LOIS RACS(C)
HUMBER PLUME AND E. COAST
R.R.S. CHALLENGER 119A
CRUISE REPORT

R.J. Uncles
Plymouth Marine Laboratory

R.K. Lowry
British Oceanographic Data Centre

PML Cruise: LOIS RACS-5a

RVS Cruise: CH 119a/95

LOIS RACS(C)
HUMBER PLUME AND EAST COAST
R.R.S. CHALLENGER 119A
CRUISE REPORT

VESSEL: R.R.S. CHALLENGER

PERIOD: 1 JUNE - 12 JUNE 1995

PERSONNEL:

R. Uncles	PML	1-8 June	Senior scientist (1-8 June)
R. Lowry	BODC		Senior scientist (9-12 June)
R. Howland	PML		
J. Stephens	PML		
D. Law	PML		
T. Fileman	PML		
R. Williams	SUDO		
M-L. Lauria	SUDO		
S. Jones	UOL		
C. Columbo	UOL		
M-C. Robinson	UOP		
T. David	UOP	1-8 June	
T. McCormack	UOP	9-12 June	
H. Anderson	RVS		
R. Powell	RVS		

OBJECTIVES:

Project Objectives

1. To quantify hydrodynamical transports and the processes affecting transformations, interactions and fates of particles, biogeochemically important elements and representative contaminants from land sources to the coastal zone.

2. To provide the first integrated environmental database for a UK coastal region covering seasonal cycles and interannual variability and incorporating measurements of the fluxes of materials and rates of biological productivity.

3. To generate new quantitative understanding of estuarine and coastal zone processes controlling the fluxes and reactivities of both natural and anthropogenic materials.

4. To provide integratable models of these processes as building blocks for comprehensive coastal zone system models which will realistically predict the effects of future environmental change.

Cruise Objectives

1. To continue regular monitoring of the LOIS Humber Wash and Humber Tweed Coastal grids.

2. To follow the progression of the ebb-tide plume from the Humber mouth to the coastal waters and obtain ground-truth data for temperature, salinity and turbidity.

3. To obtain flux data for boundary conditions of a LOIS Special Topic Consortium model of the Humber system.

Narrative:

The scientific party joined the ship at Grimsby on 31 May and commenced loading and setting up of equipment.

We sailed Grimsby 0930 on 1 June and steamed through the coastal and most southerly tracks of the LOIS Humber-Wash grid (see event log and Fig. 1). CTD, particle-sizer profiles and benthic grab samples were obtained at way-points of the LOIS track and the LOIS Fluorometer/Transmissometer moorings were recovered (Fig. 1).

Early on 2 June a pre-dawn CTD cast was made to collect water for the productivity experiments. This procedure was followed throughout the cruise. Later, on 2 June and early 3 June, the central part of the LOIS Humber-Wash grid was worked. Standard measurements were made at way-points. We subsequently anchored at a station seawards of the Humber mouth (SG13, Fig. 2) and profiled for currents, salinity, temperature, turbidity and particle sizes over a tidal cycle. The PML interfacial sampler was deployed every two hours. An EMP mooring was laid prior to profiling and recovered after the tidal cycle measurements were completed. These and later measurements are expected to provide input data for modelling studies within the LOIS Special Topic Consortium.

The central-northerly part of the LOIS Humber-Wash track was worked late on 3 June and early 4 June. Standard measurements were made. We moved to another anchor station near the Humber mouth early on 4 June (SG24, Fig. 2). An EMP mooring was laid before, and recovered after the anchor station. Profiling measurements were made throughout the tidal cycle, repeating the

previous anchor station's work at a different position on the boundary of the LOIS Special Topic Consortium's model.

Late on 4 June and early 5 June a part of the central LOIS track was reworked. A pre-dawn CTD cast was made for productivity measurements and several benthic grab samples were obtained. The LOIS Fluorometer-Transmissometer moorings were redeployed the morning of 5 June (Fig. 1). A close-knit track was then worked near the Humber mouth during the afternoon of 5 June (see Fig. 3). Near-surface data on physical variables and nutrients were monitored, covering the track as rapidly as possible in order to illustrate the near-mouth behaviour of the Humber plume during the ebb. Late on 5 June and early 6 June the northern part of the LOIS track was steamed with CTD, particle size and grab profiles being obtained at selected way-points. A CTD/Productivity station was worked.

On 6 June a close-knit grid in the Humber mouth area was surveyed for near-surface physical variables and nutrients (Fig. 3). This track was worked throughout the ebb and will provide useful information on the seaward boundary behaviour for LOIS modelling studies. The survey was to have coincided with NERC CASI overflights which would have supplied information over the many areas of shallow water, ship anchorages and RAF danger zones that could not be sampled by us. Unfortunately, aircraft problems precluded this aspect of the work.

During the late evening and following morning of 6 and 7 June, several benthic grab stations were worked together with the south-central part of the LOIS Humber-Wash track. CTD casts were taken on way points including the pre-dawn cast to collect water for the production experiments.

An anchor station was worked over a tidal cycle on 7 June. The station was located close to the Holderness coast (SG10, Fig. 3) and on a section of the LOIS Special Topic Consortium's model boundary. Currents, salinity, temperature, turbidity and particle sizes were profiled over a tidal cycle and near-surface nutrients were monitored. Strong winds and swell made taking the profile measurements difficult. Unfortunately, the interfacial sampler developed a problem and could not be deployed for the whole cycle.

A final anchor station was worked 8 June. The worsening weather made it necessary to position the station well into the Humber Estuary at a site in the Hawke anchorage (SG23, Fig. 3). Overnight of the 7 and 8 June a gale occurred and we worked ADCP tracks across the Silver Pit (a 100m-deep channel about 20 nautical miles offshore) in order to investigate wind effects on the current regime for LOIS modelling studies.

At 22.00 BST on 8th June Trevor McCormack joined the ship by pilot boat at the anchor station and Reg Uncles and Tony David left the ship. The portable MilliQ system from the Hull LOIS laboratory also arrived on the pilot boat to replace the ailing system in the clean container.

Shortly after the pilot boat transfer we weighed anchor and headed onto the LOIS coastal grid (Fig. 4). The weather had worsened considerably whilst the anchor station was worked and we sailed into a force 8 northerly gale which had whipped up a very strong northerly swell. The only option was to steam slowly northwards into the sea passing through way points C3, C5, C7, C9, C11, C15, C17, C19, C21 and C23.

At 08.00 BST on 10th June the Master gave permission for CTD work to continue. CTD and Lasentech particle sizer profiles were made at stations C25, C26, C27, C24, C23, C22, C21, C20, C19, C18, C17.

On June 11th CTD profiles were taken at C16, C15, C14 and C12. During the day northerly winds strengthened and a large northerly swell developed. Consequently, it was decided to abandon CTD work and steam through a subset of the remaining way points designed to prevent sections beam on to the swell. Way points C11, C10, C7, C4 and C1 were covered in this manner.

During the early hours of June 12th the time gained through working the shortened coastal grid was employed to rework the critical section of the Humber Wash Grid from HW7 to HW9 finishing at Spurn Head to take on the pilot at 12:00. The ship docked at Grimsby at 15:30 and scientific personnel disembarked by 17:00.

Summary

Challenger 119A came close to being a total success. The only objective which was not met was the working of the complete coastal grid due to the weather turning against us during the last few days of the cruise. Even so, 23 of the 35 way points were visited including the critical stations off the Tweed, Tyne and Tees. The full cruise track is shown in Figure 5.

The CTD and underway sensors functioned well throughout the cruise. All data were logged successfully except for approximately an hour following a short total power failure. The only equipment problems encountered were with the MilliQ system in the clean container.

Ship's operations were of the efficient and professional nature one has come to expect on Challenger with excellent support from officers, crew and RVS personnel.

Challenger 119A Event Log

Originators event I.D	Gear Code	Start Time GMT	End Time GMT	Latitude	Longitude	Water Depth	Site/ Station
CTD1	CTD	01/06/95 10:13	01/06/95 10:20	53.5442	0.1589	17.6	HW5
PG001	GPUMP	01/06/95 10:31		53.5434	0.1910	15.7	
CTD2	CTD	01/06/95 11:51	01/06/95 11:57	53.4907	0.3997	13.4	HW7
LT1	LPSP	01/06/95 12:01	01/06/95 12:14	53.4941	0.3986	13.4	HW7
BS101	BOTTLE	01/06/95 12:05		53.4934	0.3984	13.1	HW7
DG1	DGRAB	01/06/95 12:18		53.4970	0.3976	14.0	HW7
CTD3	CTD	01/06/95 14:05	01/06/95 14:12	53.3229	0.4115	14.9	HW9
LT2	LPSP	01/06/95 14:15	01/06/95 14:29	53.3252	0.4102	14.5	HW9
BS102	BOTTLE	01/06/95 14:16		53.3248	0.4113	14.6	HW9
DG2	DGRAB	01/06/95 14:31		53.3259	0.4094	14.2	HW9
PG002	GPUMP	01/06/95 17:27		53.2470	0.6488	25.2	
CTD4	CTD	01/06/95 18:15	01/06/95 18:27	53.2547	0.6621	30.1	HW12
BS103	BOTTLE	01/06/95 18:17		53.2563	0.6623	29.4	HW12
LT3	LPSP	01/06/95 18:26	01/06/95 18:40	53.2508	0.6604	32.7	HW12
DG3	DGRAB	01/06/95 18:37		53.2497	0.6592	33.8	HW12
PG003	GPUMP	01/06/95 18:46		53.2473	0.6595	34.3	HW12
CTD5	CTD	01/06/95 20:46	01/06/95 20:52	53.0007	0.4020	29.8	HW13
BS104	BOTTLE	01/06/95 20:47		53.0005	0.4018	29.9	HW13
LT4	LPSP	01/06/95 20:56	01/06/95 21:09	53.0020	0.4037	29.2	HW13
DG4	DGRAB	01/06/95 21:13		53.0035	0.4046	29.6	HW13
CTD6	CTD	02/06/95 01:06	02/06/95 01:14	52.9988	1.0701	17.2	HW14
BS105	BOTTLE	02/06/95 01:18		52.9995	1.0704	17.1	HW14
LT5	LPSP	02/06/95 01:18	02/06/95 01:32	52.9992	1.0694	16.9	HW14
DG5	DGRAB	02/06/95 01:34		53.0000	1.0690	16.6	HW14
PG004	GPUMP	02/06/95 02:07		53.0700	1.1152	22.7	
CTD7	CTD	02/06/95 02:22	02/06/95 02:30	53.0929	1.1382	20.6	
CTD8	CTD	02/06/95 04:06	02/06/95 04:14	53.2921	1.3469	22.1	HW15
BS106	BOTTLE	02/06/95 04:16		53.2942	1.3449	21.9	HW15
LT6	LPSP	02/06/95 04:27	02/06/95 04:39	53.2976	1.3419	22.3	HW15
DG6	DGRAB	02/06/95 04:41		53.2995	1.3412	22.3	HW15
CTD9	CTD	02/06/95 07:18	02/06/95 07:26	52.8972	1.5229	23.6	HW16
LT7	LPSP	02/06/95 07:29	02/06/95 07:42	52.8918	1.5309	24.8	HW16
PG005	GPUMP	02/06/95 08:45		52.7365	1.7764	19.0	
CTD10	CTD	02/06/95 09:01	02/06/95 09:07	52.7101	1.8159	35.7	HW17
LT8	LPSP	02/06/95 09:10	02/06/95 09:23	52.7013	1.8213	35.5	HW17
CTD11	CTD	02/06/95 11:06	02/06/95 11:22	52.7715	2.2041	46.5	HW18
LT9	LPSP	02/06/95 11:26	02/06/95 11:40	52.7604	2.2113	46.2	HW18
PG006	GPUMP	02/06/95 15:22		53.1989	1.4464	24.4	
PG073	GPUMP	02/06/95 16:00		53.2852	1.3585	22.3	HW15
CTD12	CTD	02/06/95 18:35	02/06/95 18:42	53.6470	0.9687	26.3	HW8
BS107	BOTTLE	02/06/95 18:38		53.6474	0.9686	26.2	HW8
LT10	LPSP	02/06/95 18:45	02/06/95 18:58	53.6433	0.9703	26.3	HW8
PC501	CPUMP	02/06/95 18:50		53.6435	0.9701	26.2	HW8
DG7	DGRAB	02/06/95 19:03		53.6403	0.9718	26.4	HW8

