

I.O.S.

R R S JOHN MURRAY

CRUISE 5/81 : 1 - 23 MAY 1981
CRUISE 7/81 : 13 - 24 JUNE 1981

NORTH SEA

CRUISE REPORT NO 128
1982

M. I. A. S.
11 JAN 1983
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NATURAL ENVIRONMENT
INSTITUTE OF OCEANOGRAPHIC SCIENCES
RESEARCH COUNCIL

INSTITUTE OF OCEANOGRAPHIC SCIENCES

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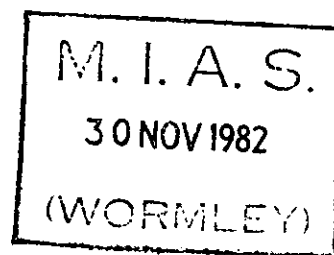
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Institute of Oceanographic Sciences,
Bidston Observatory,
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CONTENTS

	Page
Duration	ii
Scientific Staff	1
Ship's Officers	1
Scientific Objectives	2
Narrative - Deployment and profiling leg	3
Recovery leg	7
Station reports	11
Equipment lost	53
Comments on ship	54
Acknowledgements	54
Abbreviations	54
Appendix 1 : Standing orders for 25 hour current profiling stations	55
Appendix 2 : Loss of CM/TG at Station C	56
Tables	57
Figures	67

Note that all times in this Report are given in GMT. All Decca position coordinates are quoted in order red, green, purple.



DURATION

RRS JOHN MURRAY

5/81 - Deployment and profiling :

Sailed from Barry	0500	1 May 1981
Docked at North Shields	0700	8 May 1981
Sailed from North Shields	1500	8 May 1981
Docked at South Shields	0600	12 May 1981
Sailed from South Shields	1000	13 May 1981
Docked at Immingham	0600	23 May 1981

7/81 - Recovery :

Sailed from Immingham	0800	13 June 1981
Docked at North Shields	0700	18 June 1981
Sailed from North Shields	1400	18 June 1981
Docked at Dundee	1800	24 June 1981

SCIENTIFIC STAFF

Deployment leg

G. Ballard	
D.E. Cartwright	(from 13 - 23 May)
D. Flatt	
P. Foden	(from 1 - 12 May)
J. Huthnance	(from 1 - 8 May)
D.L. Leighton	
R. Palin	
D. Pugh	(Principal Scientist)

Recovery leg

G. Ballard	
A.D. Banaszek	
J. Casson	
A.J. Harrison	(Principal Scientist)
A.G. Kerr	
D.L. Leighton	
R. Palin	

SHIPS OFFICERS

Deployment leg

A.L. Moore	Master
S. Jackson	Chief Officer
P. Oldfield	Second Officer (from 8 - 23 May)
G. Harries	Third Officer
N. Wilson de Rose	Chief Engineer
D. Anderson	Second Engineer
J. Landry	Third Engineer

Recovery leg

M.A. Harding	Master
A.L. Moore	Chief Officer
J.T. Morse	Second Officer
P.G. Pepler	Third Officer
N. Wilson de Rose	Chief Engineer
P.J. Byrne	Second Engineer
J. Landry	Third Engineer

SCIENTIFIC OBJECTIVES

1. An investigation of the slope on the mean sea level surface between Leith and Immingham. Current meters and off-shore pressure gauges were deployed in conjunction with a network of coastal sea level gauges.
2. A study of the tidal energy budget in a shallow coastal region.
3. Measurements of currents around a sandbank to test theories of spring-neap changes in the mean currents.

NARRATIVE - DEPLOYMENT AND PROFILING LEG

RRS John Murray sailed from Barry at 0500 on Friday 1 May 1981 en route to the North Sea experimental area. While sailing through the Bristol Channel, the opportunity was taken to make further attempts to recover a bottom pressure gauge (BC 5) in the vicinity of the Scarweather lightvessel. The PES fish was deployed at 0820 and the CTD pump was in the water from 0845. Transmission to activate the release mechanism was continued on several courses, in good conditions, until 1105, when further attempts were abandoned; no contact was made nor was there any indication that the gauge was still on site.

On Saturday 2 May, in worsening conditions, it was necessary to shelter in Plymouth Sound. Essential repairs were effected to a fractured cooling-water tube in the engine, by RVS personnel from Barry. At 2215 it was possible to leave Plymouth Sound and to resume passage.

Following warnings of imminent gales for the Channel, it was decided to shelter in the East Solent, but as conditions worsened John Murray arranged to berth in Southampton on the evening of 3 May until the weather was safe to proceed. The CTD was switched off and the pump was inboard at 2030.

On Monday 4 May conditions had improved sufficiently to resume passage at 1830. A.L. Moore, formerly Chief Officer, replaced J.J. Moran as Master for the remainder of the cruise. The CTD was not deployed. Acoustic tests were made of six release mechanisms from 1115 on 5 May, in suitably deep water. On completion of these tests, the CTD pump was deployed at 1335.

Before deployment of equipment at Station A, it was necessary to make a bathymetric survey around the Well sandbank to locate a suitable depth and position relative to the ridge. Deployment of the current meter/tide gauge began at 0432 on Wednesday 6 May and was completed by 0455, in moderate to rough seas. A current meter rig was deployed at Station B between 0545 and 0600: it was not possible to activate the acoustics remotely on this rig. Deployment of the current meter/tide gauge at Station C1 began at 0806, but the first deployment was unsatisfactory because the gauge dropped the last few metres to the sea bed. During recovery the frame was accidentally driven hard into the block, which resulted in damage to the rotor vane and the ring support for the bottom current meter assembly. The instrument was opened and checked to be working, before redeployment from 1022 to 1039. CTD profile no. 1 was made here. The current meter rig at Station C2 was laid between 1230 and 1255; the water depth above the anchor was insufficient on the first lowering and so it was necessary to tow to slightly deeper water. Passage was then set for Station D, where we arrived at 2040, and completed the current meter deployment in darkness, at 2109. This was followed by CTD no. 2. During the night passage was made to Station E.

At first light on Thursday 7 May an attempt was made to deploy the current meter rig, but this was abortive because the lines became tangled, and could not be corrected without complete recovery. Both meters had bent spindles, which required repairs. While these were being done, the thermistor chain was deployed at 0721, and the first pop-up bottom pressure gauge (TELEOST) was deployed at 0855. The second deployment of the current meter rig was completed between 1010 and 1023, and this was followed by CTD no. 3. Station F was reached at 1240, and the current meter rig was successfully deployed between 1246 and 1301. This was followed by CTD no. 4.

The current meter rig at Station G was deployed between 1645 and 1702, and followed by CTD no. 5. Ship handling for this deployment was rather difficult because the wind was freshening from the south, and there was a strong south-going tidal current. At Station H the TELEOST bottom pressure gauge was deployed at 1953, and the current meter rig was deployed between 2025 and 2042. This Station, which was followed by CTD no. 6, was completed in darkness. Course was then set for the River Tyne.

On 8 May the CTD pump and tank were brought inboard at 0500. Equipment from Bidston and from Barry was loaded at Tyne Commission Quay, and John Murray sailed again at 1500, with a new Second Officer, but without J.M. Huthnance, whose interest had been in the completed deployments around the Well Bank. Station K was completed between 1830 and 1840 in calm conditions, but with visibility limited to 100m. CTD no. 7 followed.

This poor visibility limited overnight speeds to 6 kts, so that arrival at Station J, the outlying station from the coastal pattern, was delayed until 0730. The TELEOST bottom pressure gauge was deployed at 0745, and the current meter rig was deployed between 0806 and 0821. Some difficulty was experienced in switching off the pinger, which was eventually effected with the rig directly under the ship's bow. CTD no. 8 was followed by a more satisfactory CTD no. 9. The return passage to Station I was slow, because of heavy fog, which cleared by mid-afternoon sufficiently for normal cruising speeds to be resumed. One CTD was made on passage. At I the current meter rig was deployed by 1842 in calm sea conditions, but an initial survey was necessary to find a suitable depth as shown on the chart, and for which the rig had been designed. Acoustic tests on more releases were made between 1915 and 2000, and containers of sea water were filled for return to Bidston.

Overnight passage for Station L enabled a start on deployment at first light on Sunday 10 May. The bottom pressure gauge was deployed at 1516, again in calm conditions. A thermistor chain rig was deployed at 0621, followed by the current meter rig by 0805. CTD no. 12 followed, and passage was then set for Station M, where we arrived at 1200. This station was completed between 1240 and 1300, and was followed by CTD no. 13. At Station N, which was reached at 1618, the depth observed was 12m greater than that shown on the chart, but a survey of the surrounding area failed to show any water of the required depth. Alterations were made to fit additional wire into the rig, and the deployment was completed between 1700 and 1716. CTD no. 14 followed. It was decided to use the night-time for a run

towards the shore tide gauge at Leith, making temperature and salinity measurements.

Work at Station P began early on Monday 11 May, with deployment of the TELEOST bottom pressure rig at 0735. The current meter rig was deployed between 0823 and 0830, again in calm conditions. The final rig deployment, the thermistor chain, was delayed until 1030 because of a failure of power to the A-frame. CTD no. 15 was completed at Station P.

On passage towards the River Tyne, a visual check was made on the surface buoy at Station M. Two passes were made with the EG and G sonar fish, with 150m of line and a 75m total depth, towing 35m above the bottom at 3.5 kts, in an attempt to identify the subsurface features of the rig. This was unsuccessful on both passes, even though the approach was as close as 400m. Nearer approach was avoided because of the danger of snagging the rig with the towed fish. It appears that the EG and G fish acoustic system would not be useful aid when trying to locate rigs whose surface markers have been lost.

In preparation for the current meter profiling which was programmed for the third part of this Cruise, overside tests were made of the proposed system, and depth calibrations were made against the CTD. Overnight passage was then set for the River Tyne, with a detour towards the Seahouses tide gauge to define the density field. The run from Seahouses to the River Tyne was made close inshore (approximately 3 km away) in order to map near-coastal density variability. The CTD pump was inboard at 0515 on Tuesday 12 May, prior to docking at South Shields.

While in South Shields, all scientific equipment which was no longer required for rig deployment was sent back to Bidston, and a new stern winch was fitted to the afterdeck to enable stern anchoring for current profiling stations. This work was completed, and John Murray sailed at 1000 on Wednesday 13 May, D.E. Cartwright having replaced P. Foden. The CTD pump was deployed at 1030, 0.8 nm outside the breakwater, and as close to the Tyne efflux as was possible. Several CTD stations were occupied on passage to Station L, which was reached in the late afternoon. The procedures to be adopted for the stern-anchoring current profiling stations were not yet established, and so a cautious day-time first deployment was undertaken. The CTD was switched off to enable the Aanderaa current meter, used for profiling, to be connected through its conducting cable into a laboratory print-out system. Original ideas of a half-hour measuring cycle were eventually cut back to an hourly cycle of five measurements at each of five depths. For this work a regular scientific watch rota was established.

Profiling Station LA began at 1900 on 13 May and ended at 2000 on Thursday 14 May. During this period there was fog of varying intensity, which made it difficult for the ship's officers on watch. Despite some swell, the mechanics of stern anchoring and of profiling appeared satisfactory - as subsequent analysis of the data confirmed. Details of the profiling schedule are given in an Appendix. While at Station L, the surface floats were sighted in a satisfactory condition.

A series of CTD profiles was made while on passage to Station P, where, despite some uncertainty over the weather stability, the current meter profiling began on Friday 15 May. Station PA continued until 0900 on Saturday 16 May, with tidal streams more rectilinear than those observed at Station LA. Before leaving the Station, surface floats from the rigs were confirmed to be satisfactory. Trouble with the pump control unit for the CTD made a replacement necessary.

Passage towards the third profiling station at H was set by a series of zig-zag lines to enable a more detailed density survey of the waters in the vicinity of the coastal tide gauges. Thick fog made slow progress towards St. Abbs inevitable, and a head sea slowed passage towards Station M. At Station M, the surface Selco buoy was seen in position at 2007. Station K was observed as a flashing light at 0100 on Sunday 17 May. During 17 May the passage was continued with lines from K towards Hartlepool, from Hartlepool towards Station I, from I to Whitby and then to Station H. During the near-shore parts of the run, the CTD was set to sample at 1 minute rather than the normal 3 minute intervals. Surface floats at Stations I and G were observed to be satisfactory. Sea conditions, heavy swell and moderate to high seas, were unsuitable for a profiling station when H was reached at 1730, and so a further CTD survey towards Flamborough Head and back to H via F was made overnight.

During this survey interesting features were seen in the temperature field around Flamborough Head, including a cooler strip (7.9°C) between the open sea (8.3°C) and the warmer water close inshore (9.2°C). At Station F the toroid was found inverted, but was righted using the ship's crane, and the pellet line untangled. A third CTD control unit was fitted to replace the second one, which failed. Profiling Station HA was begun at 1100 on Monday 18 May, but it was necessary to terminate the measurements at 1800 because of heavy seas. It was decided to heave to overnight, and to review conditions in the morning.

At first light on Tuesday 19 May, although the wind had moderated slightly, the swell was too severe to anchor, and a gale warning was out. Rather than wait at Station H, passage was set towards Station E, with careful CTD monitoring across the embryonic Flamborough Head front. The better forecast for this area was correct, and John Murray was able to anchor in slight seas and force 3 winds to begin profiling at 1700. The Station (EA) was completed at 1800 on Wednesday 20 May. The rig buoys were seen to be satisfactory. However, on passage back towards Station H, via D and Withernsea, reports of the light not working on the toroid at D were confirmed. The toroid was located in darkness by careful navigation, and found to be upright and otherwise apparently satisfactory. Repairs to the light were not possible because the afterdeck winch blocked the possibility of toroid recovery, and so the rig was left without a light.

Thick fog again retarded progress towards Station H, but profiling was underway at 1300 on Thursday 21 May. Conditions were excellent for this station (HA), which was completed at 1400 on Friday 22 May. Tests with the EG and G fish to detect the rig at H were again

unproductive. The rig surface floats were sighted as satisfactory. Passage was then set for Immingham via Station D, with hourly CTD profiles. The pump was taken inboard at 0400 on Saturday 23 May, but a series of bucket samples was taken right up to the entrance of Immingham Lock, which was entered at 0545. Equipment was off-loaded and returned to Bidston for servicing before the equipment Recovery Leg.

NARRATIVE - RECOVERY LEG

RRS John Murray sailed from Immingham at 0757 hours on Saturday 13 June to recover 24 moorings which had been previously deployed during cruise 5/81 (see Figure 1, Table 1), and to carry out a CTD and surface water sampling survey in the same area (see Table 2). It was also planned to re-deploy one mooring adjacent to the Haisborough light vessel and to carry out experiments to evaluate the performance of a new surface marker buoy, a side scan sensor to aid rig recovery, and an overside sensor pack for surface water sampling.

