	27	276	0249	52 43.0N	1 56.2E	27	
741	ABA	88	276	0602	52 41.4N	2 25.0E	52	276	0613	52 41.9N	2 24.8E	52	no salinity sample
742	ACB	88	276	1159	52 39.9N	2 50.1E	45	276	1210	52 39.7N	2 50.1E	45	no salinity sample
743	ADB	88	276	1414	52 37.8N	3 15.0E	34	276	1423	52 37.7N	3 14.9E	33	no salinity sample
744	AEB	88	276	1753	52 37.2N	3 45.7E	30	276	1802	52 37.4N	3 45.8E	29	
745	AFB	88	276	1949	52 37.5N	4 0.7E	27	276	1956	52 37.6N	4 0.9E	28	
746	AGB	88	276	2130	52 37.4N	4 20.3E	22	276	2140	52 37.6N	4 20.5E	22	
747	AHA	88	276	2259	52 34.6N	4 8.9E	24	276	2308	52 34.6N	4 9.1E	27	
748	AIA	88	277	0114	52 27.8N	3 41.5E	28	277	0121	52 27.7N	3 41.4E	28	
749	AJB	88	277	0309	52 21.4N	3 15.9E	34	277	0318	52 21.2N	3 15.8E	35	
750	AKA	88	277	0525	52 15.1N	2 50.2E	40	277	0532	52 15.1N	2 50.2E	40	
751	ALB	88	277	0759	52 10.3N	2 20.1E	51	277	0815	52 10.5N	2 20.2E	49	
752	AMB	88	277	1052	52 5.1N	1 50.0E	29	277	1059	52 5.1N	1 49.9E	29	
753	ANB	88	277	1304	51 46.9N	1 47.1E	26	277	1314	51 46.8N	1 47.0E	26	
754	AOB	88	277	1519	51 30.1N	1 44.9E	37	277	1526	51 30.1N	1 45.0E	38	no chlorophyll samples
755	APB	88	277	1906	51 11.2N	1 34.0E	47	277	1914	51 11.3N	1 34.1E	47	
756	AQA	88	277	2105	51 3.0N	1 50.1E	30	277	2112	51 3.0N	1 49.9E	30	
757	ARB	88	278	0350	51 27.9N	2 40.0E	33	278	0400	51 27.8N	2 40.0E	33	
758	ASD	88	278	0825	51 45.4N	3 0.7E	30	278	0831	51 45.4N	3 0.9E	34	
759	ATA	88	278	1139	51 49.9N	3 22.0E	29	278	1147	51 49.9N	3 22.0E	28	
760	AUA	88	278	1417	52 8.0N	3 30.0E	29	278	1426	52 8.0N	3 30.1E	30	
761	AVB	88	278	1613	52 12.8N	3 51.6E	24	278	1620	52 12.6N	3 51.6E	26	
762	AWB	88	278	1758	52 20.7N	4 0.1E	24	278	1805	52 20.6N	4 0.1E	25	
763	AEA	88	278	2019	52 37.0N	3 45.9E	30	278	2039	52 37.1N	3 45.9E	29	
764	AYA	88	278	2220	52 47.1N	3 37.0E	32	278	2231	52 47.1N	3 37.0E	31	
765	AZA	88	279	0009	53 0.1N	3 26.0E	28	279	0017	53 0.2N	3 26.0E	28	
766	BAB	88	279	0153	53 12.1N	3 16.1E	28	279	0202	53 11.9N	3 16.4E	29	
767	BBD	88	279	0452	53 29.7N	3 0.2E	32	279	0500	53 29.6N	3 0.3E	32	
768	BCB	88	279	1149	53 24.8N	3 27.2E	29	279	1157	53 24.9N	3 27.3E	29	
769	BDB	88	279	1443	53 17.9N	4 0.2E	28	279	1451	53 17.9N	4 0.4E	28	
770	BEB	88	279	1620	53 13.5N	4 19.7E	30	279	1625	53 13.5N	4 19.7E	30	
771	BFB	88	279	1808	53 9.8N	4 36.9E	23	279	1813	53 9.8N	4 36.9E	23	
772	BGB	88	280	0049	53 39.0N	4 50.2E	31	280	0057	53 39.1N	4 50.4E	31	no salinity and nutrients samples
773	BHB	88	280	0305	53 54.9N	4 50.7E	41	280	0312	53 54.9N	4 50.8E	42	
774	BIB	88	280	0536	54 15.1N	4 50.1E	47	280	0546	54 15.2N	4 50.2E	47	no suspended sediment samples
775	BJB	88	280	0829	54 34.9N	4 50.4E	52	280	0836	54 35.0N	4 50.6E	52	
776	DMB	88	283	1250	54 19.8N	0 25.8E	60	283	1303	54 19.7N	0 25.9E	60	
777	EFB	88	283	1913	54 41.0N	0 32.8E	75	283	1921	54 41.1N	0 32.8E	75	