Originators event I.D	Gear Code	Start Time GMT	End Time GMT	Latitude	Longitude	Water Depth	Site/ Station
PC502	CPUMP	02/06/95 20:42		53.3970	0.7922	21.7	HW10
CTD13	CTD	02/06/95 20:46	02/06/95 20:52	53.3948	0.7922	22.6	HW10
BS108	BOTTLE	02/06/95 20:52		53.3944	0.7930	23.4	HW10
LT11	LPSP	02/06/95 20:54	02/06/95 21:07	53.3925	0.7959	23.1	HW10
PG007	GPUMP	02/06/95 20:59		53.3929	0.7953	22.9	
DG8	DGRAB	02/06/95 21:09		53.3909	0.7992	23.0	HW10
CTD14	CTD	02/06/95 22:19	02/06/95 22:23	53.4787	1.0018	22.0	HW11
BS109	BOTTLE	02/06/95 22:23		53.4783	1.0025	22.0	HW11
LT12	LPSP	02/06/95 22:29	02/06/95 22:42	53.4760	1.0076	21.6	HW11
DG9	DGRAB	02/06/95 22:45		53.4749	1.0115	21.6	HW11
CTD15	CTD	03/06/95 00:44	03/06/95 00:53	53.6317	0.8597	26.6	
PG074	GPUMP	03/06/95 02:50		53.4871	0.4145	12.6	HW7
PG008	GPUMP	03/06/95 05:17		53.5880	0.2323	17.8	SG13
BS110	BOTTLE	03/06/95 05:45		53.5861	0.2310	17.4	SG13
UCP1	UCP	03/06/95 06:07	03/06/95 06:47	53.5857	0.2318	17.9	SG13
BS111	BOTTLE	03/06/95 06:45		53.5858	0.2319	18.1	SG13
LT13	LPSP	03/06/95 06:50	03/06/95 07:04	53.5860	0.2321	18.2	SG13
IS1	IFSAMP	03/06/95 07:08	03/06/95 07:15	53.5861	0.2318	18.4	SG13
UCP2	UCP	03/06/95 07:11	03/06/95 07:24	53.5861	0.2316	18.4	SG13
UCP3	UCP	03/06/95 07:38	03/06/95 07:58	53.5860	0.2323	18.5	SG13
BS112	BOTTLE	03/06/95 07:47		53.5865	0.2320	18.5	SG13
LT14	LPSP	03/06/95 08:00	03/06/95 08:14	53.5860	0.2323	18.4	SG13
UCP4	UCP	03/06/95 08:17	03/06/95 08:32	53.5860	0.2323	18.4	SG13
UCP5	UCP	03/06/95 08:41	03/06/95 08:59	53.5862	0.2321	18.4	SG13
BS113	BOTTLE	03/06/95 08:47		53.5861	0.2320	18.3	SG13
LT15	LPSP	03/06/95 08:59	03/06/95 09:11	53.5868	0.2315	18.8	SG13
UCP6	UCP	03/06/95 09:12	03/06/95 09:27	53.5868	0.2322	18.5	SG13
IS2	IFSAMP	03/06/95 09:14	03/06/95 09:20	53.5867	0.2322	18.5	SG13
PG075	GPUMP	03/06/95 09:30		53.5868	0.2328	18.3	SG13
UCP7	UCP	03/06/95 09:36	03/06/95 09:51	53.5870	0.2325	18.1	SG13
BS114	BOTTLE	03/06/95 09:50		53.5866	0.2326	18.0	SG13
LT16	LPSP	03/06/95 09:56	03/06/95 10:10	53.5871	0.2323	17.9	SG13
UCP8	UCP	03/06/95 10:11	03/06/95 10:30	53.5871	0.2323	17.7	SG13
UCP9	UCP	03/06/95 10:39	03/06/95 10:54	53.5873	0.2317	17.3	SG13
BS115	BOTTLE	03/06/95 10:50		53.5873	0.2318	17.3	SG13
PG009	GPUMP	03/06/95 10:52		53.5873	0.2319	17.3	SG13
LT17	LPSP	03/06/95 10:56	03/06/95 11:08	53.5872	0.2318	17.1	SG13
UCP10	UCP	03/06/95 11:11	03/06/95 11:24	53.5872	0.2318	16.7	SG13
IS3	IFSAMP	03/06/95 11:14	03/06/95 11:20	53.5873	0.2318	16.7	SG13
PG076	GPUMP	03/06/95 11:15		53.5872	0.2320	16.7	SG13
UCP11	UCP	03/06/95 11:42	03/06/95 11:55	53.5873	0.2318	16.1	SG13
BS116	BOTTLE	03/06/95 11:47		53.5875	0.2318	16.2	SG13
LT18	LPSP	03/06/95 12:00	03/06/95 12:14	53.5870	0.2321	15.8	SG13
UCP12	UCP	03/06/95 12:14	03/06/95 12:27	53.5870	0.2320	15.6	SG13
UCP13	UCP	03/06/95 12:36	03/06/95 12:49	53.5871	0.2321	15.2	SG13
BS117	BOTTLE	03/06/95 12:46		53.5869	0.2326	15.2	SG13
LT19	LPSP	03/06/95 12:56	03/06/95 13:09	53.5873	0.2322	15.0	SG13
UCP14	UCP	03/06/95 13:11	03/06/95 13:23	53.5875	0.2323	14.8	SG13

Originators event I.D	Gear Code	Start Time GMT	End Time GMT	Latitude	Longitude	Water Depth	Site/ Station
IS4	IFSAMP	03/06/95 13:14	03/06/95 13:20	53.5878	0.2323	14.8	SG13
PG077	GPUMP	03/06/95 13:15		53.5878	0.2323	14.9	SG13
UCP15	UCP	03/06/95 13:40	03/06/95 13:52	53.5873	0.2324	14.6	SG13
BS118	BOTTLE	03/06/95 13:50		53.5873	0.2327	14.6	SG13
LT20	LPSP	03/06/95 13:56	03/06/95 14:08	53.5872	0.2322	14.6	SG13
UCP16	UCP	03/06/95 14:10	03/06/95 14:22	53.5871	0.2320	14.6	SG13
UCP17	UCP	03/06/95 14:40	03/06/95 14:51	53.5872	0.2320	14.7	SG13
BS119	BOTTLE	03/06/95 14:49		53.5874	0.2321	14.7	SG13
LT21	LPSP	03/06/95 14:56	03/06/95 15:08	53.5872	0.2320	14.8	SG13
UCP18	UCP	03/06/95 15:09	03/06/95 15:25	53.5871	0.2322	14.9	SG13
IS5	IFSAMP	03/06/95 15:14	03/06/95 15:20	53.5871	0.2323	14.9	SG13
PG078	GPUMP	03/06/95 15:15		53.5872	0.2326	14.8	SG13
UCP19	UCP	03/06/95 15:40	03/06/95 15:57	53.5871	0.2321	15.2	SG13
BS120	BOTTLE	03/06/95 15:50		53.5872	0.2320	15.2	SG13
LT22	LPSP	03/06/95 15:57	03/06/95 16:12	53.5869	0.2325	15.1	SG13
UCP20	UCP	03/06/95 16:12	03/06/95 16:25	53.5862	0.2314	15.3	SG13
UCP21	UCP	03/06/95 16:43	03/06/95 16:56	53.5857	0.2308	15.8	SG13
PG010	GPUMP	03/06/95 16:47		53.5856	0.2306	16.0	SG13
BS121	BOTTLE	03/06/95 16:48		53.5856	0.2308	16.0	SG13
LT23	LPSP	03/06/95 16:52	03/06/95 17:04	53.5861	0.2309	16.0	SG13
UCP22	UCP	03/06/95 17:09	03/06/95 17:24	53.5858	0.2309	16.3	SG13
IS6	IFSAMP	03/06/95 17:20	03/06/95 17:24	53.5860	0.2311	16.4	SG13
UCP23	UCP	03/06/95 17:42	03/06/95 17:57	53.5862	0.2308	16.9	SG13
BS122	BOTTLE	03/06/95 17:50		53.5863	0.2312	17.0	SG13
LT24	LPSP	03/06/95 17:58	03/06/95 18:11	53.5860	0.2311	17.2	SG13
UCP24	UCP	03/06/95 18:08	03/06/95 18:26	53.5860	0.2310	17.3	SG13
DG10	DGRAB	03/06/95 18:35		53.5860	0.2314	17.4	SG13
UCP25	UCP	03/06/95 18:39	03/06/95 18:55	53.5858	0.2315	17.6	SG13
BS123	BOTTLE	03/06/95 18:45		53.5855	0.2318	17.5	SG13
LT25	LPSP	03/06/95 18:59	03/06/95 19:13	53.5859	0.2310	18.0	SG13
UCP26	UCP	03/06/95 19:05	03/06/95 19:18	53.5860	0.2312	18.1	SG13
IS7	IFSAMP	03/06/95 19:14	03/06/95 19:20	53.5859	0.2317	18.0	SG13
CTD16	CTD	03/06/95 22:45	03/06/95 22:51	53.7649	0.8318	31.9	HW6
CTD17	CTD	04/06/95 00:02	04/06/95 00:10	53.8828	0.6924	42.5	HW4
CTD18	CTD	04/06/95 02:02	04/06/95 02:11	53.7599	0.3137	23.5	
PG011	GPUMP	04/06/95 02:47		53.7276	0.1685	17.3	
CTD19	CTD	04/06/95 02:55	04/06/95 03:02	53.7261	0.1537	16.7	HW3
LT26	LPSP	04/06/95 05:35	04/06/95 05:47	53.5346	0.2548	13.0	SG24
UCP27	UCP	04/06/95 05:35	04/06/95 05:48	53.5346	0.2547	13.0	SG24
IS8	IFSAMP	04/06/95 05:50	04/06/95 05:55	53.5346	0.2545	13.2	SG24
UCP28	UCP	04/06/95 06:09	04/06/95 06:21	53.5347	0.2545	13.5	SG24
LT27	LPSP	04/06/95 06:33	04/06/95 06:45	53.5347	0.2543	13.9	SG24
UCP29	UCP	04/06/95 06:40	04/06/95 06:52	53.5346	0.2541	14.0	SG24
UCP30	UCP	04/06/95 07:10	04/06/95 07:22	53.5350	0.2542	14.4	SG24
LT28	LPSP	04/06/95 07:26	04/06/95 07:37	53.5348	0.2541	14.6	SG24
UCP31	UCP	04/06/95 07:39	04/06/95 07:50	53.5348	0.2543	14.6	SG24
IS9	IFSAMP	04/06/95 07:40	04/06/95 07:44	53.5349	0.2542	14.6	SG24
UCP32	UCP	04/06/95 08:10	04/06/95 08:20	53.5346	0.2544	14.8	SG24
LT29	LPSP	04/06/95 08:29	04/06/95 08:38	53.5348	0.2540	14.9	SG24
UCP33	UCP	04/06/95 08:42	04/06/95 08:54	53.5346	0.2544	14.9	SG24