With the ship clear of the approaches to Immingham the PDR fish was deployed and a course set for Station D (see Figure 6). This site was eventually occupied at 1325 hours and the rig location on position. CTD profile no. 117 was taken at 1330 hours and the over-side pump rigged to allow surface temperature and conductivity to be sampled every 3 minutes, starting at 1402 hours. Recovery of the mooring commenced at 1355 hours and was successfully completed by 1415 hours although there was evidence of trawler damage to both current meters and to the acoustics unit. The ship left station D and headed for station E, with CTD profile no. 118 taken on route and profile no. 119 taken at 1645 hours when station E was eventually occupied. The pop-up thermistor mooring, (see Figure 11) was located on position at 1848 hours and successfully recovered after operating the release at 1912 hours. The CM mooring, the final rig at this site, was found on position and recovery started from the surface buoy end of the rig at 1922 hours and successfully completed by 2004 hours. There was evidence of trawler damage to the buoy line, and the bottom CM was tangled in the meter wire, (see Figure 9). The ship left station E and headed for station H, taking CTD profile no. 120, 121 and 122 on route and passing through station F.

In the early hours of Sunday 14 June station H was occupied and CTD profile no. 123 taken at 0505 hours before moving to the CM mooring position. The surface marker buoy was grappled at 0523 hours and the rig completely recovered by 0603 hours, the only defect being the bottom CM tangled in the mooring line. The pop-up TG at this station was recovered without difficulty and in good condition at 0633 hours, after which the ship left the station and headed for station G taking CTD cast no. 124 on route at 0745 hours, and arriving at 0906 hours. The CM mooring was located on position and, after carrying out CTD cast no. 125 at 0910 hours, the surface buoy was grappled and the rig recovered without difficulty by 0940 hours, at which time the ship left station G to continue a CTD section to the coast and then to station F, taking CTD cast nos. 126, 127, 128 and 129 at 1025 hours, 1229 hours, 1302 hours and 1444 hours respectively. On arrival at station F CTD cast no. 130 was carried

out at 1630 hours and recovery of the CM mooring, from the surface buoy end of the rig, was successfully completed by 1716 hours.

With the work at station F completed a CTD section was started on a line from station F to Flamborough Head, then northerly along the coast before heading north-easterly to station J via station I (see fig. 7). Between 1850 hours and 1434 hours on 15 June, CTD cast nos. 131 to 141 inclusive were taken along this track, and by 06 - 42 hours the CM mooring at station I had been successfully recovered from the surface buoy end of the rig. At station J the CM mooring was recovered complete by 1515 hours, after grappling the surface buoy marker, and the TG at this site was recovered at 1541 hours without difficulty. The ship left station J at 1543 hours to continue the CTD section to Station A, but after CTD cast no. 142 at 1930 hours the sea became too rough so the CTD profile work had to be suspended until 0805 hours the following morning, 16 June, when the ship arrived at Station A and CTD cast no. 143 was taken. To facilitate passage over the sandbanks in this area the PDR fish was brought inboard and the hull transducer used instead.

The surface marker buoy on the bottom mounted CM/TG mooring at station A was located on position but bad weather delayed the start of the recovery for a time. At 0920 hours it was decided to attempt the recovery so the surface buoy marker was grappled and the rig successfully recovered by 0943 hours. The ship then moved to station B, but on arrival there was no sign of the surface marker buoy or the instrument pellet line so the Gifford grapnel was rigged and dragging started at 1212 hours across the ground line, using the Decca plotter to navigate over the position. At 1445 hours the ground line was caught by the grapnel adjacent to the bottom mounted CM/TG frame. The mooring was recovered at 1452 hours in good condition and showed that the surface buoy line had been cut a few metres above its anchor. CTD cast no. 144 was taken at 1507 hours to complete the work on station B before the vessel manoeuvred over the sand bank to station C to carry out CTD cast no. 145 at 1633 hours. The marker buoy and surface pellets at the CM site were located on position, so recovery of the mooring started and was successfully complete by 1701 hours. The marker buoy at the bottom mounted CM/TG site was located on position and recovery started at 1710 hours, but when the CM/TG frame was brought to the surface it was found to be severely damaged and without the instrument package, which had broken away (see Appendix 2 for details). With the work at station C complete the ship left the site at 1732 hours and headed for ST Ron the Hasiborough Bank with the intention of re-deploying one of the CM/TG instruments. However, due to bad weather and the close proximity of gas pipelines it was not possible to navigate accurately enough to be sure that the mooring would be clear of the pipelines by a minimum of 1 km, so the instrument was not deployed. The vessel left ST R at 2100 hours and headed for the mouth of the River Humber to start a CTD section through stations D, E, G and I to the River Tyne. This section started at 0704 hours on Wednesday 17 June with CTD cast no. 146 and continued until 0530 hours, Thursday 18 June, when CTD cast no. 158 concluded the section, the ship then docked at North Shields to off-load equipment at 0640 hours. The ship put to sea again at 1436 hours the same day, and after rigging the overside pump, logging of surface T & C started at 1548 hours along a cruise track to station K, see Figure 7.

The current meter mooring at station K had been recovered previously by a fishing trawler but the acoustics unit and back-up buoyancy was left on the site. On arrival at station K CTD cast no. 159 was carried out at 1740 hours and an acoustic search was started. However, after an hour there had been no contact with the pinger so the ship left and headed for station L taking CTD cast no. 160 on route at 1925 hours. When station L was occupied at 2030 hours the marker buoy at the current meter site was located on position and the pinger on the pop-up thermistor mooring activated; the acoustic release then operated at 2040 hours and the thermistor mooring, with its back-up buoyancy, was recovered in good condition. The pop-up TG was then located and recovered without difficulty at 2113 hours before the ship moved to the CM site to recover the final mooring on this station at 2212 hours. CTD cast no. 161 completed the work at station L and the ship left at 2224 hours heading for station M.

During passage to station M, CTD cast no. 162 was carried out at 0021 hours on Friday 19 June then cast no. 163 on arrival at station M at 0610 hours. The current meter mooring was located on position and recovered without delay by 0722 hours. An experimental surface marker buoy was then deployed at this site, in 68m of water, with a spherical pinger and back-up buoyancy attached to the mooring line for acoustic tests and side scan sonar trials. With this work complete the ship left station M at 1205 hours and proceeded to station P taking CTD cast nos. 164 and 165 on route, and 166 on arrival at P at 1635 hours. The pop-up TG at this station was located on position and recovered at 1724 hours. Similarly, the pop-up current meter mooring was recovered at 1744 hours and the thermistor mooring at 1827 hours, all without difficulty. With this work complete the ship left station P at 1830 hours to start a CTD section to the coast line, via station N, taking CTD cast nos. 167 to 170 on route and returning to station N for recovery.

At 0600 hours, on Saturday 20 June, the CM mooring at station N was located on position and recovered in ideal weather at 0642 hours, CTD cast no. 171 was taken at 0650 hours then the ship left the station and headed for station K, via station M, (see Figure 8) carrying out CTD cast nos. 172 to 176 on route. On arrival at station K at 1555 hours a box search was started in an attempt to locate the pinger and buoyancy unit still missing at this site. By 0705 hours the following morning, Sunday 21 June, the search area had been covered but without any contacts with the pinger, so the search was ended and the CTD survey resumed with sections from the coast line through stations K, L and M then back to the coast taking cast nos. 177 to 192 on route.

Station M was re-occupied at 1100 hours on Monday 22 June to carry out acoustic trials and side scan sonar tests in association with the experimental mooring at this site. Also a new overside sensor pack for measurement of surface water temperature and conductivity was deployed and tested, the outputs of which were recorded on the surface sampling logger between 1955 hours and 0725 hours Tuesday 23 June. This work was concluded at 0825 hours with the recovery of the experimental mooring and departure from station M after CTD cast no. 193 at 0855 hours. The final CTD section was then made along a cruise track moving north west from station M and along the coast line to

the Firth of Forth, then east beyond station P and finally in a westerly direction to Dundee. CTD cast no. 194 to 216 were taken along this section at regular intervals until 1532 hours on Friday 24 June, when measurements ended and the overside pump was brought inboard. The ship docked at Dundee at 1754 hours the same day.

STATION REPORT

DEPLOYMENT LEG

Station A - bottom mounted current meter /TG
water depths are uncorrected
for tide.

Current meters : 1506, Rig No. 4

Buoys and acoustics : Toroid No. 5, W4 pinger

Deployment

time : 0432-0455 6 May 1981

Decca (Chain 5B) : A 18.15, - , C 55.16

water depth : 37 m

CTD profile : None

Comments : The gauge lifted off the bottom
at 0453 and was replaced
immediately, as there was a
chance that the first laying
was not upright.

STATION B - bottom mounted current meter/tide gauge

Current meters : 1750, Rig No. 5

Buoys and acoustics : Toroid No. 5; W3 pinger

Deployment

time : 0545-0603 6 May 1981

Decca (Chain 5B) : A 19.73, -, C 51.50

water depth : 38 m

CTD profile : None

Comments : Camera unit fitted

STATION C1 - bottom mounted current meter/tide gauge

Current meters : 302, Rig No. 3

Buoys and acoustics : Toroid No.3 with Lensref; W6
pinger

Deployment

time : 1022-1039 6 May 1981

Decca (Chain 5B) : A 18.35, -, C 54.22

water depth : 26 m

CTD profile : 1

Comments : First deployment recovered because
of possible dragging; the frame was
driven into the A-frame block on
this recovery, by accident. Rotor
replaced and instruments checked
before redeployment.

STATION C2 - U-shaped current meter rig

Current meters : 4967, 1865
Top Bottom

Buoys and acoustics : Toroid No. 6; SO 1 Pinger
Subsurface buoy No. 10

Deployment

time : 1230-1255 6 May 1981

Decca (Chain 5B) : A 18.48, -, C 53.90

water depth : 32 m

CTD profile : 1

Comments : Original site was too shallow
for the rig design and so it was
towed to slightly deeper water.

STATION D - U-current meter rig

Current meters : 3227, 4388

Buoys and acoustics : Toroid No. 11, Pinger SO 7
Subsurface No. 3

Deployment

time : 2055-2109 6 May 1981

Decca (Chain 5B) : I 11.56, -, E 65.28

water depth : 43 m

CTD profile : 2

Comments :

STATION E1 - Bottom pressure recorder TELEOST NO. 1

Recorder : WLR-500

Buoys and acoustics : 238 Pinger

Deployment

time : 0855-0856 7 May 1981

Decca (Chain 5B) : J 0.19, -, E 57.28

water depth : 55 m

CTD profile : 3

Comments :

STATION E2

Current meters : 5522, 3560

Buoys and acoustics : Toroid No. 10; Pinger S05
Subsurface buoy No. 6

Deployment

time : 1010-1023 7 May 1981

Decca (Chain 5B) : J 0.65, -, E 57.04

water depth : 55 m

CTD profile : 3

Comments : The first deployment of this rig
was recovered because the anchor
separations suggested entanglement.

STATION E3 - Pop-up thermistor rig

Recorder : Logger No. 527; Chain 118 (25m)

Buoys and acoustics : Release No. 221
Subsurface buoy No. 8

Deployment

time : 0720 - 0723 7 May 1981

Decca (Chain 5B) : J 0.83, -, E 56.73

water depth : 55 m

CTD profile : 3

Comments :

STATION F - U-shaped current meter rig

Current meters : 4968

Buoys and acoustics : Toroid No. 4; Pinger S06.
Subsurface buoy No. 11

Deployment

time : 1245-1301 7 May 1981

Decca (Chain 2A) : -, B 46.91, H 63.93

water depth : 61 m

CTD profile : 4

Comments : Toroid inverted on visit of
18 May, and so righted. Subsurface
buoy pellets not visible.

STATION G - U-shaped current meter rig

Current meters : 1139

Buoys and acoustics : Toroid No. 7; SO 10 Pinger
Subsurface buoy No. 7

Deployment

time : 1645-1647 7 May 1981

Decca (Chain 2A) : -, B 38.42, F 52.00

water depth : 68 m

CTD profile : 5

Comments : Second anchor manipulated to new
position between 1702 and 1708.

STATION H1 - Bottom pressure TELEOST gauge; pop-up No. 3

Recorder : TG 281

Buoys and acoustics : Release pinger 2167

Deployment

time : 1951-1953 7 May 1981

Decca (Chain 2A) : -, C 35.94, E 55.52

water depth : 79 m

CTD profile : 6

Comments :

STATION H2 - U-shaped current meter rig

Current meters : 1509, 1749

Buoys and acoustics : Toroid No. 9; Release 233
Subsurface buoy No. 5

Deployment

time : 2025-2042 7 May 1981

Decca (Chain 2A) : -, C 36.15, E 56.75

water depth : 80 m

CTD profile : 6

Comments :

STATION I - U-shaped current meter rig

Current meters : 1508, 570

Buoys and acoustics : Selco No. 7; Pinger SO 8.
Subsurface buoy (40") No. 2

Deployment

time : 1829-1842 9 May 1981

Decca (Chain 2A) : -, B 38.88, B 67.44

water depth : 71 m

CTD profile : 11

Comments :

STATION J1 - Bottom pressure TELEOST gauge, pop-up No. 4

Recorder : 288

Buoys and acoustics : Release 2168

Deployment

time : 0744-0745 9 May 1981

Decca (Chain 2A) : -, F 32.66, J 72.42

water depth : 80 m

CTD profile : 9

Comments :

STATION J2

U-shaped current meter rig

Current meters : 3559, 5526

Buoys and acoustics : Toroid No. 2; Pinger SO 9
Subsurface buoy No. 15

Deployment

time : 0806-0821 9 May 1981

Decca (Chain 2A) : -, F 33.08, J 70.75

water depth : 80 m

CTD profile : 9

Comments :

STATION K

U-shaped current meter rig

Current meters : 4387

Buoys and acoustics : Toroid No. 1; release No. 235
Subsurface buoy No. 17

Deployment

time : 1830-1840 8 May 1981

Decca (Chain 2A) : -, B 32.86, H 78.12

water depth : 91 m

CTD profile : 7

Comments : This rig was reported trawled
'28 miles S.E. of Farne Islands'
on 27 May, and returned from shore.
See recovery notes.

Station L.