778	EEB	88	283	2218	55 6.0N	0 43.9E	77	283	2228	55 6.1N	0 44.1E	75	
779	CSD	88	284	0346	55 29.8N	0 53.8E	86	284	0400	55 29.8N	0 54.0E	86	no reversing thermometer reading or salinity or suspended sediment samples
780	CSA	88	284	0434	55 29.8N	0 53.7E	87	284	0441	55 29.9N	0 53.9E	87	
781	CTB	88	284	1139	55 30.0N	0 24.0E	74	284	1150	55 30.0N	0 24.0E	75	
782	CUB	88	284	1409	55 29.9N	0 4.1W	76	284	1421	55 29.7N	0 4.0W	76	
783	CVB	88	284	1616	55 30.0N	0 31.7W	70	284	1625	55 29.8N	0 31.7W	70	
784	CWB	88	284	1819	55 30.3N	0 51.9W	93	284	1833	55 30.5N	0 52.0W	90	
785	CXB	88	284	1958	55 30.1N	1 11.9W	89	284	2011	55 30.1N	1 11.9W	88	
786	CYB	88	284	2205	55 30.1N	1 33.0W	31	284	2212	55 30.1N	1 33.0W	32	
787	CZA	88	284	2332	55 19.8N	1 30.0W	41	284	2341	55 19.8N	1 29.9W	42	
788	DAA	88	285	0058	55 9.7N	1 27.0W	36	285	0105	55 9.6N	1 26.9W	38	no suspended sediment samples
789	DBA	88	285	0222	54 59.8N	1 17.8W	44	285	0230	54 59.8N	1 17.8W	45	
790	DCA	88	285	0407	55 0.0N	0 56.9W	85	285	0418	54 59.9N	0 56.7W	84	
791	DDA	88	285	0547	54 59.9N	0 36.0W	71	285	0554	54 59.8N	0 35.8W	71	
792	DEB	88	285	0729	55 0.1N	0 15.0W	91	285	0746	55 0.1N	0 14.9W	92	
793	DFB	88	285	0950	54 52.4N	0 33.0W	63	285	1000	54 52.6N	0 33.0W	62	
794	DGB	88	285	1137	54 44.0N	0 50.8W	56	285	1201	54 44.1N	0 51.0W	56	
795	DHA	88	285	1316	54 39.0N	1 2.7W	28	285	1326	54 39.0N	1 2.6W	28	
796	DIB	88	285	1410	54 39.0N	0 52.8W	48	285	1419	54 39.0N	0 52.6W	47	no chlorophyll or suspended sediment samples
797	DJA	88	285	1539	54 34.9N	0 36.8W	54	285	1546	54 34.7N	0 36.4W	55	
798	DKB	88	285	1656	54 30.8N	0 21.1W	61	285	1703	54 30.7N	0 21.1W	61	
799	DLB	88	285	1915	54 26.1N	0 0.2W	61	285	1923	54 26.2N	0 0.0E	63	
800	DNB	88	286	0537	54 9.6N	0 24.8E	59	286	0546	54 9.4N	0 25.3E	60	
801	DOB	88	286	0757	53 55.0N	0 24.4E	50	286	0804	53 55.0N	0 24.5E	49	
802	DPB	88	286	1031	53 40.4N	0 24.1E	20	286	1036	53 40.4N	0 24.1E	19	
803	DQB	88	286	1226	53 30.2N	0 24.0E	14	286	1231	53 30.3N	0 24.0E	14	
804	DRB	88	286	1353	53 31.1N	0 41.1E	97	286	1403	53 31.2N	0 41.1E	97	
805	DSB	88	286	1628	53 34.3N	1 5.1E	25	286	1634	53 34.0N	1 4.9E	25	no suspended sediment samples
806	EJB	88	286	2007	54 00.1N	1 3.6E	45	286	2015	54 00.3N	1 4.0E	45	
807	EKB	88	286	2328	53 40.2N	0 43.0E	30	286	2335	53 40.2N	0 42.8E	30	
808	ELB	88	287	0307	53 19.7N	0 29.9E	16	287	0312	53 19.7N	0 29.9E	15	
809	EMA	88	287	0422	53 9.8N	0 30.8E	20	287	0428	53 9.4N	0 30.7E	21	
810	ENA	88	287	0458	53 4.9N	0 29.8E	37	287	0503	53 4.6N	0 29.6E	37	
811	EOA	88	287	0728	53 12.7N	0 47.3E	25	287	0734	53 12.6N	0 47.6E	25	
812	EPA	88	287	0917	53 1.0N	1 4.2E	19	287	0925	53 0.8N	1 4.5E	19	
813	EQA	88	287	1049	53 0.9N	1 27.2E	28	287	1055	53 0.7N	1 27.3E	28	no reversing thermometer reading
814	AAA	88	287	1411	52 43.1N	1 55.9E	30	287	1419	52 43.9N	1 55.5E	30	