Originators event I.D	Gear Code	Start Time GMT	End Time GMT	Latitude	Longitude	Water Depth	Site/ Station
PG012	GPUMP	04/06/95 08:57		53.5344	0.2547	14.9	SG24
UCP34	UCP	04/06/95 09:11	04/06/95 09:22	53.5347	0.2545	14.8	SG24
LT30	LPSP	04/06/95 09:26	04/06/95 09:38	53.5350	0.2545	14.7	SG24
UCP35	UCP	04/06/95 09:39	04/06/95 09:52	53.5346	0.2552	14.6	SG24
IS10	IFSAMP	04/06/95 09:41	04/06/95 09:45	53.5348	0.2551	14.6	SG24
UCP36	UCP	04/06/95 10:11	04/06/95 10:23	53.5352	0.2550	14.2	SG24
LT31	LPSP	04/06/95 10:28	04/06/95 10:42	53.5349	0.2552	13.8	SG24
UCP37	UCP	04/06/95 10:49	04/06/95 11:06	53.5352	0.2552	13.4	SG24
UCP38	UCP	04/06/95 11:13	04/06/95 11:26	53.5355	0.2554	13.2	SG24
LT32	LPSP	04/06/95 11:28	04/06/95 11:41	53.5351	0.2558	13.1	SG24
UCP39	UCP	04/06/95 11:38	04/06/95 11:51	53.5352	0.2560	13.1	SG24
IS11	IFSAMP	04/06/95 11:45	04/06/95 11:50	53.5350	0.2561	13.0	SG24
UCP40	UCP	04/06/95 12:12	04/06/95 12:24	53.5351	0.2564	12.6	SG24
LT33	LPSP	04/06/95 12:30	04/06/95 12:42	53.5352	0.2556	12.3	SG24
UCP41	UCP	04/06/95 12:50	04/06/95 13:05	53.5353	0.2557	11.9	SG24
UCP42	UCP	04/06/95 13:21	04/06/95 13:31	53.5354	0.2559	11.5	SG24
LT34	LPSP	04/06/95 13:26	04/06/95 13:40	53.5351	0.2557	11.5	SG24
IS12	IFSAMP	04/06/95 13:45	04/06/95 13:52	53.5353	0.2555	11.3	SG24
UCP43	UCP	04/06/95 13:46	04/06/95 13:57	53.5352	0.2555	11.2	SG24
UCP44	UCP	04/06/95 14:13	04/06/95 14:25	53.5353	0.2560	11.0	SG24
LT35	LPSP	04/06/95 14:28	04/06/95 14:42	53.5352	0.2556	10.7	SG24
UCP45	UCP	04/06/95 14:44	04/06/95 14:54	53.5355	0.2552	10.3	SG24
UCP46	UCP	04/06/95 15:13	04/06/95 15:22	53.5354	0.2553	10.3	SG24
LT36	LPSP	04/06/95 15:27	04/06/95 15:40	53.5352	0.2554	10.4	SG24
PG013	GPUMP	04/06/95 15:38		53.5352	0.2551	10.4	SG24
IS13	IFSAMP	04/06/95 15:45	04/06/95 15:52	53.5352	0.2552	10.5	SG24
UCP47	UCP	04/06/95 15:49	04/06/95 16:01	53.5354	0.2551	10.5	SG24
UCP48	UCP	04/06/95 16:13	04/06/95 16:23	53.5347	0.2559	11.0	SG24
LT37	LPSP	04/06/95 16:29	04/06/95 16:40	53.5346	0.2555	11.3	SG24
UCP49	UCP	04/06/95 16:38	04/06/95 16:48	53.5349	0.2559	11.4	SG24
UCP50	UCP	04/06/95 17:08	04/06/95 17:18	53.5346	0.2553	11.8	SG24
LT38	LPSP	04/06/95 17:31	04/06/95 17:45	53.5343	0.2548	12.2	SG24
UCP51	UCP	04/06/95 17:43	04/06/95 17:53	53.5345	0.2548	12.3	SG24
UCP52	UCP	04/06/95 18:12	04/06/95 18:22	53.5346	0.2548	12.7	SG24
LT39	LPSP	04/06/95 18:21	04/06/95 18:31	53.5343	0.2544	12.9	SG24
UCP53	UCP	04/06/95 18:34	04/06/95 18:47	53.5346	0.2545	13.2	SG24
BS124	BOTTLE	04/06/95 21:26		53.4440	0.6055	22.6	HW5C
DG11	DGRAB	04/06/95 21:30		53.4429	0.6071	21.8	HW5C
BS125	BOTTLE	04/06/95 22:22		53.3526	0.5668	18.1	HW9A
DG12	DGRAB	04/06/95 22:22		53.3526	0.5668	18.1	HW9A
PG014	GPUMP	05/06/95 01:58		53.3068	0.7018	32.7	
CTD20	CTD	05/06/95 02:07	05/06/95 02:12	53.3143	0.7020	33.9	
BS126	BOTTLE	05/06/95 03:32		53.3362	0.9789	24.7	HW10A
DG13	DGRAB	05/06/95 03:33		53.3364	0.9787	24.6	HW10A
DG14	DGRAB	05/06/95 04:30		53.3328	1.1523	30.0	HW10B
BS127	BOTTLE	05/06/95 04:32		53.3326	1.1521	30.4	HW10B
PG015	GPUMP	05/06/95 09:25		53.3263	0.4276	19.1	
PC503	CPUMP	05/06/95 09:35		53.3217	0.4140	19.4	HW9
CTD21	CTD	05/06/95 09:36	05/06/95 09:41	53.3204	0.4146	19.6	HW9

Originators event I.D	Gear Code	Start Time GMT	End Time GMT	Latitude	Longitude	Water Depth	Site/ Station
PC504	CPUMP	05/06/95 11:05		53.4756	0.4045	16.2	HW7
CTD22	CTD	05/06/95 11:17	05/06/95 11:22	53.4830	0.4003	16.2	HW7
PG016	GPUMP	05/06/95 14:25		53.6484	0.1873	15.4	
PG017	GPUMP	05/06/95 19:38		53.6368	0.5217	19.9	
CTD23	CTD	05/06/95 21:05	05/06/95 21:13	53.7621	0.8317	30.7	HW6
PC505	CPUMP	05/06/95 21:15		53.7594	0.8331	30.6	HW6
LT40	LPSP	05/06/95 21:16	05/06/95 21:30	53.7567	0.8345	31.9	HW6
PC506	CPUMP	05/06/95 22:45		53.8875	0.6859	46.3	HW4
CTD24	CTD	05/06/95 22:45	05/06/95 22:52	53.8867	0.6865	45.6	HW4
LT41	LPSP	05/06/95 22:56	05/06/95 23:12	53.8821	0.6919	43.7	HW4
CTD25	CTD	06/06/95 00:29	06/06/95 00:40	54.0320	0.5176	51.1	HW2
BS128	BOTTLE	06/06/95 00:30		54.0325	0.5166	51.4	HW2
PC507	CPUMP	06/06/95 00:30		54.0325	0.5166	51.4	HW2
LT42	LPSP	06/06/95 00:43	06/06/95 01:00	54.0329	0.5202	50.8	HW2
DG15	DGRAB	06/06/95 01:03		54.0336	0.5220	50.5	HW2
PG018	GPUMP	06/06/95 01:53		53.9766	0.3385	52.6	
CTD26	CTD	06/06/95 02:05	06/06/95 02:19	53.9660	0.2991	51.6	
PC508	CPUMP	06/06/95 02:10		53.9658	0.2994	50.7	
CTD27	CTD	06/06/95 03:38	06/06/95 03:46	53.8726	0.0164	18.1	HW1
BS129	BOTTLE	06/06/95 03:41		53.8728	0.0162	18.2	HW1
PC509	CPUMP	06/06/95 03:45		53.8724	0.0167	18.0	HW1
LT43	LPSP	06/06/95 03:50	06/06/95 04:03	53.8736	0.0176	18.6	HW1
DG16	DGRAB	06/06/95 04:00		53.8740	0.0181	18.9	HW1
PC510	CPUMP	06/06/95 05:30		53.7263	0.1289	18.4	HW3
CTD28	CTD	06/06/95 05:32	06/06/95 05:40	53.7255	0.1302	18.3	HW3
BS130	BOTTLE	06/06/95 05:33		53.7263	0.1292	18.4	HW3
LT44	LPSP	06/06/95 05:43	06/06/95 05:56	53.7236	0.1347	18.2	HW3
DG17	DGRAB	06/06/95 05:55		53.7226	0.1363	18.2	HW3
PG019	GPUMP	06/06/95 07:08		53.6025	0.2268	19.9	
PC511	CPUMP	06/06/95 08:35		53.5441	0.1513	17.5	HW5
PG051	GPUMP	06/06/95 08:35		53.5441	0.1513	17.5	HW5
PG052	GPUMP	06/06/95 09:30		53.5965	0.2164	20.2	U12
PG020	GPUMP	06/06/95 13:53		53.5242	0.2428	11.8	
BS131	BOTTLE	06/06/95 19:31		53.5434	0.1498	15.4	HW5
DG18	DGRAB	06/06/95 19:33		53.5422	0.1473	15.6	HW5
PG021	GPUMP	06/06/95 19:50		53.5413	0.1868	13.4	
BS132	BOTTLE	06/06/95 20:16		53.5380	0.2691	14.8	
DG19	DGRAB	06/06/95 20:17		53.5380	0.2691	14.8	
BS133	BOTTLE	06/06/95 21:09		53.4937	0.4275	15.6	
DG20	DGRAB	06/06/95 21:09		53.4937	0.4275	15.6	
CTD29	CTD	06/06/95 21:15	06/06/95 21:22	53.4914	0.4283	16.4	HW7
CTD30	CTD	06/06/95 23:09	06/06/95 23:15	53.3205	0.4203	18.1	HW9
CTD31	CTD	07/06/95 01:03	07/06/95 01:11	53.2555	0.6567	25.6	HW12
PC512	CPUMP	07/06/95 01:05		53.2552	0.6561	25.7	HW12
PG022	GPUMP	07/06/95 01:58		53.3810	0.5948	22.6	HW12
UCP54	UCP	07/06/95 05:52	07/06/95 06:05	53.6140	0.1894	14.6	SG10

Originators event I.D	Gear Code	Start Time GMT	End Time GMT	Latitude	Longitude	Water Depth	Site/ Station
LT45	LPSP	07/06/95 06:03	07/06/95 06:17	53.6139	0.1896	14.7	SG10
UCP55	UCP	07/06/95 06:16	07/06/95 06:27	53.6139	0.1894	14.8	SG10
UCP56	UCP	07/06/95 06:48	07/06/95 07:02	53.6137	0.1889	15.2	SG10
LT46	LPSP	07/06/95 07:00	07/06/95 07:14	53.6139	0.1888	15.3	SG10
IS14	IFSAMP	07/06/95 07:15	07/06/95 07:24	53.6140	0.1887	15.4	SG10
UCP57	UCP	07/06/95 07:16	07/06/95 07:29	53.6138	0.1888	15.4	SG10
UCP58	UCP	07/06/95 07:56	07/06/95 08:09	53.6129	0.1890	15.9	SG10
LT47	LPSP	07/06/95 08:00	07/06/95 08:14	53.6130	0.1889	16.0	SG10
UCP59	UCP	07/06/95 08:23	07/06/95 08:40	53.6126	0.1892	16.2	SG10
UCP60	UCP	07/06/95 08:46	07/06/95 09:03	53.6126	0.1890	16.5	SG10
LT48	LPSP	07/06/95 09:00	07/06/95 09:12	53.6123	0.1889	16.7	SG10
UCP61	UCP	07/06/95 09:17	07/06/95 09:30	53.6117	0.1892	17.0	SG10
PG024	GPUMP	07/06/95 09:23		53.6123	0.1890	17.0	SG10
UCP62	UCP	07/06/95 09:45	07/06/95 10:00	53.6102	0.1898	17.5	SG10
LT49	LPSP	07/06/95 10:01	07/06/95 10:15	53.6099	0.1897	17.6	SG10
UCP63	UCP	07/06/95 10:20	07/06/95 10:36	53.6098	0.1896	17.7	SG10
UCP64	UCP	07/06/95 10:52	07/06/95 11:05	53.6098	0.1899	17.8	SG10
LT50	LPSP	07/06/95 11:01	07/06/95 11:14	53.6098	0.1897	17.8	SG10
UCP65	UCP	07/06/95 11:16	07/06/95 11:31	53.6093	0.1898	17.7	SG10
IS15	IFSAMP	07/06/95 11:17	07/06/95 11:25	53.6094	0.1899	17.7	SG10
UCP66	UCP	07/06/95 11:45	07/06/95 12:01	53.6096	0.1898	17.8	SG10
LT51	LPSP	07/06/95 12:00	07/06/95 12:14	53.6094	0.1897	17.6	SG10
UCP67	UCP	07/06/95 12:16	07/06/95 12:31	53.6092	0.1899	17.4	SG10
UCP68	UCP	07/06/95 12:47	07/06/95 13:00	53.6093	0.1897	17.3	SG10
LT52	LPSP	07/06/95 13:01	07/06/95 13:14	53.6092	0.1897	17.1	SG10
UCP69	UCP	07/06/95 13:16	07/06/95 13:29	53.6097	0.1902	17.0	SG10
UCP70	UCP	07/06/95 13:47	07/06/95 14:00	53.6102	0.1903	16.5	SG10
LT53	LPSP	07/06/95 14:03	07/06/95 14:15	53.6109	0.1892	16.4	SG10
UCP71	UCP	07/06/95 14:16	07/06/95 14:42	53.6109	0.1887	16.2	SG10
UCP72	UCP	07/06/95 14:50	07/06/95 15:06	53.6111	0.1880	15.7	SG10
LT54	LPSP	07/06/95 15:01	07/06/95 15:14	53.6110	0.1879	15.5	SG10
UCP73	UCP	07/06/95 15:22	07/06/95 15:35	53.6109	0.1881	15.3	SG10
UCP74	UCP	07/06/95 15:47	07/06/95 16:00	53.6109	0.1881	15.0	SG10
LT55	LPSP	07/06/95 16:00	07/06/95 16:16	53.6109	0.1880	14.8	SG10
UCP75	UCP	07/06/95 16:15	07/06/95 16:27	53.6110	0.1881	14.7	SG10
UCP76	UCP	07/06/95 16:45	07/06/95 16:55	53.6107	0.1877	14.5	SG10
LT56	LPSP	07/06/95 17:01	07/06/95 17:15	53.6109	0.1882	14.4	SG10
UCP77	UCP	07/06/95 17:16	07/06/95 17:27	53.6111	0.1881	14.4	SG10
UCP78	UCP	07/06/95 17:47	07/06/95 18:01	53.6106	0.1889	14.3	SG10
PG025	GPUMP	07/06/95 17:55		53.6105	0.1891	14.5	SG10
LT57	LPSP	07/06/95 18:02	07/06/95 18:16	53.6103	0.1885	14.2	SG10
UCP79	UCP	07/06/95 18:15	07/06/95 18:28	53.6099	0.1887	14.3	SG10
UCP80	UCP	07/06/95 18:44	07/06/95 18:55	53.6098	0.1893	14.4	SG10
LT58	LPSP	07/06/95 19:02	07/06/95 19:16	53.6098	0.1893	14.6	SG10
PG026	GPUMP	08/06/95 01:59		53.5160	0.6710	96.0	
CTD32	CTD	08/06/95 02:18	08/06/95 02:45	53.5210	0.6853	101.2	
LT59	LPSP	08/06/95 07:10	08/06/95 07:21	53.5950	0.0361	9.1	SG23
UCP81	UCP	08/06/95 07:19	08/06/95 07:30	53.5950	0.0363	9.2	SG23
UCP82	UCP	08/06/95 07:46	08/06/95 07:53	53.5951	0.0358	9.5	SG23
LT60	LPSP	08/06/95 08:01	08/06/95 08:14	53.5949	0.0361	9.6	SG23
UCP83	UCP	08/06/95 08:15	08/06/95 08:23	53.5948	0.0356	9.8	SG23