- a) Pop-up thermistor rig with back-up buoyancy
- b) Pop-up pressure recorder
- c) Current meter rig.

a) Pop-up thermistor rig with back-up buoyancy

Sea data thermistor Logger No.1
 Aanderaa thermistor chain, 50m, No.774
 Aanderaa back-up buoyancy x3
 Release pinger No.237

Deployment position (-, C34.92, I57.12) 2A
 Recovery position (- C34,85, I56.95) 2A
 Release operated at 20.40 hrs 18 June
 All equipment recovered in good condition by 20.54 hrs.

b) Pop-up pressure recorder

Teleost TG No.5
 Teleost pressure recorder No.284 (SG)
 Release pinger NO.236

Deployment position (-, C35.14, I59.06) 2A
 Recovery position (- C35.00, I59.20) 2A
 Release operated at 21.06 hrs. 18 June
 TG on surface 21.08 "
 TG on deck and recovery complete 21.13
 All items in good order and operational.

c) Current meter rig

Current meter No. 2971 Top
 No. 5525 Bottom
 Command pinger No. 2320

Deployment position (-, C34.47, I58.28) 2A
 Recovery position (-, C34.42, I58.05) 2A
 Recovery started at 21.30 hrs 18 June
 Surface buoy anchor on deck 21.40 hrs
 Sub-surface buoy anchor on deck 21.45 hrs
 Pinger on deck 21.47 "
 Bottom CM on deck 21.51 "
 Top CM on deck 21.52 "
 Sub-surface buoy and pellets on deck 21.56 hrs
 Surface buoy on deck and recovery complete 22.12 hrs

All equipment recovered in good condition and operational.
 However, the rotor was knocked out of CM No.2971 on deck
 after recovery.

CTD profile No.161 at 22.24 hrs 18 June
 181 at 14.19 " 21 June

STATION L1 Bottom pressure TELEOST gauge, pop-up No. 5

Recorder : 284

Buoys and acoustics : Release No. 236

Deployment

time : 0516 10 May 1981

Decca (Chain 2A) : -, C 35.14, I 59.06

water depth : 74 m

CTD profile : 12

Comments :

STATION L2

U-shaped current meter mooring

Current meters : 2971, 5525

Buoys and acoustics : Selco No. 14; Pinger 2320
Subsurface buoy No. 14

Deployment

time : 0752-0805 10 May 1981

Decca (Chain 2A) : -, C 34.47, I 58.28

water depth : 78 m

CTD profile : 12

Comments :

STATION L3 Thermistor chain - pop-up

Recorder : Sea data logger No. 1.
 Chain (50 m) No. 774

Buoys and acoustics : Subsurface buoy No. 12
 Release No. 237

Deployment

 time : 0615-0621 10 May 1981

 Decca (Chain 2A) : -, C 34.92, I 57.12

 water depth : 78 m

 CTD profile : 12

Comments :

STATION P1 Bottom pressure TELEOST gauge, pop-up No. 6

Recorder : 287 Gauge No. 6

Buoys and acoustics : Release No. 220

Deployment

time : 0734-0737 11 May 1981

Decca (Chain 2A) : J 16.50, G 39.10, C 52.14

water depth : 67 m

CTD profile : 15

Comments :

STATION P2

Current meter rig, pop-up

Current meters : 5523, 5527

Buoys and acoustics : Release No. 229
Subsurface buoy No. 16

Deployment

time : 0823-0830 11 May 1981

Decca (Chain 2A) : B 17.70, G 40.92, C 50.86

water depth : 67 m

CTD profile : 15

Comments :

STATION REPORT. RECOVERY LEG

Decca Co-ordinates for chains 2A, 2E, 5B, in sequence Red, Green,
Purple.

Station A.

Bottom mounted CM/TG rig No. 4

Current meter No. 1506

Pressure sensor, Digiquartz No. 4143

Command pinger No. W 4

Deployment position (A 18.15, -, C 55.16)	5B
Recovery position (I 10.08, E 42.40, -)	2E
Recovery started at 09-26 hrs	16 June
Surface buoy on deck 09-28 hrs	
Surface buoy anchor on deck 09-34 hrs	
CM/TG on deck and recovery complete 09-43 hrs	
Surface pellet floats were visible before recovery started	
Anglers fishing line around rotor spindle	
CTD profile No. 143 at 08-05 hrs	16 June

STATION B

Bottom mounted CM/TG No. 5

Current meter No. 1750

Pressure sensor, Digiquartz No. 4132

Command pinger No. W 3

Camera unit

Deployment position (A 19.73, -, C 51.50) 5B

Recovery position (I 9.68, E 42.00, -) 2E

Rig recovered by dragging, (surface buoy and pellets missing).

Ground line caught by grapnel 14-35 hrs 16 June

CM/TG on deck 14-45 hrs

Surface buoy anchor on deck 14-52 hrs

The surface buoy wire had been cut a few metres above the anchor

High friction on rotor pivots

CTD profile No. 144 at 15-07 hrs 16 June

STATION C

- a) Current meter rig
- b) Bottom mounted CM/TG rig No. 3

a) Current meter rig

Current meter No. 4967 Top

1856 Bottom

Command pinger No. SO 1

Deployment position (A 18.48, -, C 53.90) 5B

Recovery position (I 8.85, E 43.00 -) 2E

Recovery started at 16-45 hrs 16 June

Surface buoy on deck 16-46 hrs

Surface buoy anchor on deck 16-53 hrs

Sub-surface buoy anchor on deck 16-58 hrs

Bottom CM & pinger on deck 16-58 hrs

Top CM on deck 16-59 hrs

Sub surface buoy on deck and recovery complete 17-01 hrs

All equipment recovered in good condition and operational.

Sub-surface buoy pellets visible before recovery started

b) Bottom mounted CM/TG rig No. 3

Current meter No. 302

Pressure transducer, Digiquartz No. 4161

Command pinger No. W 6

Deployment position (A 18.35, -, C 54.22) 5B

Recovery position (I 9.10, E 42.80, -) 2E

Surface buoy and pellet floats visible

Recovery started at 17 - 13 hrs 16 June

Surface buoy on deck 17 - 15 hrs

Surface buoy anchor on deck 17 - 23 hrs

Part of CM/TG recovered 17 - 31 hrs

Only part of the CM/TG frame was recovered and the instrument package was lost, see appendix for detail.

CTD profile No. 145 at 16 - 33 hrs on 16 June

STATION D

Current meter rig

Current meter No. 3277 Top

4388 Bottom

Command pinger No. SO 7

Deployment position (I 11.56, -, E 65.28) 5B

Recovery position (I 11.50, -, E 65.10) 5B

Recovery started at 13-54 hrs 13 June

Surface buoy on deck 13-57 hrs

Surface buoy anchor on deck 14-04 hrs

Sub-surface buoy anchor on deck 14-07 hrs

Pinger and both current meters on deck tangled together 14-10
hrs

Sub-surface buoy on deck 14-15 hrs and recovery complete.

Top CM had a bent mooring spindle and its rotor is missing

Bottom CM had cable polish marks on pressure case and bronze
casting

Cable marks on spherical pinger also

CTD profile No. 117 at 13-25 hrs 13 June

148 at 09-12 hrs 17 June

STATION E

- a) Pop-up pressure recorder
- b) Pop-up thermistor rig
- c) Current meter rig

a) Pop-up pressure recorder

Teleost TG No. 1

Aanderaa pressure recorder WLR - 500 (DIG)

Release pinger No. 238

Deployment position (J 0.19, -, E 57.28) 5B

Recovery position (J 0.15, - E 57.25) 5B

Release operated at 18-32 hrs 13 June

TG on surface 18-34 hrs

TG on deck and recovery complete 18-38 hrs

All parts in good condition and operating

b) Pop-up thermistor rig

Aanderaa Thermistor Logger No. 527

Aanderaa Thermistor chain, 25 m No. 118

Release pinger No. 221 C

Deployment position (J 0.83, -, E 56.73) 5B

Recovery position (J 0.75, - E 56.80) 5B

Release operated at 19-03 hrs 13 June

Sub-surface buoy grappled 19-08

All equipment on deck in good condition and recovery complete 19-12 hrs.

c) Current meter rig

Current meter No. 5522 Top
 3560 Bottom

Command pinger No. SO 5

Deployment position (J 0.65, -, E 57.04) 5B

Recovery position (J 0.50, - E 57.10) 5B

Surface buoy on deck at 19-36 hrs 13 June

Surface buoy anchor on deck 19-44 hrs

Sub-surface buoy anchor on deck 19-53 hrs

Pinger on deck 19-55 hrs

Bottom CM on deck tangled in meter wire 20-02 hrs

Top CM and sub surface buoy on deck, recovery complete 20-04 hrs

Sub-surface buoy pellets visible before recovery started.

A section of fishing net was found attached to the surface buoy anchor and the surface buoy mooring line was badly damaged 4 m above the anchor.

The bottom CM was tangled with its meter wire and had cable marks on the pressure case and fastening band screw

The rotor was knocked out of the CM on deck after recovery.

CTD profile No. 119 at 16-45 hrs 13 June

150 at 12-00 hrs 17 June

STATION F

Current meter rig:

Current meter No. 4968

Command pinger No. SO 6

Deployment position (-, B 46.91, H 63.93) 2A

Recovery position (-, B 46.95, H 63.50) 2A

Surface buoy on deck 16-54 hrs 14 June

Surface buoy anchor on deck (tangled) 17-00 hrs

Sub-surface buoy anchor on deck 17-11 hrs

CM and pinger on deck 17-14 hrs

Sub-surface buoy and pellets on deck and recovery complete
17-16 hrs

CTD profile No. 121 at 23-45 hrs 13 June

130 at 16-30 hrs 14 June

STATION G

Current-meter rig

Current meter No. 1139

Command pinger No. S 10

Deployment position (-, B38.42, F 52.00)

Recovery position (-, B38.35, F54.0) 2A

Recovery started at 09-19 hrs 14 June

Surface buoy on deck 09-22 hrs

Surface buoy anchor on deck, (tangled) 09-26 hrs

Sub-surface buoy anchor on deck 09-33 hrs

CM and pinger on deck 09-36 hrs

Sub-surface buoy and pellets on deck and recovery complete
09-40 hrs

CTD profile No. 125 at 09-10 hrs 14 June

b) Pop-up pressure recorder

TELEOST TG No. 3

Teleost pressure recorder No. 281 (SG)

Release pinger No. 2167

Deployment position (-, C35.94, E55.52) 2A

Recovery position (-, C36.00, E55.80) 2A

Release operated at 06-16 hrs 14 June

TG on surface 06-18 hrs

TG on deck and recovery complete 06-33 hrs

All parts in good condition and operational

CTD profile No. 123 at 05-05 hrs 14 June

STATION J.

- a) Current-meter rig
- b) Pop-up pressure recorder

a) Current-meter rig

Current meter No. 3559 Top

5526 Bottom

Command pinger No. S 09

Deployment position (- , F33.08, J70.75) 2A

Recovery position (- , F33.10, J70.50) 2A

Recovery started at 14 .48 hrs 15 June

Surface buoy on deck 14.53 hrs

Surface buoy anchor on deck 15.00 "

Sub-surface buoy anchor on deck 15.08 "

Pinger & bottom CM on deck 15.12 "

Top CM on deck 15.13 "

Sub-surface buoy and pellets on deck, recovery complete 15.15 hrs.

All equipment recovered in good condition and operational.

b) Pop-up pressure recorder

Teleost TG No.4

Teleost pressure recorder No.288

Pressure transducer, Digiquartz No.4597

Release pinger No.2168

Deployment position (-, F.32.66, J72.42)

Recovery position (-, F32.50, J72.50) 2A

Release operated at 15.34 hrs 15 June

TG on surface 15.35 "

TG on deck and recovery complete 15.41

All items in good condition and operational.

CTD profile No.141 at 14.35 hrs 15 June.

Station K.

Pop-up current meter rig (back-up buoyancy)

Current meter No.4387
Corning glass back-up buoyancy x2
Release pinger No.235.

Deployment position (-, B.32.86, H78.12)

Recovery of the CM and sub-surface buoy was made by a fishing trawler during MAY 81 and the back-up buoyancy unit by another fishing trawler in JAN. 82.

The release pinger was not recovered.

CTD profile No.159	at 17.40 hrs.	18 June
176	at 15.45 "	20 June
179	at 11.27 "	21 June

Station M

- a) Current meter rig
- b) Temporary buoy rig

a) Current meter rig

Current meter No.2575
Command pinger No.S 02

Deployment position (-, C34.31, D63.31) 2A
Recovery position (- C34.07, D63.14) 2A
Recovery started at 06.36 hrs 19 June
Surface buoy anchor on deck 07.00 hrs.
Sub-surface buoy anchor on deck 07.08
Pinger on deck 07.11
CM on deck 07.14
Sub-surface buoy and pellets on deck 07.16
Surface buoy on deck and recovery complete 07.22

Instruments recovered in good condition but the surface buoy mooring line was badly frayed in one section.

b) Temporary buoy rig

Experimental surface buoy
Buoyancy unit
Command pinger No.S02

Deployment position (-, C34.04, D62.44) 2A
Deployment depth 68m.
Deployment started 10.46 hrs. 19 June
Deployment complete 11.07
Recovery started 08.05 23 June
Recovery complete 08.25

All equipment recovered in good condition.

CTD profile No.163 at 06.10 hrs 19 June
173 at 10.58 " 20 June
190 at 02.00 " 22 June
193 at 08.55 " 23 June

Station N

Current meter rig

Current meter No.1746 top
No.3561 bottom
Command pinger No.S 11

Deployment position (-, E30.47, A74.32) 2A
Recovery position (I18.23, D47.44, A74.33) 2A
Recovery started at 06.15 hrs 20 June
Surface buoy on deck 06.22
Surface buoy anchor on deck 06.28
Sub-surface anchor on deck 06.35
Pinger and bottom CM on deck 06.38
Top CM on deck 06.40
Sub-surface buoy and pellet on deck, recovery complete 06.42

Sub-surface buoy pellets were visible before recovery started

All equipment recovered in good condition and operational.

CTD profile No.168 at 21.10 hrs 19 June
171 at 06.50 " 20 June.

Station P

- a) Pop-up pressure recorder
- b) Pop-up current meter rig with back-up buoyancy
- c) Thermistor chain rig

a) Pop-up pressure recorder

Teleost TG No.6
 Teleost pressure recorder No.287
 Pressure transducer, Digiquartz No.4137
 Release pinger No.220

Deployment position (J16.50, G39.10, C52.14) 2A
 Recovery position (-, G.38.28, C52.0) 2A
 Release operated at 17.14 hrs 19 June
 TG on deck and recovery complete 17-24 Hrs

Rig in good condition and operational but release mechanism shows signs of corrosion on pins.

b) Pop-up current meter rig with back-up buoyancy

Current meter No. 5528 Top
 5527 Bottom
 Aanderaa back-up buoyancy x2
 Release pinger No.229

Deployment position (B.17.70, G40.92, C50.86) 2A
 Recovery position (G39.90, C50.8) 2A

Release operated at 17.35 hrs 19 June
 Rig on surface 17.36
 Sub-surface buoy on deck 17.42
 Top CM on deck 17.43
 Bottom CM on deck 17.44
 Pinger on deck and recovery complete 17.45

All items in good condition and operational.

c) Thermistor chain rig

Aanderaa thermistor Logger No.561
 Aanderaa thermistor chain 50m No.763
 Command pinger No. S12

Deployment position (B.17.12, G39.30, C50.52) 2A
 Recovery position (-, G38.58, C50.50) 2A
 Recovery started at 17.57 hrs 19 June
 Surface buoy anchor on deck 18.05
 Sub-surface buoy anchor on deck 18.19
 Thermistor recorder on deck 18.20
 Sub-surface buoy and pellets on deck 18.22
 Surface buoy on deck and recovery complete 18.27

All items in good condition and operational.
 Sub-surface pellets were visible before recovery started

CTD profile No.166 at 16.35 hrs. 19 June

EQUIPMENT LOSSES

Toroidal surface buoy with flashing light	Station	B
Bottom mounted current meter/tide gauge	Station	C
Acoustic command pinger W6	Station	C
Toroidal surface buoy with flashing light	Station	K
Acoustic release unit CR 235 C	Station	K

COMMENTS ON THE SHIP SUITABILITY

RRS John Murray has been used on several previous occasions by IOS Bidston for mooring deployment and recovery. Although generally effective, there are difficulties in working in conditions exceeding moderate seas, and there is insufficient deck space to carry all the necessary equipment. Mid-cruise calls at North Shields were needed to load and off-load equipment in the middle of the deployment and recovery legs. For our work a slightly larger ship with a bow-thruster would be more suitable. A hydraulic winch for deployment of the PDR fish would also be an advantage.