Station numbers are sequential throughout the North Sea Project. Station codes refer to the site (first two letters) and to the observations there (last letter: A - CTD and water bottles; B - CTD, water bottles and plankton trawl; D - CTD, water bottles, plankton trawl and cores). Unless otherwise stated, samples were obtained near-surface, at mid-depth and near-bottom for nutrients, chlorophyll and suspended sediment, and near-bottom also for salinity. The near-bottom temperature was also recorded by reversing thermometers.

Core Station List

Core Site No.	Date	Time	Latitude °N	Longitude °E	Water Depth m	Tubes Deployed	Obtained	Comments
1	4/10/88	0854	51° 45.37'	3° 0.02'	34	8	4	
		0926	51° 45.37'	2° 59.95'	35	8	4	
		0941	51° 45.42'	2° 59.84'	36	12	6	
		0955	51° 45.40'	2° 59.91'	34	12	8	
2	5/10/88	2300	53° 37.15'	4° 35.72'	30	12	9	
		2326	53° 37.11'	4° 35.78'	30	12	11	
4	10/10/88	0200	55° 29.9'	0° 54.50'	86	12	12	
		0243	55° 29.95'	0° 54.40'	86	9	9	
5	9/10/88	1818	54° 38.98'	0° 31.33'	70	12	12	
	11/10/88	2245	54° 39.16'	0° 30.90'	69	12	12	leg bent on deployment
6	5/10/88	0531	53° 30.89'	2° 58.92'	32	12	12	
		0558	53° 30.82'	2° 59.43'	32	12	9	

Table

Moorings and Bottom Mounted Instruments

Mooring Code	Latitude N	Longitude E	Decca Chain	Red	Green	Purple	Water Depth m	Time/Date recovered	Time/Date laid	Instrument	Height m
A	55° 29.9'	0° 54.1'	2A	A2.37	F30.62	A63.45	86	0655, 10/10/88		POLDOP/#4 acoustics #236c	
	55° 30.34'	0° 54.31'	2A	A2.53	F31.19	A62.82	80		0931, 10/10/88	POLDOP/#2 acoustics #2472c	
	55° 30.50'	0° 53.40'	2A	A2.42	F30.94	A61.64	84	0808, 10/10/88		Thermistor chain #1612 Fluorimeter missing	30 - 80
	55° 30.82'	0° 54.31'	2A	A2.59	F31.64	A61.55	84		0909, 10/10/88	Thermistor chain #1612	30 - 80
C	54° 20.5'	0° 23.7'	2A	A8.53	B45.02	H64.72	61	1410, 09/10/88		POLDOP/#1	
	54° 19.99'	0° 24.22'	2A	A8.60	B45.01	H66.32	61		1444, 09/10/88	POLDOP/#5 acoustics #229c	
	54° 20.1'	0° 23.9'	2A	A8.65	B44.93	H66.16	62	1510, 09/10/88		Thermistor chain #1611	18 - 58
D	53° 30.0'	2° 59.8'	2E	J8.8	D41.3	E69.5	32	0830, 05/10/88		POLDOP/#5	
	53° 29.87'	2° 59.79'	2E	J8.79	D41.30	E69.80	32		0910, 05/10/88	POLDOP/#6 acoustics #237c	
	53° 30.1'	2° 59.9'	2E	J8.9	D41.3	E69.6	32	0900, 05/10/88		Thermistor chain #1608	3 - 28
E	52° 42.9'	2° 25.6'	2E	H11.80	F30.86	H57.86	50	0730, 02/10/88			
	52° 42.2'	2° 26.0'	2E	H11.54	F30.90	H57.40	50		1000, 02/10/88	RCM8 #9353	7
										S4 # 15	20
										S4 # 16	35
										release #2460	
F	52° 36.9'	3° 45.6'	2E	I7.96	D36.86	A61.08	28	1647, 02/10/88			
	52° 36.96'	3° 46.08'	2E	I8.38	D36.60	A60.23	29		2050, 04/10/88	RCM8 #9348	7
										S4 # 15	12
										release #2464	

Cruise Track