Originators event I.D	Gear Code	Start Time GMT	End Time GMT	Latitude	Longitude	Water Depth	Site/ Station
UCP84	UCP	08/06/95 08:46	08/06/95 08:54	53.5953	0.0361	9.9	SG23
BS134	BOTTLE	08/06/95 08:50		53.5953	0.0358	10.0	SG23
LT61	LPSP	08/06/95 08:59	08/06/95 09:16	53.5955	0.0356	10.2	SG23
UCP85	UCP	08/06/95 09:16	08/06/95 09:23	53.5953	0.0353	10.4	SG23
UCP86	UCP	08/06/95 09:48	08/06/95 09:58	53.5952	0.0338	11.0	SG23
BS135	BOTTLE	08/06/95 09:50		53.5950	0.0344	10.8	SG23
LT62	LPSP	08/06/95 10:00	08/06/95 10:15	53.5953	0.0330	11.2	SG23
UCP87	UCP	08/06/95 10:15	08/06/95 10:23	53.5955	0.0336	11.2	SG23
BS136	BOTTLE	08/06/95 10:50		53.5950	0.0340	11.5	SG23
UCP88	UCP	08/06/95 10:51	08/06/95 11:02	53.5946	0.0341	11.6	SG23
LT63	LPSP	08/06/95 11:01	08/06/95 11:21	53.5953	0.0339	11.8	SG23
UCP89	UCP	08/06/95 11:15	08/06/95 11:25	53.5959	0.0340	11.8	SG23
UCP90	UCP	08/06/95 11:46	08/06/95 11:56	53.5960	0.0340	12.0	SG23
BS137	BOTTLE	08/06/95 11:55		53.5958	0.0345	12.0	SG23
LT64	LPSP	08/06/95 12:00	08/06/95 12:15	53.5957	0.0346	12.0	SG23
UCP91	UCP	08/06/95 12:17	08/06/95 12:26	53.5955	0.0351	12.0	SG23
BS138	BOTTLE	08/06/95 12:46		53.5953	0.0360	12.3	SG23
UCP92	UCP	08/06/95 12:48	08/06/95 12:54	53.5949	0.0356	12.3	SG23
LT65	LPSP	08/06/95 12:58	08/06/95 13:14	53.5950	0.0359	12.1	SG23
UCP93	UCP	08/06/95 13:16	08/06/95 13:25	53.5949	0.0358	12.1	SG23
UCP94	UCP	08/06/95 13:45	08/06/95 13:55	53.5949	0.0361	12.0	SG23
LT66	LPSP	08/06/95 13:58	08/06/95 14:13	53.5950	0.0359	11.9	SG23
BS139	BOTTLE	08/06/95 14:15		53.5950	0.0359	11.8	SG23
UCP95	UCP	08/06/95 14:16	08/06/95 14:26	53.5950	0.0360	11.8	SG23
UCP96	UCP	08/06/95 14:45	08/06/95 14:57	53.5949	0.0359	11.4	SG23
LT67	LPSP	08/06/95 15:01	08/06/95 15:16	53.5950	0.0360	11.1	SG23
UCP97	UCP	08/06/95 15:17	08/06/95 15:27	53.5949	0.0359	11.0	SG23
PG027	GPUMP	08/06/95 15:30		53.5948	0.0360	10.8	SG23
BS140	BOTTLE	08/06/95 15:35		53.5947	0.0362	10.8	SG23
UCP98	UCP	08/06/95 15:45	08/06/95 15:53	53.5947	0.0360	10.6	SG23
LT68	LPSP	08/06/95 16:02	08/06/95 16:15	53.5949	0.0361	10.2	SG23
UCP99	UCP	08/06/95 16:14	08/06/95 16:22	53.5948	0.0361	10.1	SG23
UCP100	UCP	08/06/95 16:45	08/06/95 16:52	53.5947	0.0362	9.6	SG23
BS141	BOTTLE	08/06/95 16:53		53.5948	0.0362	9.6	SG23
LT69	LPSP	08/06/95 17:02	08/06/95 17:15	53.5948	0.0360	9.5	SG23
UCP101	UCP	08/06/95 17:15	08/06/95 17:24	53.5949	0.0362	9.3	SG23
UCP102	UCP	08/06/95 17:45	08/06/95 17:56	53.5948	0.0359	9.0	SG23
LT70	LPSP	08/06/95 18:00	08/06/95 18:13	53.5947	0.0362	8.9	SG23
BS142	BOTTLE	08/06/95 18:13		53.5949	0.0362	8.8	SG23
UCP103	UCP	08/06/95 18:15	08/06/95 18:23	53.5944	0.0362	8.7	SG23
UCP104	UCP	08/06/95 18:46	08/06/95 18:52	53.5947	0.0358	8.6	SG23
LT71	LPSP	08/06/95 19:01	08/06/95 19:16	53.5947	0.0361	8.5	SG23
UCP105	UCP	08/06/95 19:16	08/06/95 19:22	53.5945	0.0361	8.6	SG23
BS143	BOTTLE	08/06/95 19:33		53.5948	0.0360	8.5	SG23
UCP106	UCP	08/06/95 19:45	08/06/95 19:51	53.5947	0.0360	8.6	SG23
BS144	BOTTLE	08/06/95 20:53		53.5946	0.0363	9.1	SG23
PG053	GPUMP	09/06/95 05:40		54.1227	0.2341	56.2	C5
PC513	CPUMP	09/06/95 12:00		54.3788	0.0551	63.4	C7
PG054	GPUMP	09/06/95 12:10		54.3859	0.0487	63.9	C7

Originators event I.D	Gear Code	Start Time GMT	End Time GMT	Latitude	Longitude	Water Depth	Site/ Station
PC514	CPUMP	09/06/95 17:35		54.6454	-0.2244	68.8	C9
PG055	GPUMP	09/06/95 17:35		54.6454	-0.2244	68.8	C9
PG056	GPUMP	09/06/95 20:25		54.8058	-0.6157	62.7	C11
PG028	GPUMP	09/06/95 20:30		54.8109	-0.6261	63.3	C11
PC515	CPUMP	09/06/95 20:31		54.8119	-0.6282	63.2	C11
PG057	GPUMP	09/06/95 23:02		54.9482	-0.9155	78.5	C15
PG058	GPUMP	10/06/95 01:03		55.0926	-1.0583	94.4	C17
PG059	GPUMP	10/06/95 02:42		55.2079	-1.0169	89.9	C19
PG060	GPUMP	10/06/95 04:12		55.3419	-1.0595	93.7	C21
PG061	GPUMP	10/06/95 05:44		55.4925	-1.0687	99.7	C23
PC516	CPUMP	10/06/95 07:58		55.7417	-1.2485	70.9	C25
CTD33	CTD	10/06/95 08:06	10/06/95 08:17	55.7456	-1.2514	70.5	C25
LT72	LPSP	10/06/95 08:20	10/06/95 08:36	55.7464	-1.2530	70.6	C25
PG029	GPUMP	10/06/95 08:25		55.7464	-1.2528	70.7	
PC517	CPUMP	10/06/95 10:55		55.7578	-1.9140	31.5	C26
CTD34	CTD	10/06/95 11:08	10/06/95 11:16	55.7594	-1.9330	32.8	C26
LT73	LPSP	10/06/95 11:20	10/06/95 11:35	55.7567	-1.9320	32.1	C26
PC518	CPUMP	10/06/95 13:25		55.9120	-1.5877	66.2	C27
CTD35	CTD	10/06/95 13:33	10/06/95 13:44	55.9143	-1.5806	69.6	C27
LT74	LPSP	10/06/95 13:45	10/06/95 14:02	55.9126	-1.5804	68.5	C27
PG030	GPUMP	10/06/95 16:03		55.5744	-1.5467	42.7	
CTD36	CTD	10/06/95 16:09	10/06/95 16:19	55.5682	-1.5497	38.6	C24
PC519	CPUMP	10/06/95 16:10		55.5677	-1.5491	38.0	C24
LT75	LPSP	10/06/95 16:21	10/06/95 16:34	55.5695	-1.5528	39.5	C24
PC520	CPUMP	10/06/95 18:32		55.4928	-1.0694	99.8	C23
CTD37	CTD	10/06/95 18:34	10/06/95 18:44	55.4938	-1.0700	98.2	C23
LT76	LPSP	10/06/95 18:47	10/06/95 19:07	55.4967	-1.0733	102.9	C23
PC521	CPUMP	10/06/95 20:45		55.3925	-1.4928	43.0	C22
CTD38	CTD	10/06/95 20:47	10/06/95 20:56	55.3922	-1.4934	42.9	C22
LT77	LPSP	10/06/95 21:00	10/06/95 21:15	55.3914	-1.4944	42.8	C22
PC522	CPUMP	10/06/95 22:42		55.3413	-1.0754	98.0	C21
CTD39	CTD	10/06/95 22:45	10/06/95 23:01	55.3397	-1.0644	93.8	C21
LT78	LPSP	10/06/95 23:05	10/06/95 23:24	55.3348	-1.0621	93.0	C21
CTD40	CTD	11/06/95 01:04	11/06/95 01:11	55.2056	-1.4511	44.3	C20
PC523	CPUMP	11/06/95 01:11		55.2044	-1.4511	44.4	C20
LT79	LPSP	11/06/95 01:14	11/06/95 01:29	55.2006	-1.4513	44.3	C20
CTD41	CTD	11/06/95 03:06	11/06/95 03:16	55.2059	-1.0306	91.1	C19
PC524	CPUMP	11/06/95 03:16		55.2056	-1.0302	90.8	C19
LT80	LPSP	11/06/95 03:20	11/06/95 03:33	55.2033	-1.0292	90.6	C19
PC525	CPUMP	11/06/95 05:16		55.0135	-1.3653	24.1	C18
CTD42	CTD	11/06/95 05:16	11/06/95 05:22	55.0136	-1.3655	24.0	C18
LT81	LPSP	11/06/95 05:25	11/06/95 05:42	55.0146	-1.3671	22.6	C18
PC526	CPUMP	11/06/95 06:59		55.0841	-1.0506	87.8	C17
CTD43	CTD	11/06/95 07:02	11/06/95 07:13	55.0855	-1.0518	88.7	C17
LT82	LPSP	11/06/95 07:17	11/06/95 07:33	55.0889	-1.0511	90.9	C17
CTD44	CTD	11/06/95 08:56	11/06/95 09:03	54.9330	-1.3143	22.7	C16
PG031	GPUMP	11/06/95 09:15		54.9350	-1.2742	39.5	