Concerning the current-meter profiling over 25 hour periods using a stern anchor, the results were satisfactory. Four such stations were completed, and a fifth had to be abandoned after 7 hours because of worsening weather. Unfortunately the fitting of the anchor winch on the afterdeck precluded any rig recovery or maintenance on the last part of the first leg. Profiling was possible in moderate seas and in winds to force 6. However, least satisfactory results, and maximum discomfort occurred when profiling with swell from the east on the beam, while John Murray was aligned along the north-south tidal current.

ACKNOWLEDGEMENTS

We would like to thank the Masters, Officers and crew of RRS John Murray for their cooperation and assistance during these cruises. Their willingness to experiment with stern anchoring enabled the profiling stations to be completed. Particular thanks are due to A.L. Moore, who assumed the role of Master on Leg 1 at short notice.

ABBREVIATIONS

IOS	Institute of Oceanographic Sciences
CM	Current meter
CM/TG	Current meter and pressure recorder rig
TG	Tide gauge, bottom pressure recorder
CTD	Conductivity, temperature, depth profiling equipment
PDR	Precision depth recorder.

ROUTINE FOR CURRENT PROFILING

APPENDIX 1

Hourly cycle maintained for 25 hours, possibly 50 hours, with steady recordings at 5 depths. D1 D2 D3 D4 D5. E.g. for 70m total depth, record at 15, 30, 45, 55, 65m, the first 3 depths determined by the metre wheel, plus wire angle. In determining the depth of c/m at large wire-angle use can be made of pinger or of depth-reading on print out and the last (bottom) two from the Mufax, allowing 1m for distance of current meter rotor above pinger.

Timing is very important, and one must record the proper depth at the proper time, even if there are interruptions due to mishaps. It doesn't matter too much if depth is out by 1 or 2 metres, provided the scans are taken at the proper times. Note that a current-meter 'scan' starts on the minute (0 sec) and finishes about 28s later. (Double 'Bonk' on printer - wait for it) or 'Line Return'.

Time sequence

Depth 1	for complete scans starting	5, 6 ... 10 min past hour	
Depth 2	"	15, 16 ..20	"
Depth 3	"	25, 26 ..30	"
Depth 4	"	35, 36 ..40	"
Depth 5	"	45, 46 ..50	"

After completion of last scan, i.e. 50½ min after hour, raise current meter to surface for a brief inspection, possible de-fouling etc, then lower to Depth 1 (usually 15m) to await start of next hourly cycle.

If something goes wrong, interrupting the full cycle, re-start at any depth at the proper time (e.g. Depth 4 at 35 min).

Record essential details in log book, some features, e.g. total depth, ship's head, only one on hour.

APPENDIX 2

Loss of CM/TG No.3 at Station C

A meeting was held to discuss the damage sustained by the frame of CM/TG No.3 moored at station C which results in its loss.

Present : J. Howarth
 J. Casson
 G. Ballard
 A. Harrison

From the damaged parts of the frame which were recovered, it is evident that some of the welded sections failed soon after deployment, since the broken sections are badly corroded and have marine organisms growing on the fractured surfaces. Other damaged frame members had clear fractured surfaces and were probably broken at the time of recovery.

During deployment the instrument was damaged when it hit the ship's 'A' frame and also the mooring used had a long ground line, either of which may have contributed to the subsequent failure of the frame.

Points from discussion :-

1. Frame to be strengthened in certain areas.
2. Mooring ground line to be kept to a minimum length.
3. Deployment to be carried out - "buoy first, instrument last".
4. Recovery to be carried out - "instrument first, buoy last".
5. Large surface pellet floats to be used at the top of the instrument line.
6. Spherical pinger to be shackled direct to the top lifting point in the instrument line with 2 x trawl floats fitted 2m above the pinger and a guard ring welded to the top of the frame.
7. Acoustic recall system to be investigated.

TABLES

Table 1	Summary of station positions and equipment deployed
Table 2	CTD profile positions
Table 3	List of equipment deployed

FIGURES

Figure 1	Map of station positions
Figure 2	Map of CTD profile stations. Deployment leg.
Figure 3	Map of CTD profile stations. Recovery leg.
Figure 4	Deployment leg track chart 6 - 12 May
Figure 5	Deployment leg track chart 13 - 23 May
Figure 6	Recovery leg track chart 13 - 14 June
Figure 7	Recovery leg track chart 15 - 19 June
Figure 8	Recovery leg track chart 20 - 24 June
Figure 9	Diagram of U-shaped current meter mooring
Figure 10	Diagram of U-shaped CM/TG mooring
Figure 11	Diagram of pop-up thermistor mooring
Figure 12	Bathymetry and station positions around Well Bank (A, B, C)

Table 1

Station SummaryNorth Sea 1981

Station	Latitude	Longitude	Water Depth below chart datum (m)	equipment deployed	Meter heights (m) above sea floor
<u>RIGS</u>					
A	53°17.3'N	2°1.1'E	34	CM/TG	0.75
B	53 14.4'N	2 5.1'E	35	CM/TG	0.75
C1	53 15.5'N	2 0.2'E	25	CM/TG	0.75
2	53 14.9'N	2 0.5'E	32	2 CM	7, 15
D	53 51'N	0 29'E	38	2 CM	10, 20
E1			50	PR	
2	54 01'N	0 29'E	51	2 CM	15, 30
3			50	TC	18 → 43
F	54 20'N	0 30'E	60	CM	25
G	54 37'N	0 13'W	65	CM	30
H1			76	PR	
2	54 47'N	0 17'E	77	2 CM	25, 50
I	54 56'N	0 31'E	67	2 CM	20, 40
J1			78	PR	
2	55 35'N	0 44'E	78	2 CM	25, 50
K	55 11'N	1 0'N	87	CM	35
L1			72	PR	
2	55 19'N	0 33'W	74	2 CM	25, 50
3			75	TC	16 → 66
M	55 42'N	1 15'W	71	CM	35
N	56 4'N	1 45'W	63	2 CM	15, 30
P1			63	PR	
2	56 17'N	1 13'W	63	2 CM	20, 40
3			65	TC	5 → 55

CURRENT PROFILES

				<u>hours</u>	meter heights <u>below</u> <u>surface</u>	<u>above</u> <u>bottom</u>
EA	54°00.0'N	0°54.0'E	45	25	10,20,30	10, 5
HA	54 50.3'N	0 15.3'E	75	25+7	15,30,45	20,10
LA	55 19.6'N	0 38.0'W	75	25	15,30,45	20,10
PA	56 16.5'N	1 16.2'W	58	25	10,20,30	20,10

Note. Rig latitudes and longitudes are given for the current meter deployment at each station; these are close to the nominal station positions. Pressure recorders and thermistor chains were deployed as close as practicable to this position, and usually within 500m. Station reports give exact Decca coordinates of all rigs.

TABLE 2. LIST OF CTD PROFILES.

PROFILE NUMBER	DATE	TIME STARTED	POSITION		RIG
			LATITUDE	LONGITUDE	
1	6/ 5/81	10. 0	N 53 15.0	E 2 0.	B
2	6/ 5/81	21.12	N 53 50.0	E 0 30.0	D
3	7/ 5/81	8.10	N 54 0.	E 0 50.0	E
4	7/ 5/81	13. 2	N 54 20.0	E 0 30.0	F
5	7/ 5/81	17.11	N 54 38.0	W 0 12.0	G
6	7/ 5/81	20.48	N 54 48.0	E 0 17.0	H
7	8/ 5/81	18.50	N 55 11.0	W 1 0.	K
8	9/ 5/81	8.24	N 55 35.0	E 0 44.0	J
9	9/ 5/81	9.20	N 55 35.0	E 0 45.0	J
10	9/ 5/81	15.05	N 55 15.0	E 0 0.2	
11	9/ 5/81	18.56	N 54 56.0	W 0 31.0	I
12	10/ 5/81	8.15	N 55 20.0	W 0 33.0	L
13	10/ 5/81	13. 0	N 55 42.0	W 1 14.0	M
14	10/ 5/81	17.20	N 56 4.0	W 1 45.0	N
15	11/ 5/81	9.30	N 56 16.0	W 1 13.0	P
16	11/ 5/81	17.40	N 55 42.0	W 1 13.0	M
17	13/ 5/81	10.40	N 55 6.0	W 1 26.0	
18	13/ 5/81	11.43	N 55 9.0	W 1 18.0	
19	13/ 5/81	12.53	N 55 13.0	W 1 10.0	
20	13/ 5/81	14. 3	N 55 16.0	W 1 1.0	
21	13/ 5/81	15. 7	N 55 19.0	W 0 54.0	
22	13/ 5/81	16.48	N 55 24.0	W 0 44.0	
23	14/ 5/81	20.40	N 55 20.0	W 0 37.0	L
24	14/ 5/81	21.30	N 55 24.0	W 0 38.0	
25	14/ 5/81	22.34	N 55 29.0	W 0 44.0	
26	14/ 5/81	23.35	N 55 36.0	W 0 48.0	
27	15/ 5/81	0.30	N 55 41.0	W 0 53.0	
28	15/ 5/81	1.30	N 55 46.0	W 0 56.0	
29	15/15/81	2.30	N 55 53.0	W 0 59.0	
30	15/ 5/81	3.30	N 56 0.	W 1 4.0	
31	15/ 5/81	4.30	N 56 8.0	W 1 9.0	
32	15/ 5/81	5.30	N 56 16.0	W 1 14.0	P
33	16/ 5/81	9.34	N 56 17.0	W 1 16.0	
34	16/ 5/81	10.30	N 56 12.0	W 1 24.0	
35	16/ 5/81	11.30	N 56 8.0	W 1 35.0	
36	16/ 5/81	12.30	N 56 5.0	W 1 47.0	
37	16/ 5/81	13.30	N 55 54.0	W 1 57.0	
38	16/ 5/81	14.22	N 55 55.0	W 2 5.0	
39	16/ 5/81	14.40	N 55 54.0	W 2 5.0	
40	16/ 5/81	15. 0	N 55 54.0	W 2 4.0	
41	16/ 5/81	15.43	N 55 52.0	W 1 57.0	
42	16/ 5/81	16.46	N 55 50.0	W 1 47.0	
43	16/ 5/81	17.30	N 55 48.0	W 1 38.0	
44	16/ 5/81	18.30	N 55 50.0	W 1 41.0	
45	16/ 5/81	19.32	N 55 44.0	W 1 20.0	
46	16/ 5/81	20.35	N 55 40.0	W 1 13.0	
47	16/ 5/81	21.32	N 55 35.0	W 1 11.0	
48	16/ 5/81	22.31	N 55 28.0	W 1 7.0	
49	16/ 5/81	23.32	N 55 21.0	W 1 5.0	
50	17/ 5/81	0.30	N 55 15.0	W 1 2.0	
51	17/ 5/81	1.12	N 55 11.0	W 1 0.	

PROFILE NUMBER	DATE	TIME STARTED	POSITION		RIG
			LATITUDE	LONGITUDE	
52	17/ 5/81	2.31	N 55 0.	W 1 3.0	
53	17/ 5/81	3.32	N 54 52.0	W 1 5.0	
54	17/ 5/81	4.31	N 54 44.0	W 1 7.0	
55	17/ 5/81	4.53	N 54 42.0	W 1 9.0	
56	17/ 5/81	5.30	N 54 46.0	W 1 1.0	
57	17/ 5/81	6.30	N 54 48.0	W 0 54.0	
58	17/ 5/81	7.30	N 54 51.0	W 0 43.0	
59	17/ 5/81	8.30	N 54 55.0	W 0 32.0	
60	17/ 5/81	9.30	N 54 51.0	W 0 33.0	
61	17/ 5/81	10.30	N 54 49.0	W 0 39.0	
62	17/ 5/81	11.32	N 54 37.0	W 0 35.0	
63	17/ 5/81	12.30	N 54 30.0	W 0 36.0	
64	17/ 5/81	13.30	N 54 33.0	W 0 24.0	
65	17/ 5/81	14.30	N 54 36.0	W 0 11.0	
66	17/ 5/81	15.30	N 54 38.0	E 0 3.0	
67	17/ 5/81	16.30	N 54 39.0	E 0 13.0	
68	17/ 5/81	17.30	N 54 40.0	E 0 27.0	
69	17/ 5/81	18.45	N 54 48.0	E 0 16.0	H
70	17/ 5/81	19.34	N 54 44.0	E 0 13.0	
71	17/ 5/81	20.30	N 54 37.0	E 0 11.0	
72	17/ 5/81	21.30	N 54 32.0	E 0 11.0	
73	17/ 5/81	22.31	N 54 26.0	E 0 6.0	
74	17/ 5/81	23.30	N 54 20.0	E 0 4.0	
75	18/ 5/81	0.30	N 54 13.0	E 0 2.0	
76	18/ 5/81	1.10	N 54 8.0	W 0 1.0	
77	18/ 5/81	2.30	N 54 13.0	E 0 13.0	
78	18/ 5/81	3.30	N 54 17.0	E 0 23.0	
79	18/ 5/81	4.36	N 54 20.0	E 0 30.0	F
80	18/ 5/81	6.30	N 54 27.0	E 0 27.0	
81	18/ 5/81	7.30	N 54 34.0	E 0 23.0	
82	18/ 5/81	9. 4	N 54 48.0	E 0 16.0	H
83	19/ 5/81	5.45	N 54 49.0	E 0 19.0	
84	19/ 5/81	6.30	N 54 45.0	E 0 19.0	
85	19/ 5/81	7.30	N 54 40.0	E 0 18.0	
86	19/ 5/81	8.30	N 54 34.0	E 0 19.0	
87	19/ 5/81	9.30	N 54 28.0	E 0 19.0	
88	19/ 5/81	10.30	N 54 21.0	E 0 19.0	
89	19/ 5/81	11.30	N 54 14.0	E 0 19.0	
90	19/ 5/81	12.30	N 54 8.0	E 0 18.0	
91	19/ 5/81	13.31	N 54 2.0	E 0 17.0	
92	19/ 5/81	14.30	N 54 1.0	E 0 30.0	
93	19/ 5/81	15.30	N 54 1.0	E 0 45.0	
94	20/ 5/81	18.30	N 54 1.0	E 0 54.0	
95	20/ 5/81	19.37	N 53 57.0	E 0 42.0	
96	20/ 5/81	20.32	N 53 53.0	E 0 35.0	
97	20/ 5/81	21.31	N 53 50.0	E 0 24.0	
98	20/ 5/81	22.30	N 53 46.0	E 0 12.0	
99	20/ 5/81	23.31	N 53 49.0	E 0 5.0	
100	21/ 5/81	0.30	N 53 57.0	E 0 6.0	
101	21/ 5/81	1.30	N 54 6.0	E 0 8.0	
102	21/ 5/81	2.30	N 54 14.0	E 0 11.0	
103	21/ 5/81	3.31	N 54 20.0	E 0 12.0	
104	21/ 5/81	5.30	N 54 24.0	E 0 14.0	