Originators event I.D	Gear Code	Start Time GMT	End Time GMT	Latitude	Longitude	Water Depth	Site/ Station
PC527	CPUMP	11/06/95 09:17		54.9353	-1.2647	41.3	C16
CTD45	CTD	11/06/95 10:33	11/06/95 10:47	54.9460	-0.9198	77.4	C15
PC528	CPUMP	11/06/95 10:40		54.9460	-0.9197	77.5	C15
PC529	CPUMP	11/06/95 12:40		54.6877	-1.1213	27.1	C14
PG032	GPUMP	11/06/95 12:41		54.6875	-1.1214	27.0	C14
CTD46	CTD	11/06/95 12:42	11/06/95 12:48	54.6870	-1.1214	26.4	C14
CTD47	CTD	11/06/95 13:45	11/06/95 13:50	54.6506	-0.9998	36.3	C12
PC530	CPUMP	11/06/95 13:49		54.6505	-0.9997	36.3	C12
PG062	GPUMP	11/06/95 16:15		54.7992	-0.6014	63.8	C11
PC531	CPUMP	11/06/95 16:24		54.7802	-0.6074	63.3	C11
PC532	CPUMP	11/06/95 17:42		54.5773	-0.7348	41.7	C10
PG063	GPUMP	11/06/95 17:45		54.5736	-0.7233	40.3	C10
PC533	CPUMP	11/06/95 22:52		54.0681	-0.0361	25.4	C7
PG033	GPUMP	12/06/95 08:36		53.4263	0.4468	14.1	

Explanation of Gear Codes

BOTTLE	Hand-held water bottle sample
CPUMP	Sample from all-plastic pumped surface water supply
CTD	CTD cast with rosette water bottle sampler
DGRAB	Day Grab sample
GPUMP	Sample from ship's general non-toxic seawater supply
IFSAMP	PML interfacial water sampler deployment
LPSP	Lasentec particle sizer deployment
UCP	DRCM current profile with STD and spm meter

Figures for Main Cruise Report

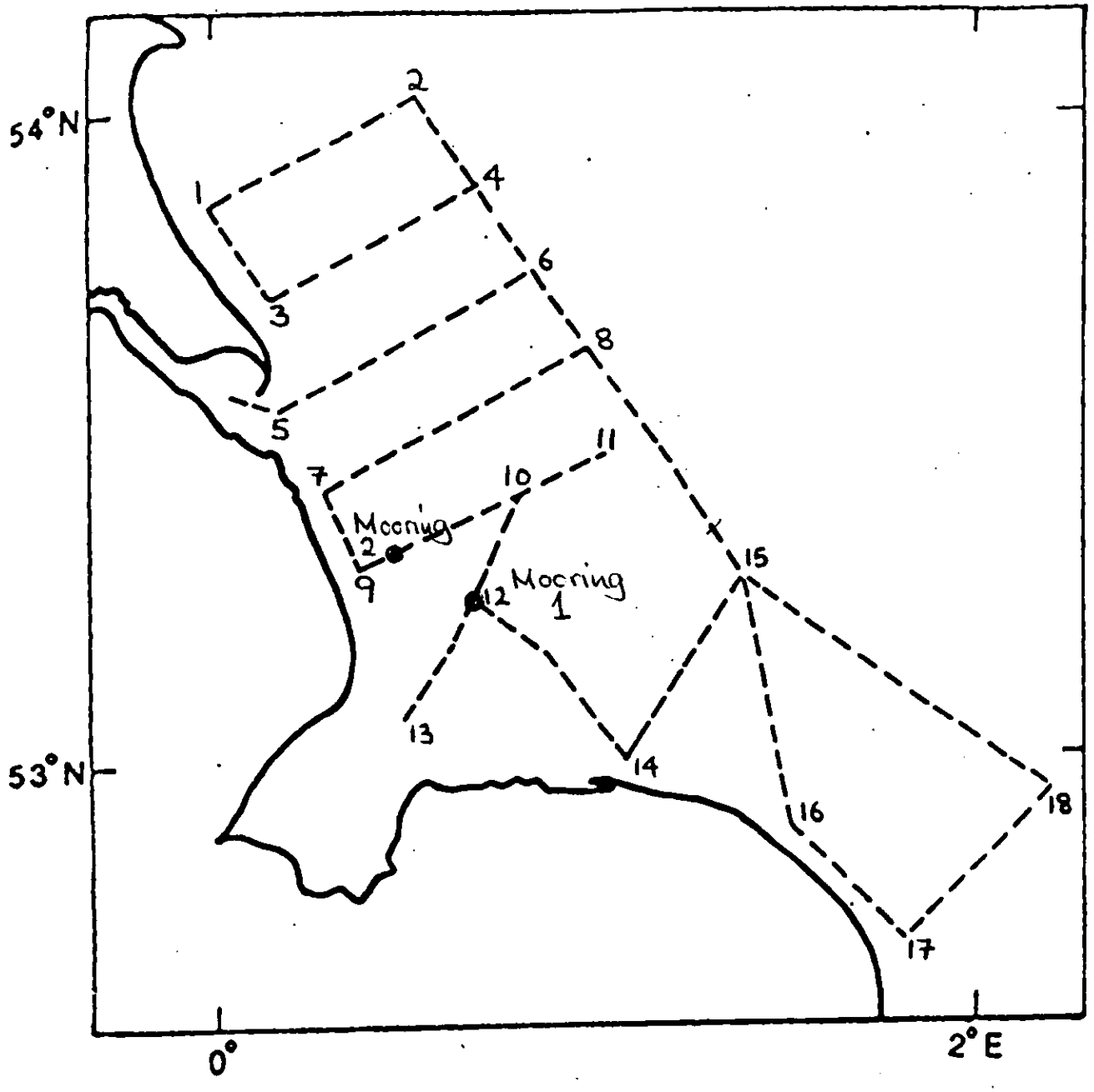
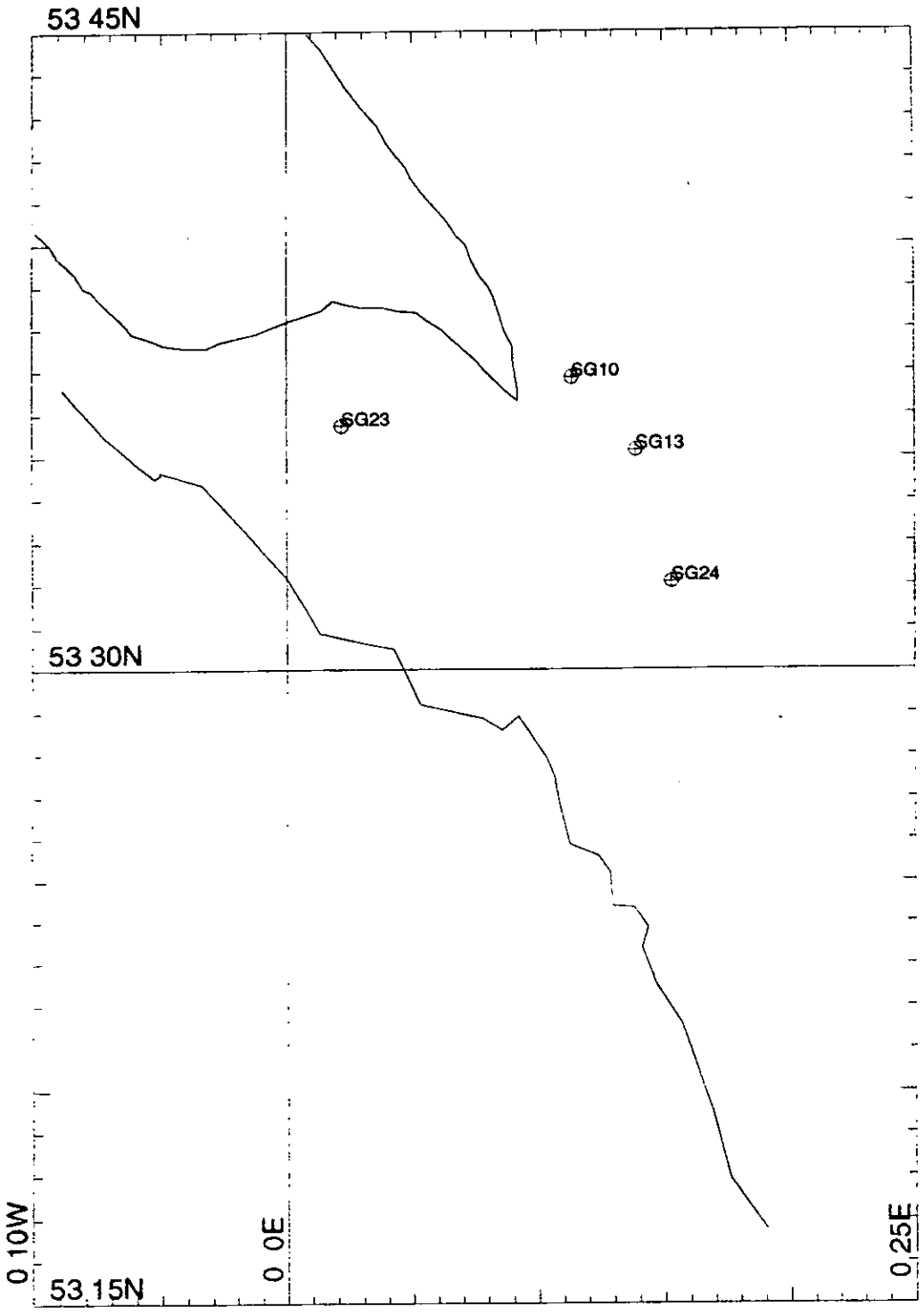


Figure 1. Humber/Wash grid track.

Figure 2.



MERCATOR PROJECTION

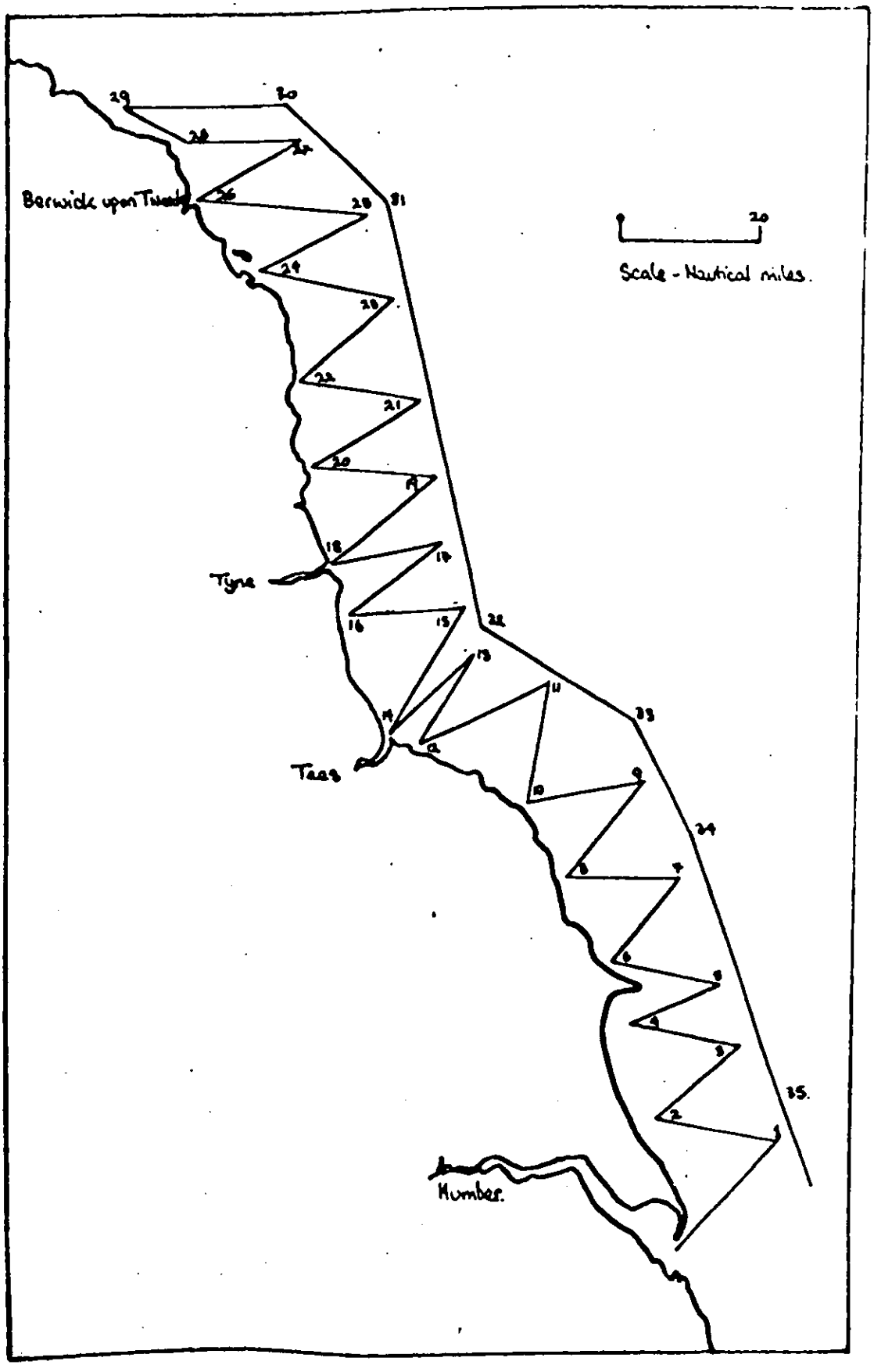
GRID NO. 1

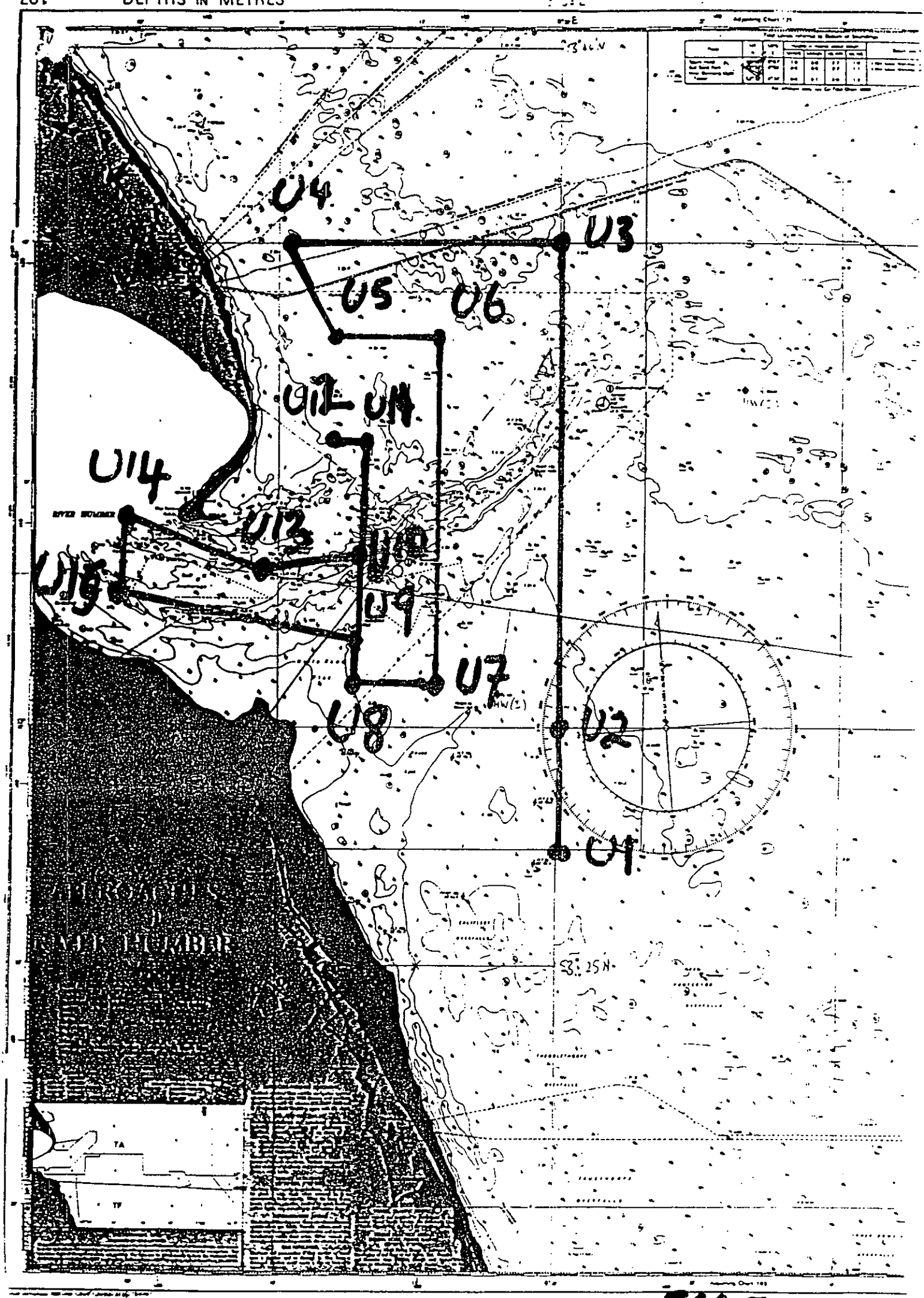
SCALE 1 TO 500000 (NATURAL SCALE AT LAT. 0)

INTERNATIONAL SPHEROID PROJECTED AT LATITUDE 54

Humber Approaches Anchor Stations

Figure 3. North east coastal grid.

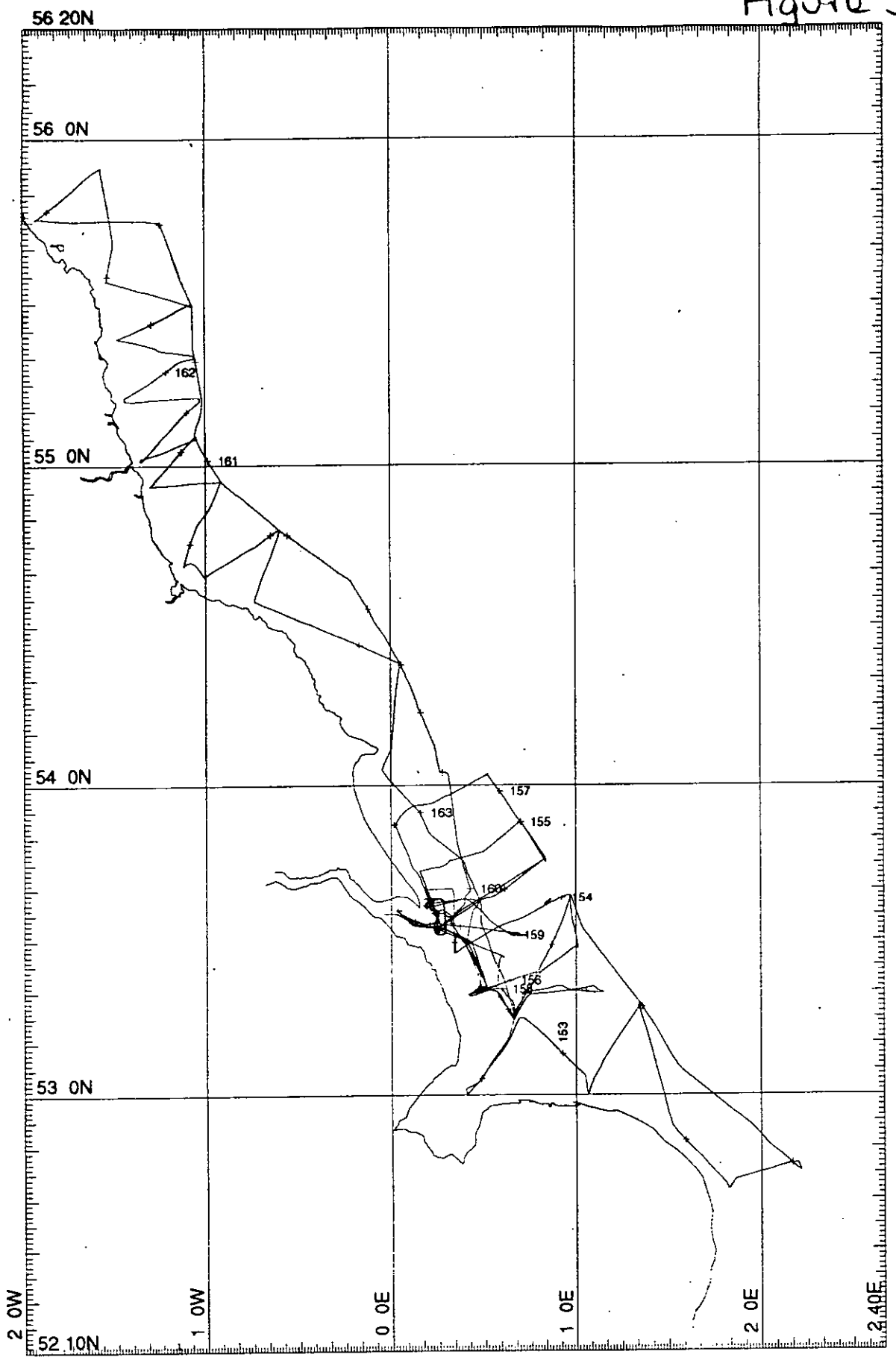



DEPTHS IN METRES
U4
U3
U5
U6
U11
U10
U14
U13
U16
U9
U7
U8
U2
U1
PETROCHEMICALS
RIVER HUMBER

SPARE

Fig 3

Figure 5.



MERCATOR PROJECTION

GRID NO. 1

SCALE 1 TO 1800000 (NATURAL SCALE AT LAT. 54)

INTERNATIONAL SPHEROID PROJECTED AT LATITUDE 54

Challenger 119A Cruise Track

Scaled to fit

Individual Project Reports

In-situ Nutrient Sensor.

Tony David, University of Plymouth.

Objective:

1. To deploy a submersible in-situ flow injection based nutrient sensor (TON) and to compare data obtained with that produced by the on-board auto-analyser.

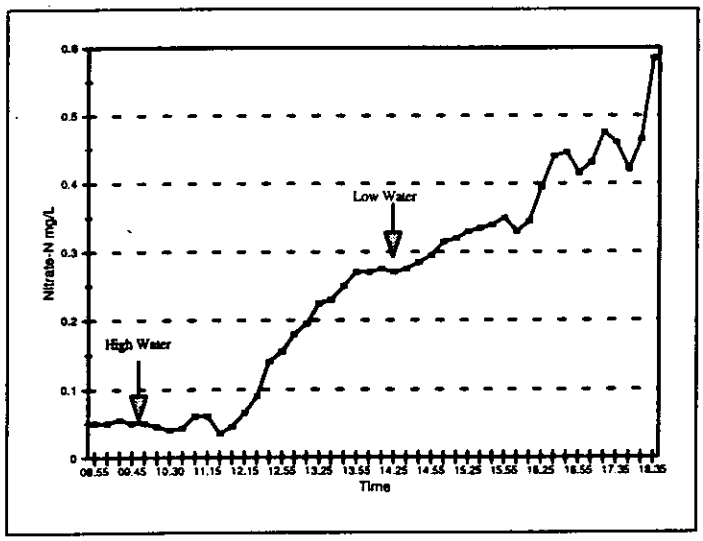
Development of the nutrient sensor was funded by a NERC SIDAL Special Topics Award.

Narrative:

The system was deployed at anchor stations SG13, SG24 and SG10 on 03.06.95, 04.06.95 and 07.06.95 respectively at a depth of 4 metres, i.e. the same depth as the non-toxic supply intake. Each deployment attempted to cover a full tidal cycle; taking TON measurements every 10 to 15 minutes.

Results:

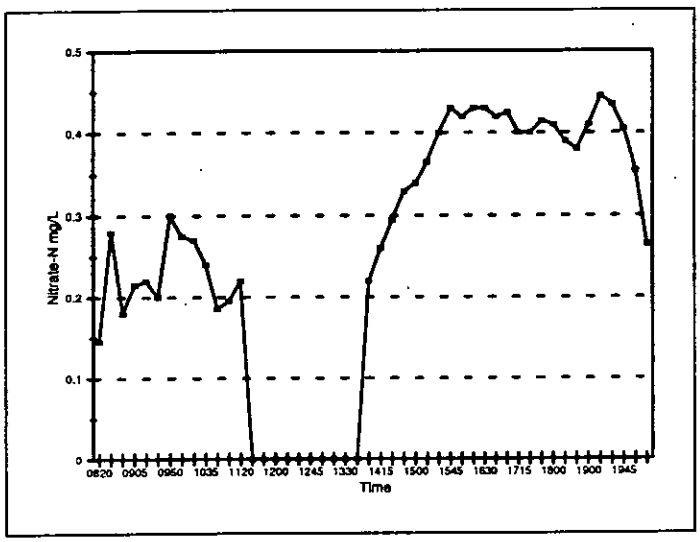
03.06.95. Anchor Station SG13. (High/Low Water 0930/1600hrs BST)
System functioned reliably from power-up at 0700hrs to retrieval at 1900hrs (BST).