PROFILE NUMBER	DATE	TIME STARTED	POSITION		RIG
			LATITUDE	LONGITUDE	
105	21/ 5/81	7.30	N 54 29.0	E 0 14.0	
106	21/ 5/81	10.30	N 54 41.0	E 0 16.0	
107	21/ 5/81	11.45	N 54 47.0	E 0 17.0	
108	22/ 5/81	14.30	N 54 50.0	E 0 19.0	
109	22/ 5/81	16.30	N 54 38.0	E 0 18.0	
110	22/ 5/81	17.30	N 54 31.0	E 0 21.0	
111	22/ 5/81	18.32	N 54 23.0	E 0 24.0	
112	22/ 5/81	19.31	N 54 16.0	E 0 25.0	
113	22/ 5/81	20.30	N 54 7.0	E 0 27.0	
114	22/ 5/81	21.30	N 53 59.0	E 0 28.0	
115	22/ 5/81	22.30	N 53 54.0	E 0 29.0	
116	22/ 5/81	23.31	N 53 46.0	E 0 31.0	
117	13/ 6/81	13.25	N 53 50.0	E 0 29.0	D
118	13/ 6/81	15.32	N 53 58.0	E 0 42.0	
119	13/ 6/81	16.40	N 54 0.	E 0 50.0	E
120	13/ 6/81	22. 0	N 54 10.0	E 0 41.0	
121	13/ 6/81	23.45	N 54 21.0	E 0 32.0	F
122	14/ 6/81	1.40	N 54 34.0	E 0 24.0	
123	14/ 6/81	5. 5	N 54 48.0	E 0 17.0	H
124	14/ 6/81	7.45	N 54 42.0	E 0 2.0	
125	14/ 6/81	9.10	N 54 37.0	W 0 12.0	G
126	14/ 6/81	10.25	N 54 33.0	W 0 23.0	
127	14/ 6/81	11.29	N 54 28.0	W 0 32.0	
128	14/ 6/81	13. 0	N 54 26.0	W 0 11.0	
129	14/ 6/81	14.41	N 54 23.0	E 0 10.0	
130	14/ 6/81	16.30	N 54 20.0	E 0 31.0	F
131	14/ 6/81	18.45	N 54 14.0	E 0 13.0	
132	14/ 6/81	20.25	N 54 7.0	W 0 2.0	
133	14/ 6/81	21.55	N 54 18.0	W 0 17.0	
134	15/ 6/81	0.37	N 54 35.0	W 0 41.0	
135	15/ 6/81	2.29	N 54 39.0	W 1 2.0	
136	15/ 6/81	4. 5	N 54 47.0	W 0 47.0	
137	15/ 6/81	5.50	N 54 56.0	W 0 30.0	I
138	15/ 6/81	8.25	N 55 5.0	W 0 12.0	
139	15/ 6/81	10.20	N 55 15.0	E 0 6.0	
140	15/ 6/81	12.10	N 55 25.0	E 0 25.0	
141	15/ 6/81	14.29	N 55 35.0	E 0 45.0	J
142	15/ 6/81	19.30	N 55 5.0	E 1 1.0	
143	16/ 6/81	08.05	N 53 17.0	E 2 2.0	A
144	16/ 6/81	14.48	N 53 14.0	E 2 7.0	B
145	16/ 6/81	16.29	N 53 15.0	E 2 2.0	C
146	17/ 6/81	7. 5	N 53 41.0	E 0 8.0	
147	17/ 6/81	8. 4	N 53 45.0	E 0 19.0	
148	17/ 6/81	9.12	N 53 50.0	E 0 29.0	D
149	17/ 6/81	10.12	N 53 55.0	E 0 40.0	
150	17/ 6/81	12. 0	N 54 0.	E 0 50.0	E
151	17/ 6/81	13.28	N 54 3.0	E 0 32.0	
152	17/ 6/81	15. 0	N 54 6.0	E 0 14.0	
153	17/ 6/81	16.35	N 54 7.0	W 0 2.0	
154	17/ 6/81	19.20	N 54 23.0	W 0 12.0	
155	17/ 6/81	21.40	N 54 38.8	W 0 22.0	
156	18/ 6/81	0. 5	N 54 56.1	W 0 31.0	I
157	18/ 6/81	2.40	N 54 58.0	W 0 56.0	

PROFILE NUMBER	DATE	TIME STARTED	POSITION		RIG
			LATITUDE	LONGITUDE	
158	18/ 6/81	5.32	N 54 60.0	W 1 21.0	
159	18/ 6/81	17.42	N 55 12.0	W 0 59.0	K
160	18/ 6/81	19.24	N 55 16.0	W 0 47.0	
161	18/ 6/81	22.24	N 55 12.0	W 0 33.0	L
162	19/ 6/81	0.16	N 55 31.0	W 0 53.0	
163	19/ 6/81	6. 0	N 55 42.0	W 1 14.0	M
164	19/ 6/81	13.25	N 55 35.0	W 1 14.0	
165	19/ 6/81	15. 0	N 56 4.0	W 1 13.0	
166	19/ 6/81	16.30	N 56 15.0	W 1 13.0	P
167	19/ 6/81	19.45	N 56 10.0	W 1 29.0	
168	19/ 6/81	21.10	N 56 4.0	W 1 45.0	N
169	19/ 6/81	22.25	N 55 60.0	W 1 56.0	
170	19/ 6/81	23.30	N 55 56.0	W 2 7.0	
171	20/ 6/81	06.50	N 56 4.0	W 1 46.0	N
172	20/ 6/81	8.30	N 55 54.0	W 1 29.0	
173	20/ 6/81	10.52	N 55 42.0	W 1 14.0	M
174	20/ 6/81	12.22	N 55 31.0	W 1 9.0	
175	20/ 6/81	13.55	N 55 22.0	W 1 4.0	
176	20/ 6/81	15.32	N 55 12.0	W 1 0.	K
177	21/ 6/81	9. 0	N 55 4.0	W 1 24.0	
178	21/ 6/81	10. 5	N 55 7.0	W 1 12.0	
179	21/ 6/81	11.27	N 55 11.0	W 1 0.	K
180	21/ 6/81	12.42	N 55 16.0	W 0 47.0	
181	21/ 6/81	14.19	N 55 19.0	W 0 33.0	L
182	21/ 6/81	15.40	N 55 24.0	W 0 19.0	
183	21/ 6/81	17. 0	N 55 28.0	W 0 7.0	
184	21/ 6/81	18.47	N 55 35.0	W 0 13.0	
185	21/ 6/81	20. 0	N 55 41.0	W 0 20.0	
186	21/ 6/81	21. 0	N 55 48.0	W 0 27.0	
187	21/ 6/81	22. 0	N 55 54.0	W 0 33.0	
188	21/ 6/81	23.23	N 55 50.0	W 0 47.0	
189	22/ 6/81	0.32	N 55 46.0	W 0 59.0	
190	22/ 6/81	2. 0	N 55 42.0	W 1 13.0	M
191	22/ 6/81	3.10	N 55 38.0	W 1 25.0	
192	22/ 6/81	4.13	N 55 35.0	W 1 35.0	
193	23/ 6/81	8.59	N 55 42.0	W 1 14.0	M
194	23/ 6/81	10. 0	N 55 47.0	W 1 40.0	
195	23/ 6/81	11.22	N 55 43.0	W 1 47.0	
196	23/ 6/81	12.21	N 55 49.0	W 1 55.0	
197	23/ 6/81	13.46	N 55 56.0	W 2 8.0	
198	23/ 6/81	15.11	N 56 2.0	W 2 23.0	
199	23/ 6/81	16.47	N 56 6.0	W 2 41.0	
200	23/ 6/81	18.20	N 56 7.0	W 2 22.0	
201	23/ 6/81	19.40	N 56 7.0	W 2 4.0	
202	23/ 6/81	20.45	N 56 7.0	W 1 46.0	
203	23/ 6/81	22. 0	N 56 7.0	W 1 29.0	
204	23/ 6/81	23.17	N 56 7.0	W 1 11.0	
205	24/ 6/81	0.58	N 56 7.0	W 0 53.0	
206	24/ 6/81	2.17	N 56 6.0	W 0 35.0	
207	24/ 6/81	3.38	N 56 7.0	W 0 17.0	
208	24/ 6/81	5.28	N 56 20.0	W 0 17.0	
209	24/ 6/81	6.51	N 56 20.0	W 0 35.0	
210	24/ 6/81	8.10	N 56 20.0	W 0 53.0	

PROFILE NUMBER	DATE	TIME STARTED	POSITION		RIG
			LATITUDE	LONGITUDE	
211	24/ 6/81	9.20	N 56 20.0	W 1 10.0	
212	24/ 6/81	10.50	N 56 20.0	W 1 29.0	
213	24/ 6/81	11.55	N 56 21.0	W 1 46.0	
214	24/ 6/81	13. 7	N 56 20.0	W 2 4.0	
215	24/ 6/81	14.16	N 56 20.0	W 2 22.0	
216	24/ 6/81	15.27	N 56 21.0	W 2 40.0	

*

TABLE 3

List of equipment deployed

1. Surface buoys
 - a) Selco fitted with flashing light
Manufactured by:-
Selco, Oslo,
Norway.
 - b) Toroidal 1.8m DIA
600 Kg buoyancy
Manufactured by:-
COSALT Ltd.
Lowestoft, UK.
 - c) Experimental pillar buoy
IOS Bidston design

2. Sub-surface buoys

Hollow steel sphere
32" DIA 175 Kg buoyancy
40" DIA 295 Kg buoyancy

Manufactured to
IOS design.

3. Back-up buoyancy
 - a) VINY, Plastic twin unit.
35 cm DIA 35 Kg buoyancy
Supplied by:-
Aanderaa Instru-
ments, Norway.
 - b) Glass sphere 41 cm DIA.
23 Kg buoyancy
Manufactured by:-
Corning.

4. Current meters

RCM4 No. 570, 1139, 1508, 1509
1746, 1749, 1865, 2575
2971, 3277, 3559, 3560
3561, 4387, 4388, 4967
4968, 5522, 5523, 5525,
5526, 5527.

Manufactured by:-
Aanderaa Instru-
ments, Norway.

5. Thermistor Recorders
 - a) TRI Logger, No. 527, 561
chain No. 111, 763, 774
Manufactured by:-
Aanderaa Instru-
ments, Norway.
 - b) Logger TYPE 610 No.1
Manufactured by:-
Sea-Data Corpn.
Massachusetts, USA

6. Bottom mounted CM/TG

Moored CM/TG system consisting of RCM 4 current meter, direction vane and pressure sensor.

IOS Bidston

Current meter No. 302
1506
1750

Manufactured by:-
Aanderaa Instru-
ments, Norway.

Digiquartz pressure transducer
MODEL 2400A.

Manufactured by:-
Paroscientific,
Washington, USA.

7. Pressure recorder

Teleost pop-up TG
consisting of:-

IOS Bidston

a) Pressure/temperature
sensor and data logger
with Bell & Howell SG
or Digiquartz transducer

IOS Bidston

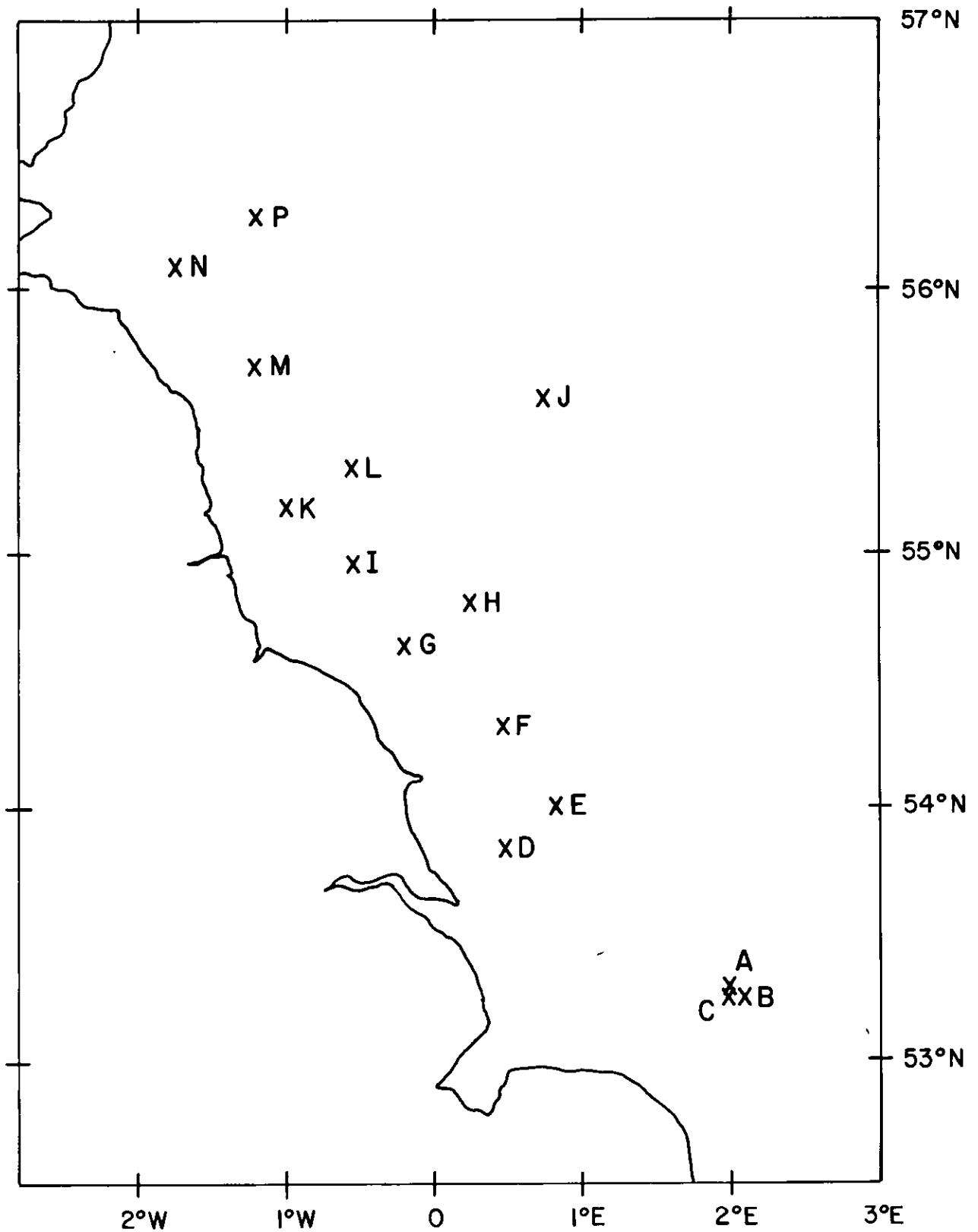
b) Water level recorder
Model 5 with Digiquartz
transducer. No. 500

Manufactured by:-
Aanderaa Instru-
ments, Norway.