Preliminary results of anchor station SG 13.

Anchor Station SG24. 04.06.95. (High/Low Water: 1000/1630hrs BST)

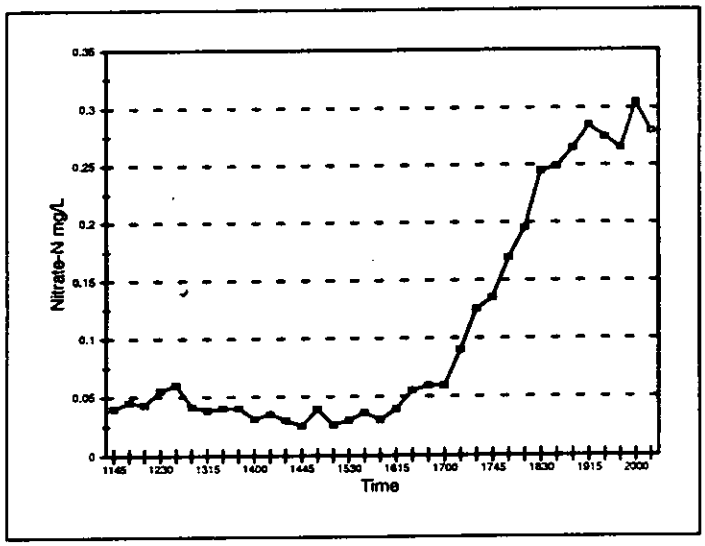
System powered-up at 0640hrs and ran reliably to 1120hrs (BST) when the detector response started to fade. The system was retrieved and the fault was traced to a small connector in the detection circuit. The connector was replaced and system re-deployed at 1355hrs. System was finally retrieved at 2020hrs (BST).



Preliminary results from anchor station SG24.

Anchor Station SG10. 07.06.95 (High/Low Water 1230/1930hrs BST)

After some initial calibration problems caused by contaminated reagents, the system was deployed at 1145hrs and was finally retrieved at 2020hrs (BST).



Preliminary results from anchor station SG10.

Conclusions:

The cruise provided a good opportunity for extended deployments of the nutrient sensor. The results obtained and supporting data from other cruise activities has contributed to a successful conclusion to the project.

Overflight and Profiling Experiment in the Humber ROFI

R. J. Uncles & J. A. Stephens, Plymouth Marine Laboratory.

Objective:
To obtain seaward boundary data for the LOIS Special Topic Consortium by:

(a) following the progression of the ebb-tide plume from the Humber mouth to the Humber ROFI during CASI overflights and obtain ground truth data for temperature, salinity, turbidity and nutrients.

obtain water, salt, sediment and nutrient data for seaward boundaries of the Humber.

Achievements:

Boundary fluxes were obtained using classical anchor station methods whereby profiling of currents, salinity, temperature and turbidity was undertaken at approximately half-hour intervals over a tidal cycle. Four stations were successfully completed (Fig. 2 of main report) despite the difficulties imposed at two stations by strong winds. The three seaward stations exhibited strong currents (>1m/s) and generally low turbidity (<50 mg/l). Near-surface nutrients were monitored throughout.

Conditions were generally well-mixed for salinity and temperature with some slight stratification in turbidity. A preliminary look at the data indicates that the Humber plume 'hugs' the Holderness coast during the ebb and then moves somewhat offshore before returning south on the flood. In the ROFI, turbidity is generally very low (<20 mg/l) outside of the Humber's ebb-tide plume. These data were complemented by those obtained from EMP deployments, suspended particle sizing and precise near-bed sediment concentration determinations.

The overflight experiments could not be undertaken due to problems with the aircraft. However, we obtained useful details of the Humber's ROFI by ship tracking over a close-knit grid near the Humber's mouth (Fig. 3 of main report). Hopefully it will be possible to fly the area with CASI in the near future.

Nutrient and Aluminium Studies

Robb Howland, Plymouth Marine Laboratory

Objectives:

1. Characterisation of the distributions of nutrients (phosphate, silicate, nitrate and nitrite) and aluminium over seasonal, spring-neap and shorter time scales in the LOIS RACS(C) area.

2. To gain an understanding of the processes controlling the fluxes of nutrients from the estuaries to the coastal zone, particularly the Humber.

During the cruise nutrients (phosphate, silicate, nitrate+nitrite and nitrite) were measured over the whole of the Humber/Wash grid and most of the east coast grid. Additionally, detailed flux studies in the Humber mouth region were carried out in conjunction with the physical studies. These centred on four semi-diurnal anchor stations, two at spring and two at neap tides, and a grid of underway stations in close proximity to the Humber mouth. Throughout, the Alpchem auto-analyser was supplied with sample

from the ship's non-toxic supply (sampled from ahead of the vessel at a depth of 4.5 metres) via a continuous filtration block.

In the Humber/Wash region nutrients were almost completely depleted in strong bloom conditions throughout the cruise, except in the areas immediately adjacent to the Humber mouth and station HW 13, in the Wash. The waters of the north east coast grid area were similarly depleted. Even the areas close to the major freshwater inputs (R. Tyne, R. Tees and R. Tweed) showed very small signals, never exceeding 2-3μM for nitrate and silicate and 1μM for phosphate. Concentrations across both grid areas were typically <0.1μM for nitrate and phosphate, <0.01μM for nitrite and <1.0μM for silicate.

Throughout the cruise the analyser worked extremely well. Early in the cruise I spent one afternoon adjusting the chemical manifold layout on the phosphate channel which, on previous cruises had responded sluggishly. The modifications greatly improved the flow characteristics and response time without greatly affecting the sensitivity.

Samples for aluminium analysis were taken at most way points on the Humber/Wash and East coast grids. Where CTD's were carried out, the samples were taken from the surface bottle and on 'steam throughs' the sample was taken from the non-toxic supply. In all, 30 samples were taken and analysed on board using the fluorometric method of Hydes and Liss. Results showed clearly that anthropogenic inputs were dominant with strong signals close to the major freshwater inputs (and inshore generally) decreasing seawards.

Production Studies

Richard Williams and Mary-Lou Lauria
Southampton University, Department of Oceanography.

The aim of this work was to determine factors influencing the uptake of nutrients by phytoplankton in North East coastal regions of the U.K. To this end, sampling and 24 hour on-deck incubation experiments were carried out during the cruise to provide a data base from which principal factors may be identified on completion of analytical work to be conducted on return to Southampton, i.e.

(1) Mapping of nutrients in the Humber/Wash and Humber/Tweed coastal regions: urea, dissolved inorganic phosphorus, dissolved organic phosphorus and particulate total phosphorus.

(2) Determination of primary production using the ^{14}C labelling and *in situ* on-deck incudabtor technique.

(3) Determination of nutrient uptake by phytoplankton in *in situ* on-deck incubators using ^{15}N-labelled urea, nitrate and ammonium, and ^{33}P-labelled orthophosphate.

(4) Assessment of nutrient concentrations (urea, ammonium and P fractions) in samples taken for incubation experiments.

Seven consecutive 24 hour incubations were completed during the cruise, from inshore and offshore sampling stations. The samples used for incubations should provide a variety of suspended material content and nutrient concentrations throughout the area covered by the cruise.

Samples for nutrient analyses were collected from CTD casts or the non-toxic supply from way points on both the Humber/Wash and Humber/Tweed surveys, with several replicates taken for P species.

In addition to this work, underway measurements of dissolved oxygen (DO) were made using an Endeco pulsed oxygen electrode and a Yellow Springs Instruments autonomous oxygen logging probe. Both systems were set to measure DO in the ship's non-toxic supply, the Endeco unit plumbed into the supply and the YSI unit placed in the on-deck flow box.

Remote Sensing

Marie-Claire Robinson, University of Plymouth/Plymouth Marine Laboratory

The Remote Sensing element of the cruise was to have consisted of overflights by the NERC aircraft using the Compact Airborne Spectrographic Imager (CASI), Airborne Thematic Mapper (ATM) and airborne camera. However, no overflights occurred during the cruise due to aircraft problems in the first instance and unfavourable weather thereafter. The aircraft experienced problems with one of its engines on 01/06/95 and became operational on 07/06/95. On 07/06/95 the plane took off from Coventry for the vicinity of the ship but had to withdraw due to new complications with the undercarriage. The plane was serviceable from 08/06/95 but from this time until the end of the cruise the weather remained unfavourable for any work.

This particular work is highly dependent upon the weather conditions, the presence of cloud across the area contaminating the signal received at the CASI. Also, the sea state plays an important part in the achievement of good quality data. Conditions from 08/06/95 until the end of the cruise did not satisfy these requirements.

LOIS Organic Micropollutants Special Topic

Tim Fileman, Plymouth Marine Laboratory

Objective:

To sample selected sites on the Humber/Wash grid for water, suspended particulates and sediment in order to characterise micropollutant geochemistry. Sites, including two tidal anchor stations, were selected in order to provide the best coverage for modelling micropollutant fluxes from the Humber. Levels of a range of critically selected pollutants (PCBs, lindane, atrazine, PAHs, organophosphorous pesticides, pyrethroides and phthalate plasticisers) known to occur in the Humber will be measured together with other parameters, such as marine variables, suspended particulate concentration (SPM), DOC, POC, particulate mineralogy etc.

Method:

Water samples were taken using a hand held sampler (clean glass winchester held in a stainless steel frame with a sprung PTFE stopper) at a depth of about 1 metre. Samples were filtered and extracted on board Challenger. Extraction was performed using a solid phase extraction technique following addition of internal standards. Sub samples of water were also filtered for particulate and dissolved organic carbon (POC and DOC) and suspended particulate gravimetry.

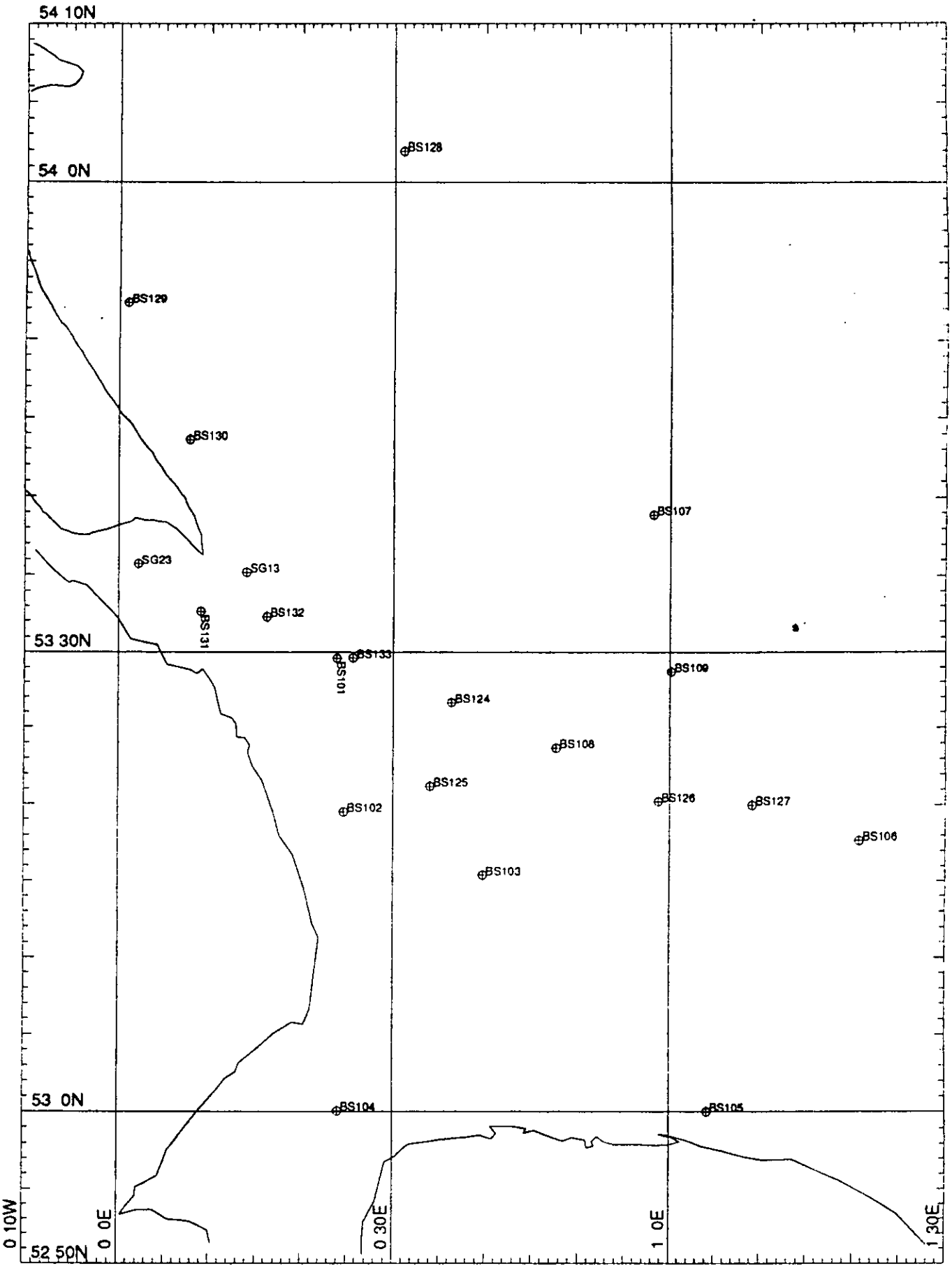
See charts and sample table below for sites sampled and samples taken.

Table 1: Surface Bottle Samples

Sample id	Date/Time	Fixed Station	Determinants	Comments
BS101	01/06/95 12:05	HW7	OMP, DOC, POC, spm	
BS102	01/06/95 14:16	HW9	OMP, DOC, POC, spm	
BS103	01/06/95 18:17	HW12	OMP, DOC, POC, spm	
BS104	01/06/95 20:47	HW13	OMP, DOC, POC, spm	
BS105	02/06/95 01:18	HW14	OMP, DOC, POC, spm	
BS106	02/06/95 04:16	HW15	OMP, DOC, POC, spm	
BS107	02/06/95 18:38	HW8	OMP, DOC, POC, spm	
BS108	02/06/95 20:52	HW10	OMP, DOC, POC, spm	
BS109	02/06/95 22:23	HW11	OMP, DOC, POC, spm	
BS110	03/06/95 05:45	SG13	OMP, DOC, POC, spm	Anchor station
BS111	03/06/95 06:45	SG13	OMP, DOC, POC, spm	Anchor station
BS112	03/06/95 07:47	SG13	OMP, DOC, POC, spm	Anchor station
BS113	03/06/95 08:47	SG13	OMP, DOC, POC, spm	Anchor station
BS114	03/06/95 09:50	SG13	OMP, DOC, POC, spm	Anchor station
BS115	03/06/95 10:50	SG13	OMP, DOC, POC, spm	Anchor station

BS116	03/06/95 11:47	SG13	OMP, DOC, POC, spm	Anchor station
BS117	03/06/95 12:46	SG13	OMP, DOC, POC, spm	Anchor station
BS118	03/06/95 13:50	SG13	OMP, DOC, POC, spm	Anchor station
BS119	03/06/95 14:49	SG13	OMP, DOC, POC, spm	Anchor station
BS120	03/06/95 15:50	SG13	OMP, DOC, POC, spm	Anchor station
BS121	03/06/95 16:48	SG13	OMP, DOC, POC, spm	Anchor station
BS122	03/06/95 17:50	SG13	OMP, DOC, POC, spm	Anchor station
BS123	03/06/95 18:45	SG13	OMP, DOC, POC, spm	Anchor station
BS124	04/06/95 21:26	HW5C	OMP, DOC, POC, spm	
BS125	04/06/95 22:22	HW9A	OMP, DOC, POC, spm	
BS126	05/06/95 03:32	HW10A	OMP, DOC, POC, spm	
BS127	05/06/95 04:32	HW10B	OMP, DOC, POC, spm	
BS128	06/06/95 00:30	HW2	OMP, DOC, POC, spm	
BS129	06/06/95 03:41	HW1	OMP, DOC, POC, spm	
BS130	06/06/95 05:33	HW3	OMP, DOC, POC, spm	
BS131	06/06/95 19:31	HW5	OMP, DOC, POC, spm	
BS132	06/06/95 20:16		OMP, DOC, POC, spm	
BS133	06/06/95 21:09		OMP, DOC, POC, spm	
BS134	08/06/95 08:50	SG23	OMP, DOC, POC, spm	Anchor station
BS135	08/06/95 09:50	SG23	OMP, DOC, POC, spm, Phth	Anchor station
BS136	08/06/95 10:50	SG23	OMP, DOC, POC, spm, Phth	Anchor station
BS137	08/06/95 11:55	SG23	OMP, DOC, POC, spm, Phth	Anchor station
BS138	08/06/95 12:46	SG23	OMP, DOC, POC, spm, Phth	Anchor station
BS139	08/06/95 14:15	SG23	OMP, DOC, POC, spm, Phth	Anchor station
BS140	08/06/95 15:35	SG23	OMP, DOC, POC, spm, Phth	Anchor station
BS141	08/06/95 16:53	SG23	OMP, DOC, POC, spm, Phth	Anchor station
BS142	08/06/95 18:13	SG23	OMP, DOC, POC, spm, Phth	Anchor station
BS143	08/06/95 19:33	SG23	OMP, DOC, POC, spm, Phth	Anchor station
BS144	08/06/95 20:53	SG23	OMP, DOC, POC, spm, Phth	Anchor station

Notes:
OMP - Organic Micropolloutants
DOC - Dissolved Organic Carbon
POC - Particulate Organic Carbon
spm - Suspended Particulate Matter
Phth - Phthalate Plasticisers



MERCATOR PROJECTION

GRID NO. 1

SCALE 1 TO 570000 (NATURAL SCALE AT LAT. 53)

INTERNATIONAL SPHEROID PROJECTED AT LATITUDE 53

Challenger 119A Surface Bottle Stations

Scaled to

Trace Metals.

Simon Jones. University of Liverpool.

Problems with the PES meant that the lower section of the Humber Wash grid was missed, and with the time constraints imposed by tidal cycle monitoring, we were unable to return to this area of interest, however, the rest of the cruise was more successful, the upper part of the Humber Wash grid was extensively surveyed, measuerments being made of total dissolved concentrations of copper, cadmium and nickel and total chromiumVI. Anchor station also allowed me to observe metal fluxes of the same metals.

The Humber Tweed track was continuously measured for total dissolved concentrations of copper and cadmium, and the area off the Tweed was also monitored for chromium VI and chromium III.

Throughout the cruise, discrete samples were taken off our clean supply at grid way-points, for the later analysis of total and total dissolved concentrations of zinc, lead, copper, nickel, chromium, cadmium and cobalt.

Tangential flow samples were taken at two sites to allow a study of particle-dissolved trace metal speciation.

Although the data has only recieved a cursory check, I expect the data to show similar trends to Challenger 118A.

Trace Metals

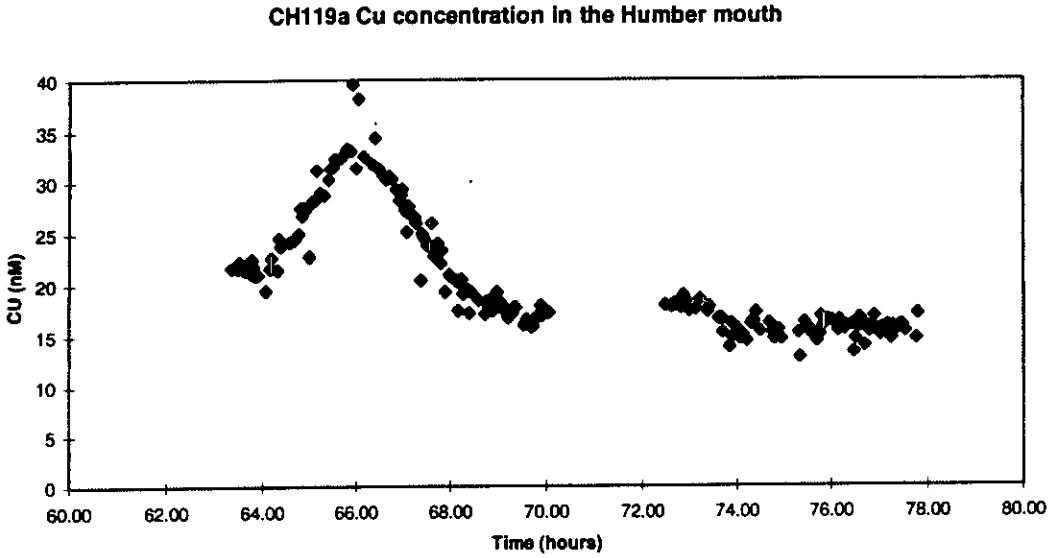
Carlo Colombo, University of Liverpool.

Despite initial problems due to the PES head and few more due to the setting up of my new instrument, I have continuously analysed the total dissolved concentration of copper, using a newer, home made electrochemical system. The system consist principally of a flow cell, that enabled me to perform more accurate measurements.I could therefore test the reproducibility and the functionality of the new cell as well collecting data that can be correlated with the geographical position, and that can be used as a reference map in future cruises.

The data collected so far has shown a good correlation between proximity to the coast and an increase in trace metal levels, especially in the Humber mouth where, due to the particular track (U1-U15) it was possibile to observe an increase in metal concentration entering the plume and a decrease leaving. Further analysis of the data, plotting against geographical location and salinity should reveal more however.

The concentration of copper was lower in the upper part of the Humber-Tweed grid, probably due to the decreasing influence of the Humber.

I can therefore say that the cruise has been successful from my point of view. In the figure below the copper concentration during the U1-U15 track is shown as a function of time.



Shipboard Data Management

Roy Lowry, British Oceanographic Data Centre

Standard event logging procedures were implemented without problem and a set of event log spreadsheets were prepared for each type of sampling equipment employed.

Underway instrumentation generally worked well. The thermosalinograph was cleaned out twice and hence will require calibration in at least three segments. The shipboard ADCP was used on several different settings and hence subsequent processing will require care.

The most important discovery of the cruise was a bug in the software controlling the transfer of the ADCP data from the PC to the Level C. The wrong field is used to specify the bin depths: the pulse length is taken instead of bin depth. Consequently, when handling any previous Challenger ADCP data the ADCP header file MUST be consulted and the bin depths recomputed if required.

In-situ Particle Size Analysis & Interfacial Sampling.

D.J.Law (PML/UCNW)

In-situ particle size analysis:

Deployment of the Lasentec Par-tec 100i laser backscattering system, modified for direct suspended particulate size analysis, was carried out at four anchor stations all stations on the Humber-Wash and eight stations on the Humber-Tweed coastal tracks. Dips followed the same procedure as previous cruises (CH118, 117 & 115) in that measurements were taken in the surface (5m depth or 2m depending on total water depth) and bottom (approximately 3m altitude) waters, from the starboard hydro-wire directly after a CTD cast. During anchor stations this was carried out on an hourly basis.

The recorded size distribution was taken in most cases as the average of ten individual 25 second analyses (cycles), providing a total analysis time of approximately five minutes at each depth. Where particle concentrations were sufficiently high this was reduced to an average of five cycles. Whilst concentrations were relatively low on the coastal grid, statistically valid size distributions, number frequency and volume, were obtained following this method.

No problems were encountered concerning the operation of the Par-tec 100i.

Near bed sampling:

During anchor stations, a rig housing five 5 litre sampling tubes was deployed from the stern 'A' frame on a two hourly basis. The bottles developed at PML, operate on a syringe basis, with the sample being drawn into the tube by the action of a piston, the tube then being closed by a cocked lever. Tubes were set at fixed points above the base of the rig and are only fired if the attitude of the rig is vertical, so allowing measurement of near bed concentration profiles. All bottles are fired simultaneously, after a thirty second delay, by a control unit/camshaft arrangement. Bottle heights were, 0.125m, 0.34m, 0.54m, 1m and 2m above the bed. Once on deck sub samples were taken from each tube for suspended solids load determination by filtering on to preweighed GF/C papers and a sample taken for particle size analysis.

Deployment took place at SG13 and SG24. Later anchor stations were not worked owing to a leak in the control unit, firstly disabling the sea water switch and then leading to total system failure.