8. Acoustics Unit

No. W3, W4, W6, S01, S02, S05, S06,
S07, S08, S09, S010, S011, S012
CB233, CB2320, CR220, CR221,
CR229, CR235, CR236, CR237,
CR238, CR2167, CR2168.

IOS Bidston/
Wormley



RIG POSITIONS NORTH SEA 1981

Figure 1

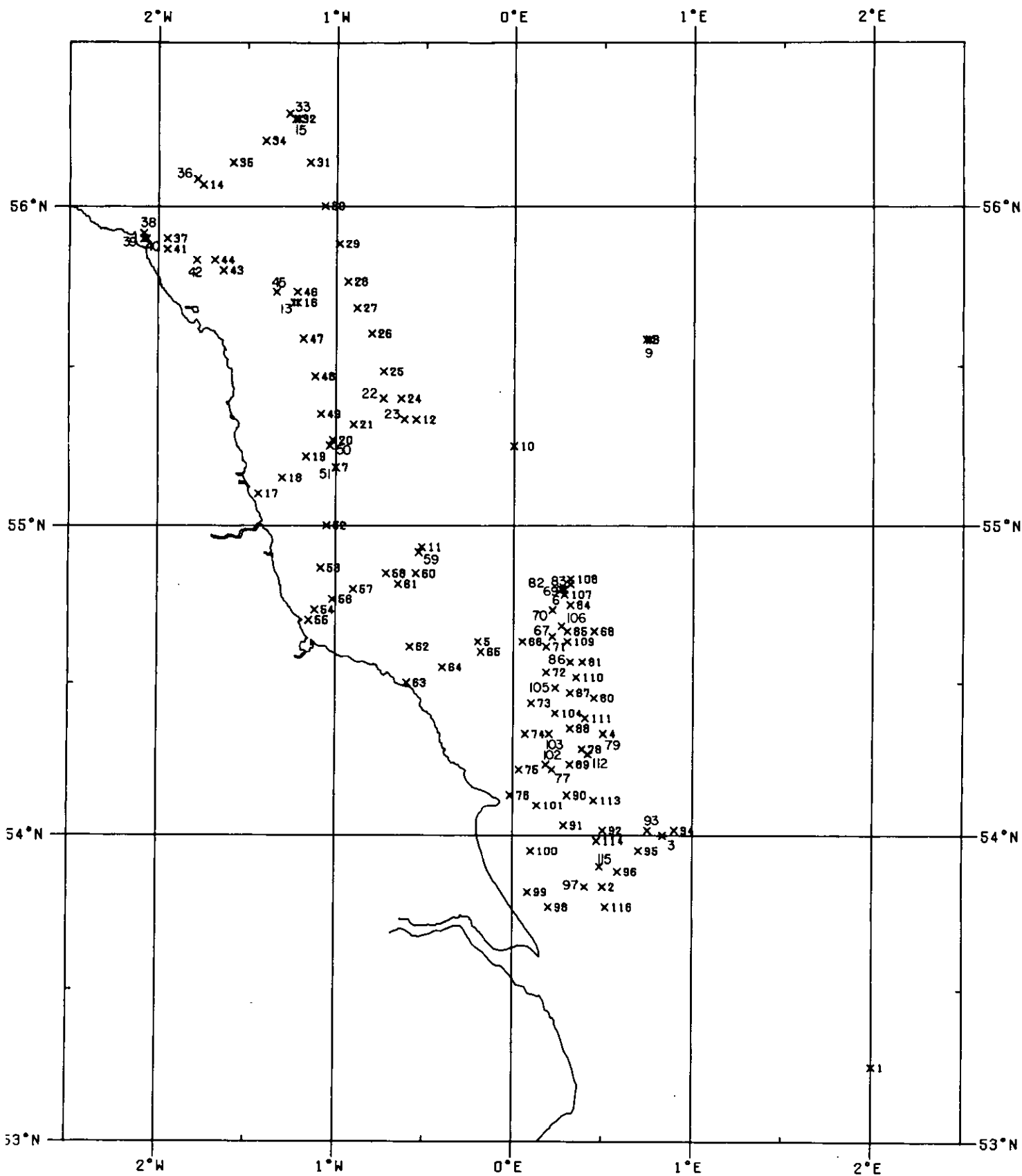


Figure 2 Map of CTD profile stations. Deployment leg

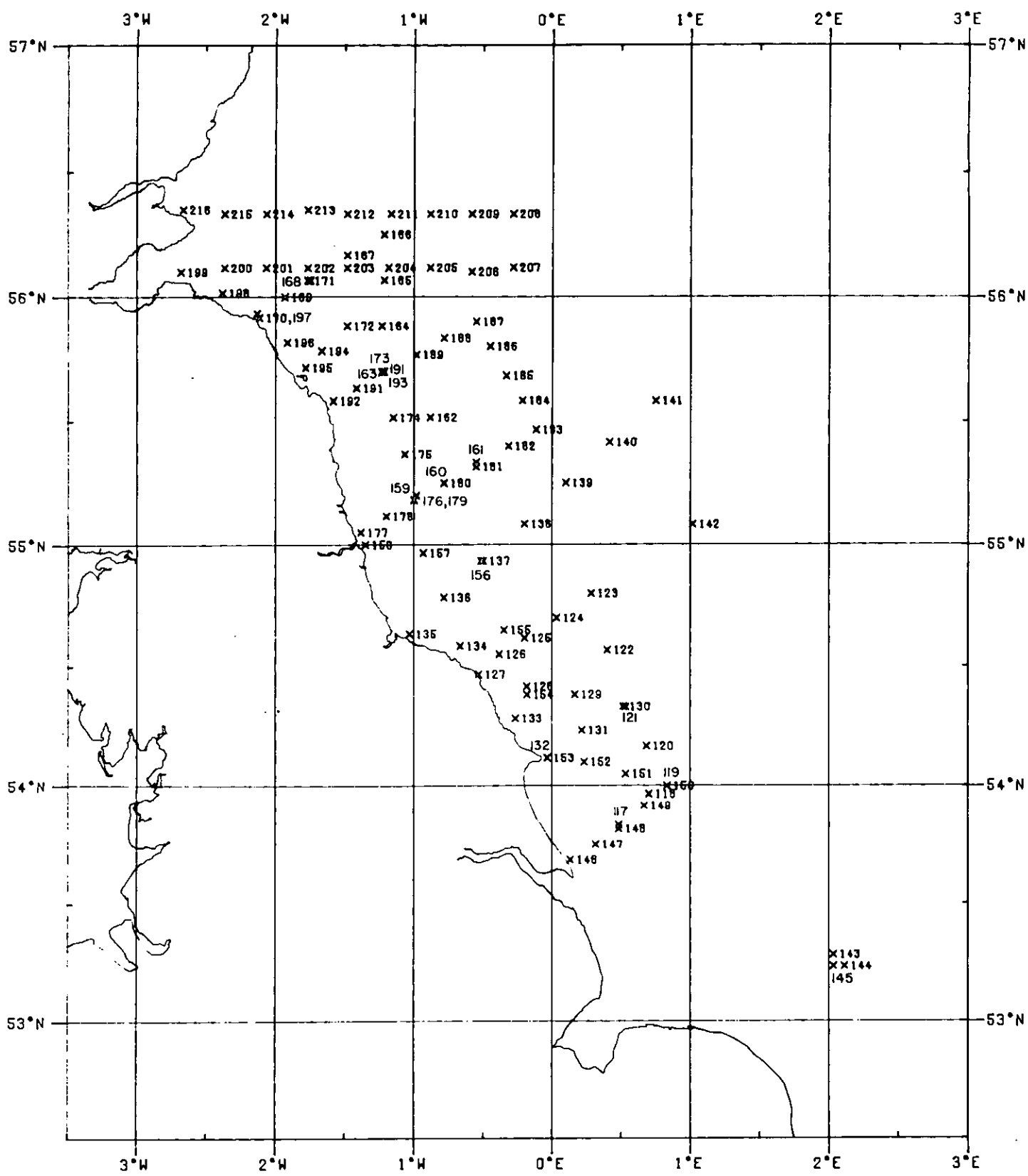


Figure 3 Map of CTD profile stations. Recovery leg

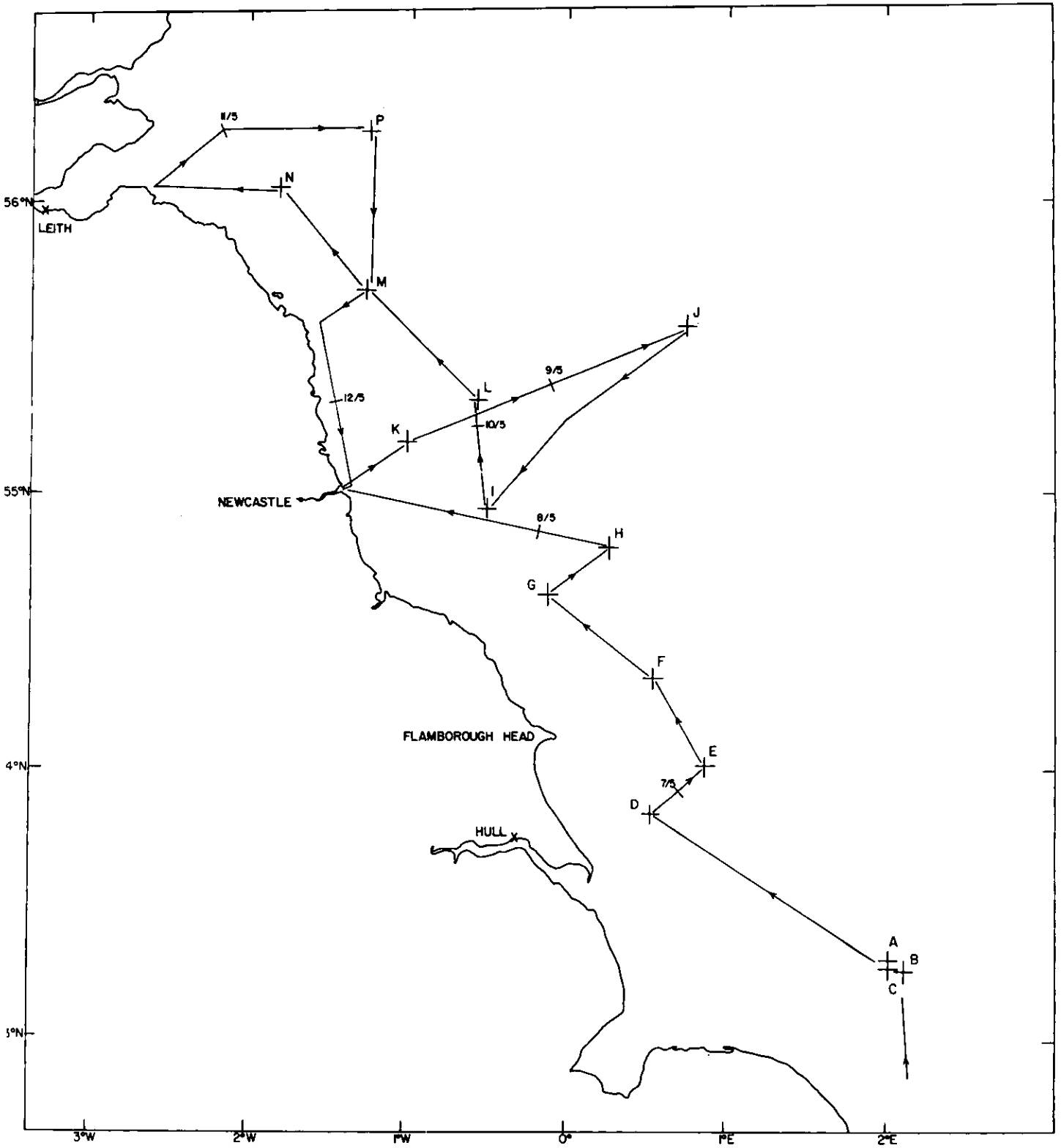


Figure 4 Deployment leg track chart

6 - 12 May

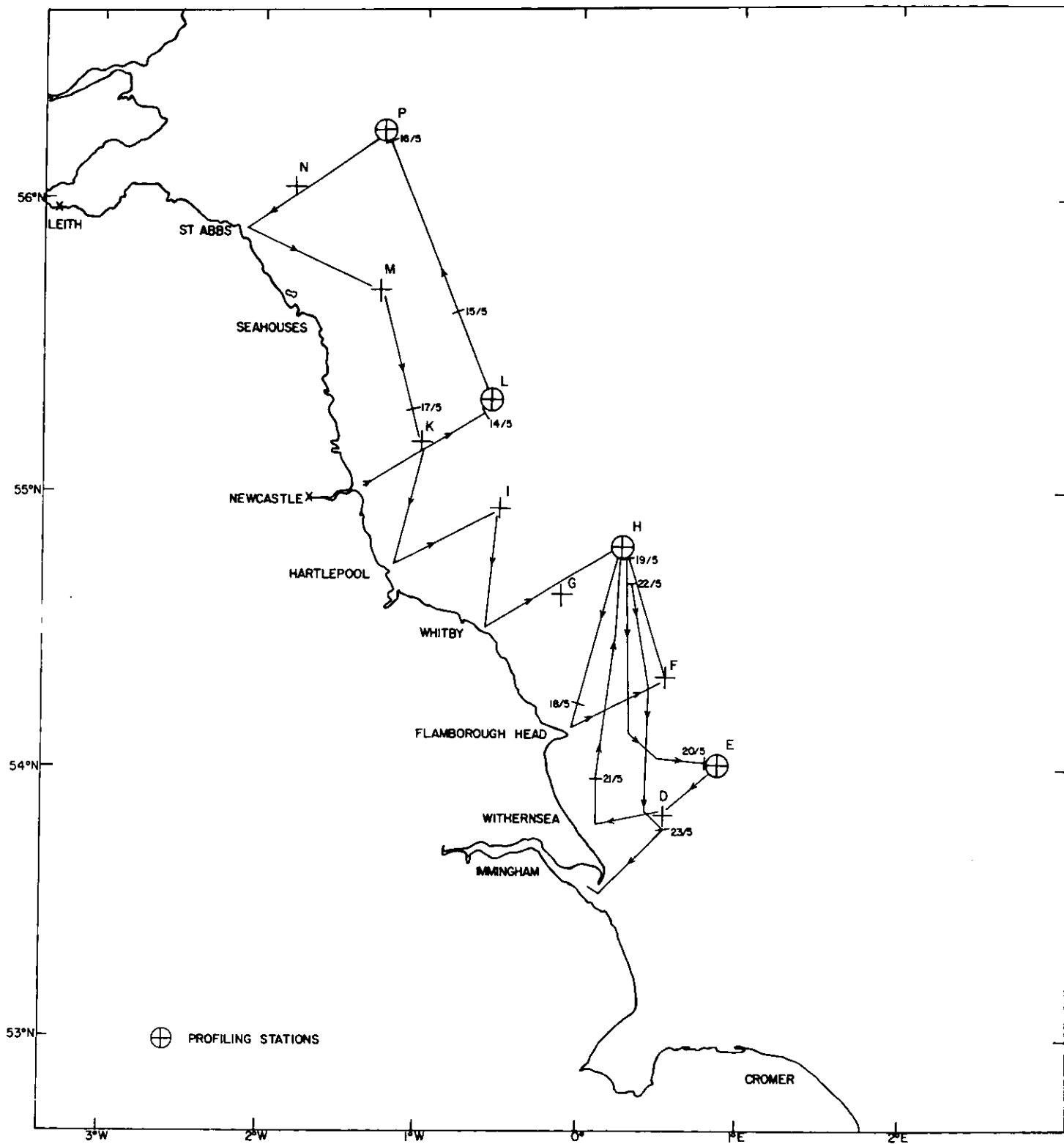


Figure 5 Deployment leg track chart

13 - 23 May

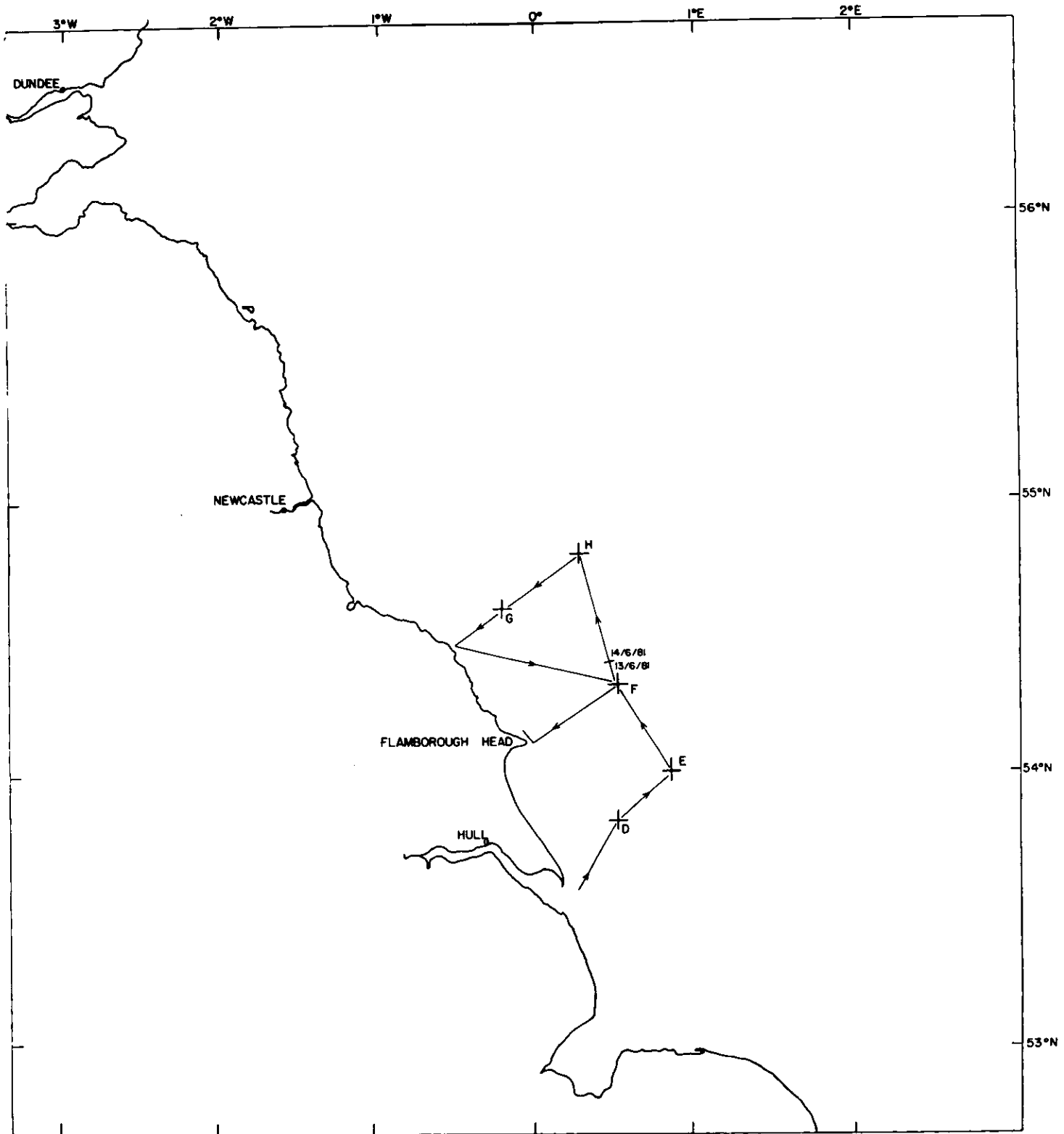


Figure 6 Recovery leg track chart

13 - 14 June

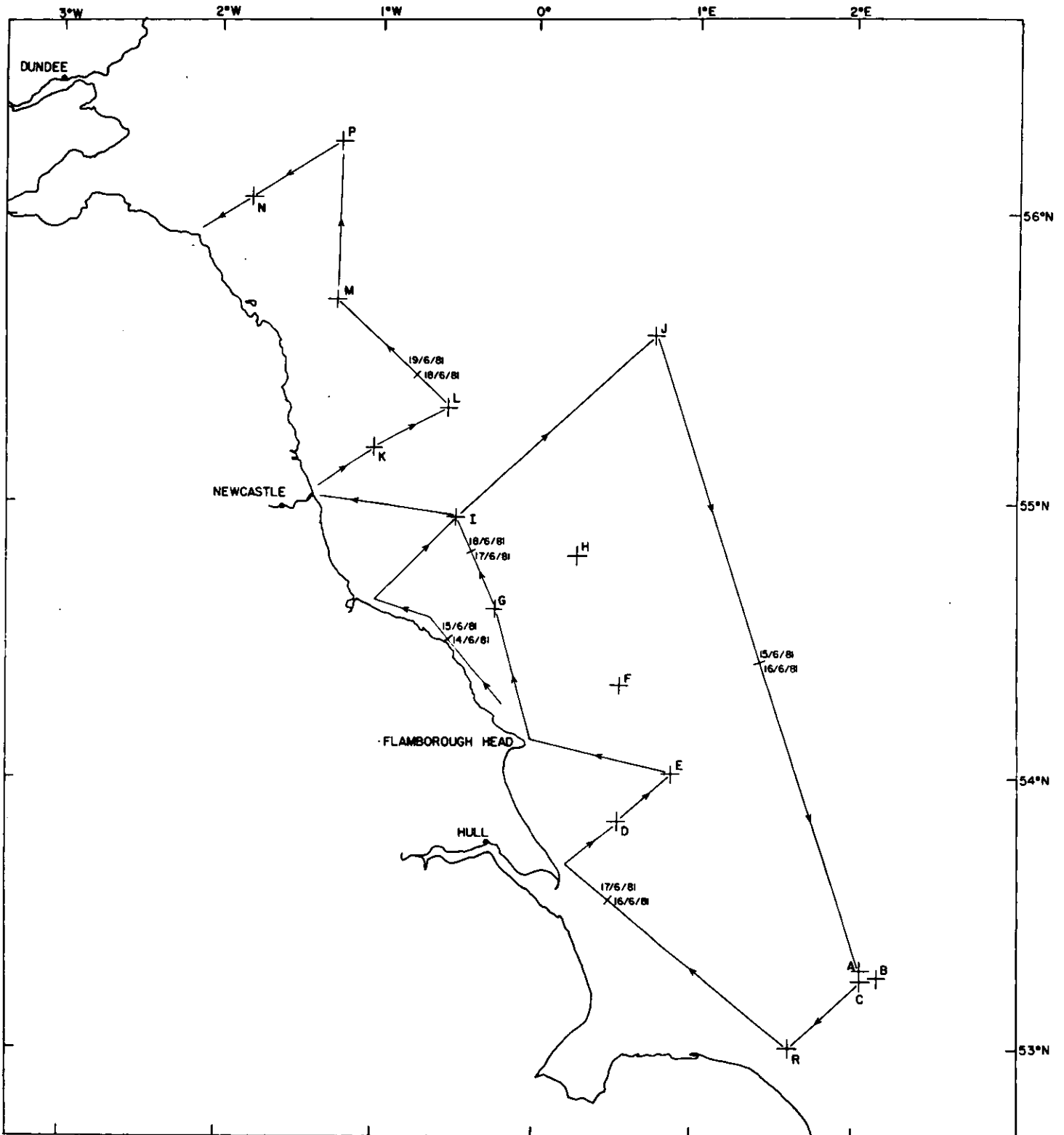


Figure 7 Recovery leg track chart

15 - 19 June

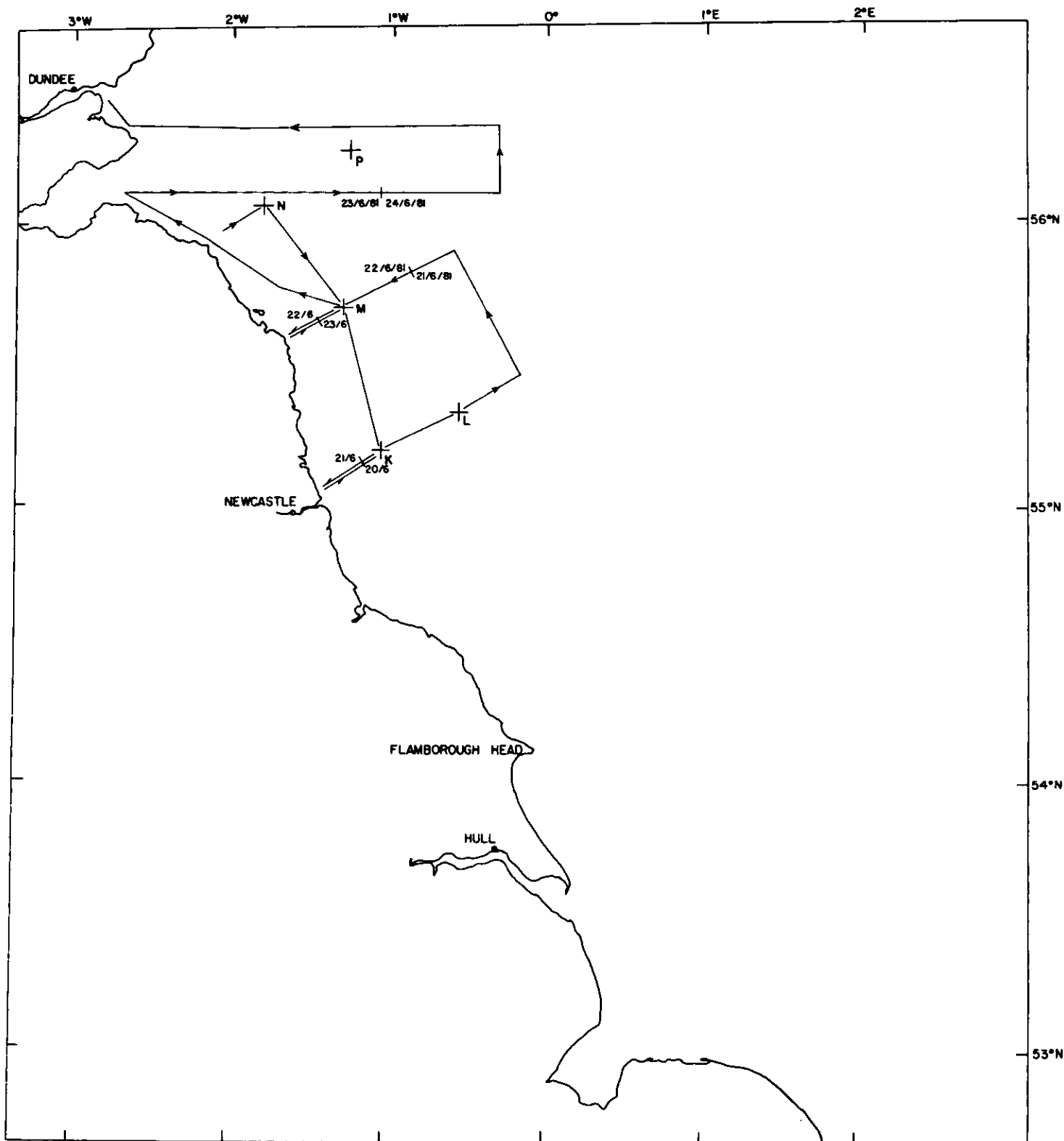


Figure 8 Recovery leg track chart

20 - 24 June

THERMISTOR CHAIN RIGS

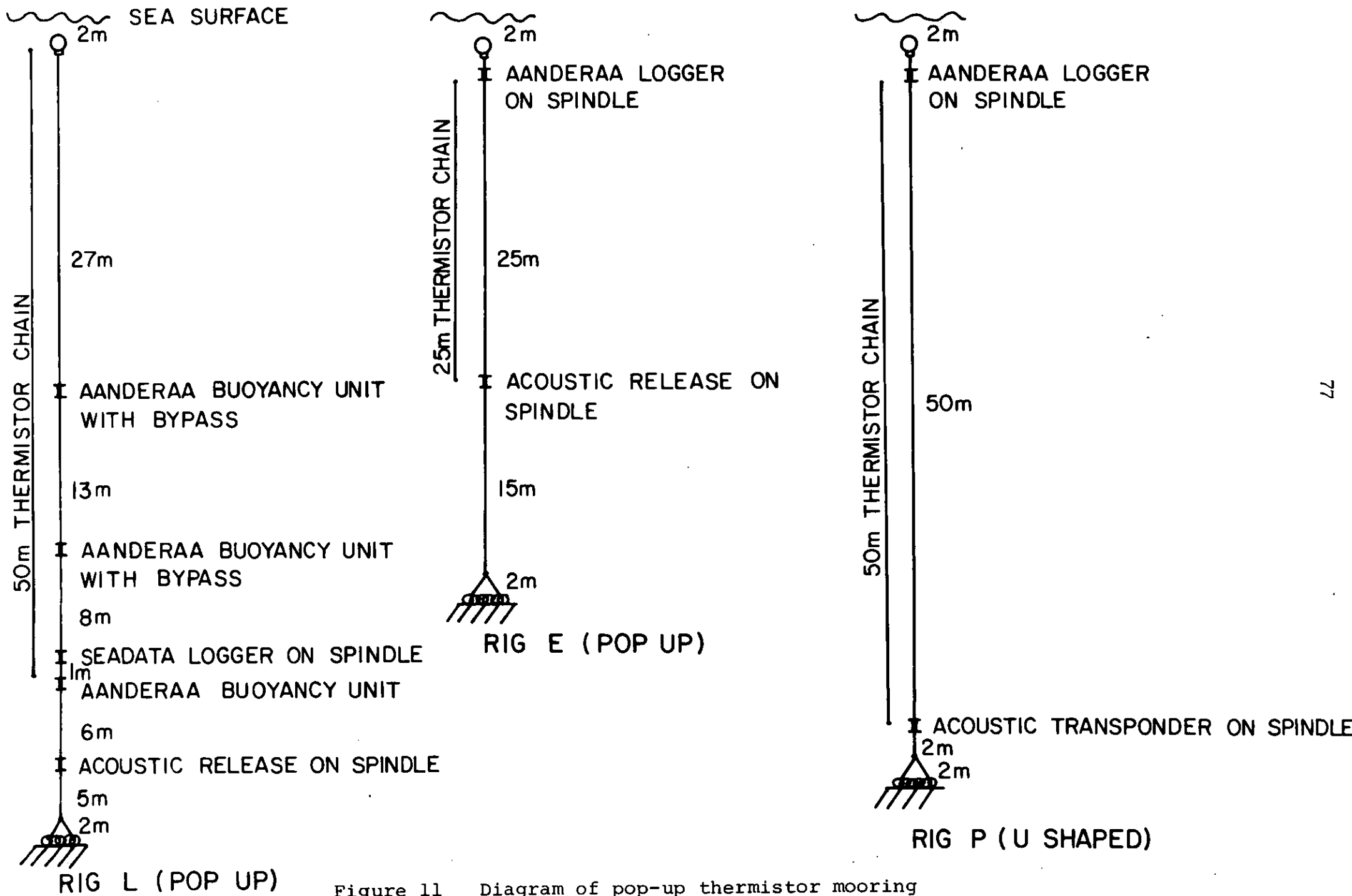


Figure 11 Diagram of pop-up thermistor mooring

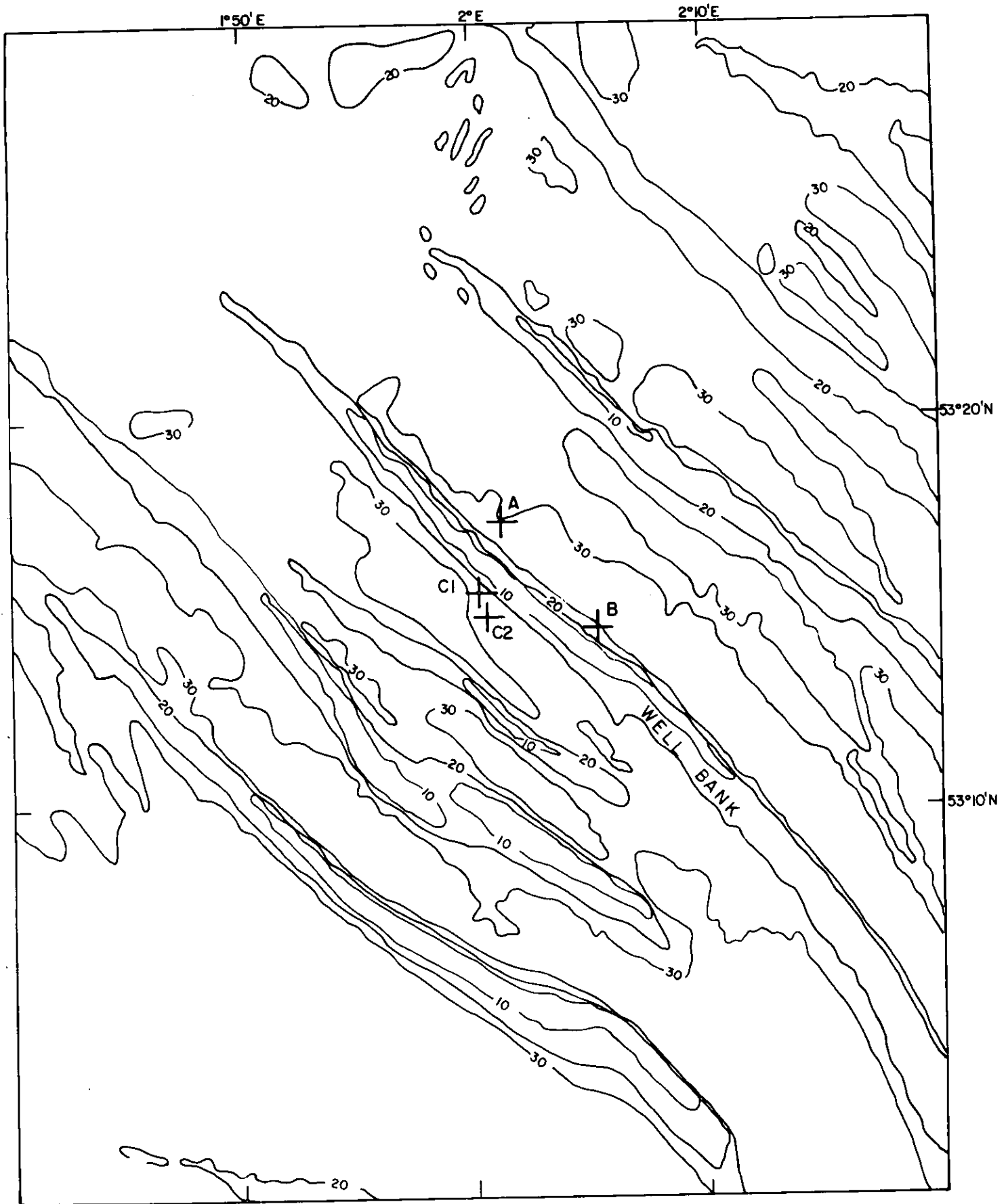
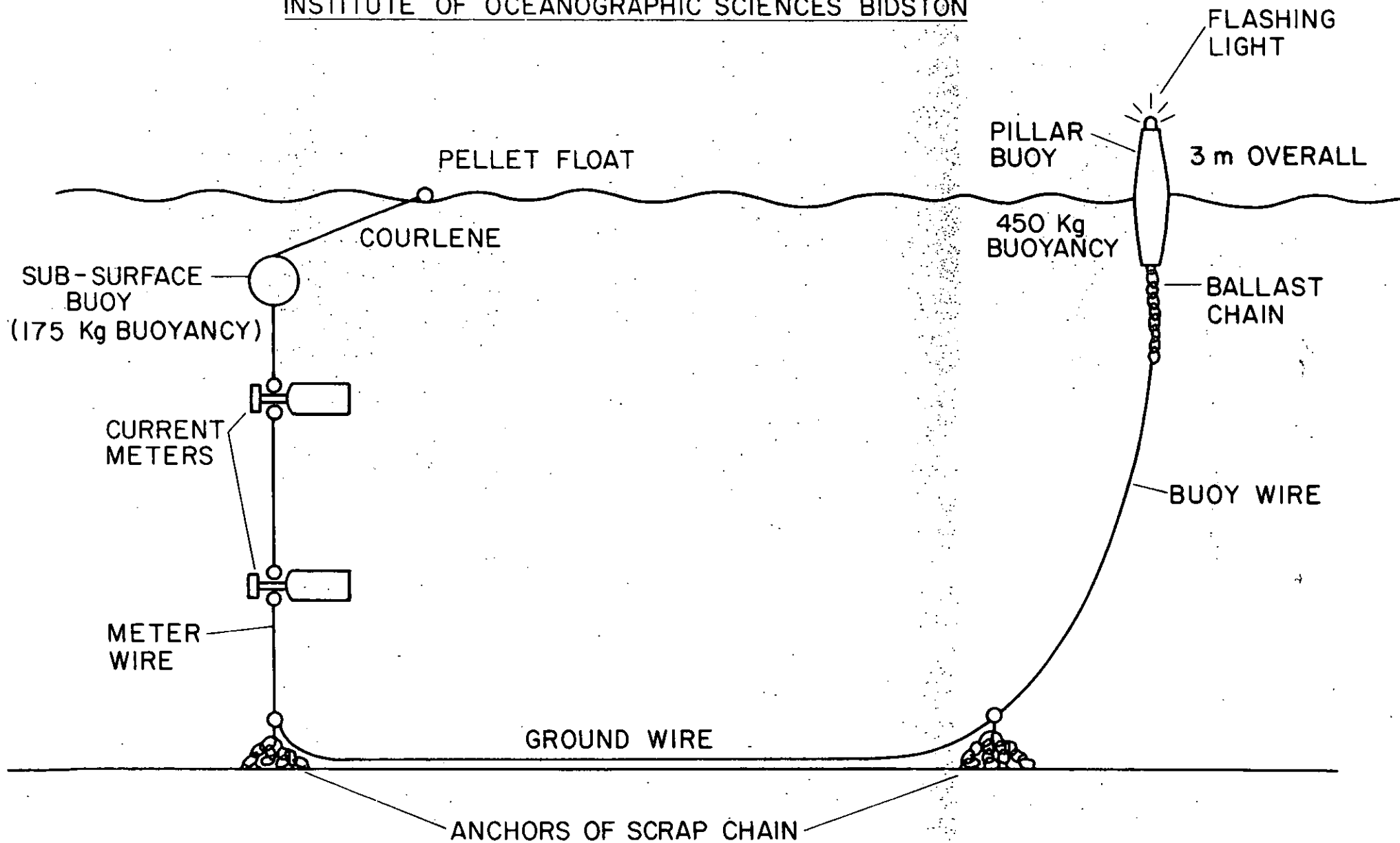


Figure 12 Bathymetry and station positions around Well Bank (A, B, C)

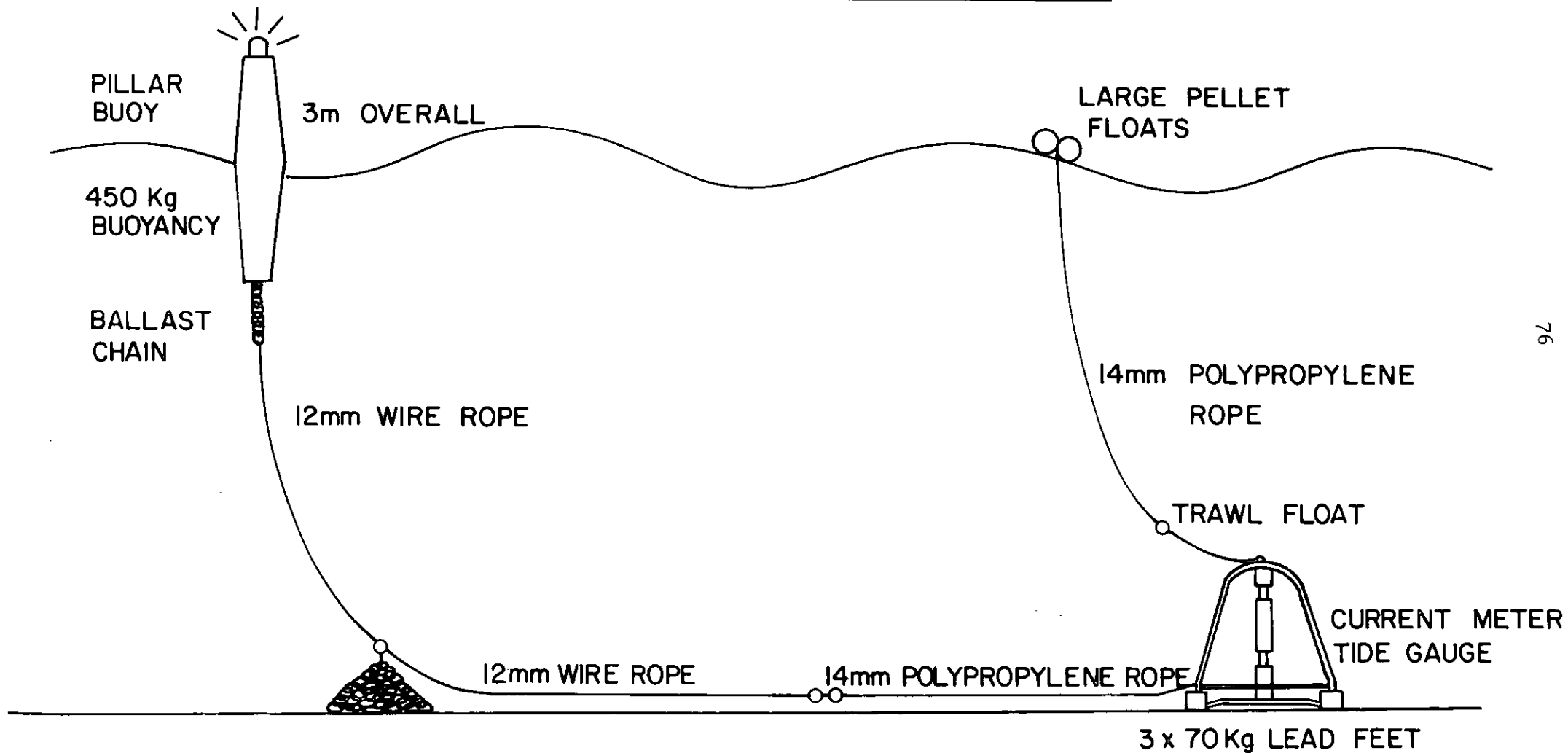
CURRENT METER MOORING SYSTEM
INSTITUTE OF OCEANOGRAPHIC SCIENCES BIDSTON



75

Figure 9 Diagram of U-shaped current meter mooring

BOTTOM MOUNTED CURRENT METER / TIDE GAUGE MOORING SYSTEM
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76

Figure 10 Diagram of U-shaped CM/TG mooring