

P.O.L.

RRS FREDERICK RUSSELL

CRUISE 7/85 and 9/85

21 August - 3 September 1985

1 October - 15 October 1985

CURRENT PROFILES

CELTIC SEA

CRUISE REPORT NO.4

1989

**PROUDMAN
OCEANOGRAPHIC
LABORATORY**

NATURAL ENVIRONMENT
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PROUDMAN OCEANOGRAPHIC LABORATORY

CRUISE REPORT NO. 4

RRS FREDERICK RUSSELL

CRUISE 7/85 : 21st August - 3rd September 1985

CRUISE 9/85 : 1st October - 15th October 1985

Current Profiles

Celtic Sea

Principal Scientists

M.J. Howarth

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1989

DOCUMENT DATA SHEET

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TITLE RRS "Frederick Russell" Cruise 7/85, 21 August - 3 September; and 9/85, 1 - 15 October, 1985. Current profiles, Celtic Sea.		
REFERENCE Proudman Oceanographic Laboratory, Cruise Report, No. 4, 35pp.		
ABSTRACT <p>During Frederick Russell 7/85 22 rigs were deployed at 5 sites in the Celtic Sea as part of a study of the vertical variation of currents in an area of weak tidal currents and during stratified conditions. 14 of the rigs were concentrated at one site, near the south coast of Ireland to be within range of a shore-based HF radar system for measuring surface currents. The remaining 8 rigs were deployed at 4 other sites to measure spatial gradients. As well as measuring currents and current profiles, particularly near the sea surface, the instruments measured sea bed pressures, temperature profiles, winds and waves.</p> <p>3 rigs were recovered on Frederick Russell 7/85 and the remainder were left for Frederick Russell 9/85. On this cruise 10 rigs were recovered but the rest, all deployed at the main site close to the coast, could not be located. 5 of them came ashore during September, October and November 1985, mainly in Ireland, leaving 4 rigs lost.</p> <p>During both cruises CTD surveys were carried out to determine the vertical structure of the temperature, salinity and density field.</p>		
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KEYWORDS CELTIC SEA TEMPERATURE SHELF CURRENTS SALINITY CURRENT PROFILES FREDERICK RUSSELL/RRS-CRUISE(1985)(7) SURFACE CURRENTS FREDERICK RUSSELL/RRS-CRUISE(1985)(9)		CONTRACT PROJECT LS-21-2 PRICE

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SCIENTIFIC PERSONNEL

- 7/85 : A.J. Bunting (25/8 - 3/9)
P.G. Collar (21/8 - 24/8)
D. Flatt
M.J. Howarth (Principal Scientist)
C.A. Hunter (21/8 - 24/8)
A.G. Kerr
D.L. Leighton
W. O'Sullivan (Observer)
R.I.R. Palin (25/8 - 3/9)
J. Perrett
- 9/85 : G. Ballard
D. Flatt
A.J. Harrison (Principal Scientist)
A.G. Kerr
D.L. Leighton
R.I.R. Palin

SHIP'S OFFICERS

	7/85	9/85
Master	E. Dowell	P. Maw
Chief Officer	N. Jonas	S. Jackson
Second Officer	S. Sykes	J. Seymour
Chief Engineer	P. Byrne	P. Byrne
Second Engineer	N. Wilson	C. Harman
Third Engineer	B. Entwistle	A. Greenhorn

ACKNOWLEDGEMENT

The co-operation and assistance of the Masters, Officers and Crew of RRS FREDERICK RUSSELL was much appreciated and contributed greatly to the success of the experiment.

OBJECTIVE - OVERALL

To measure and understand the vertical variation of current with depth in an area of weak tidal currents and in stratified conditions. Measurements of the current profile are concentrated at one site with measurements at four other sites used to determine spatial gradients.

SPECIFIC OBJECTIVES

- 1) To deploy and recover 23 rigs at five sites in the Celtic Sea (Table 1 and Fig. 2a). Fourteen of the rigs are concentrated at site 1 close to the Irish coast, to be within range of shore-based HF radar measurements of surface current. The instruments measure currents, sea bed pressures, temperature profiles, waves and winds. Three of the rigs will be recovered on the deployment cruise after about 10 days in the sea, the remainder after about 40 days in the sea.
- 2) To evaluate methods of measuring current profiles, particularly near the sea surface.
- 3) To determine the spatially varying temperature, salinity and density fields in the region of the rigs.

NARRATIVE - 7/85

The priorities for the cruise were to deploy fourteen rigs at site 1, of which three were to be recovered during the cruise, to deploy nine rigs at four other sites and to conduct a CTD survey. Because this programme exceeded the carrying capacity of RRS Frederick Russell two port calls at Milford Haven were arranged. At site 1 the rigs were to be moored in two approximately east/west lines about 500m apart and with 200m spacing between the rigs in each line (Fig. 1). At the ends of each line the rigs were to be marked with surface buoys. At each of the four other sites one rig was to be marked by a surface buoy.

RRS Frederick Russell left Birkenhead docks at 11.00 GMT on Wednesday 21st August heading for site 1, (Fig. 2a). On the way, from 15.00 to 16.20 on 22nd August, the ship stopped for wire tests of acoustic releases. Immediately on arrival at site 1, at 18.00 on 22nd August, rig deployment started since the weather forecast was poor. First, by 19.07, rig 3A, a satellite buoy, was deployed. This instrument senses the current 1m below the sea surface and telemeters the data to land via the ARGOS satellite system. A toroidal electro-magnetic sensor is mounted rigidly on a spar beneath a disc shaped, surface following buoy (Collar et al., 1988). The deployment of a second satellite buoy, which in addition recorded the data internally, was delayed while a fault in its compass channel was resolved. After more wire tests of

acoustic releases rig 12, ARIES, was deployed (21.28-21.38). ARIES is an upward looking sonar which records near surface bubble movements and is moored on a wire (Thorpe, 1986). Next an acoustic doppler current profiler, rig 0, was deployed (22.33-22.39). This instrument operates at a frequency of 1MHz and was mounted looking upwards on a wire to measure the near surface current profile (Griffiths & Flatt, 1987). Its recovery was planned for end of this cruise.

After further wire tests a pop-up current meter rig, rig 5, was deployed (01.27-01.39 on 23rd August) which supported one Vector Averaging Electro-magnetic Current Meter (VAECM). This instrument has a toroidal electro-magnetic head and records the vector averaged current on a Sea Data logger. Next a surface current meter rig, rig 4, was deployed (04.00-05.04). Five vector averaging current meters were suspended beneath a tethered surface toroidal buoy. The five, from top to bottom, were an Inter Ocean S4 - a 0.25m diameter spherical electro-magnetic current meter, an EG & G VMCM which has two orthogonal propellers and was on loan for a short period from MOD, a Bell acoustic current meter belonging to SMBA, a second S4 (SMBA) and a VAECM. By this time the second satellite buoy had been repaired and was deployed as rig 3B (09.07-09.14). An acoustic doppler current profiler was now being prepared. This instrument operates at 250 KHz and is mounted in a frame which sits on the seabed (Flatt et al., 1988). It measures the current profile over the majority of the water column. It was float tested using the ship's crane at 13.45 to check that there was sufficient buoyancy to enable its recovery and was deployed, as rig 8 (14.35-14.43).

A course was then set for Milford Haven in order to load more equipment, including the CTD system, and to exchange personnel. However, because the wind soon began blowing force 8 or 9 from the southwest shelter was sought in Ballycotton Bay, arriving there at 21.30. The next day, 24th August, the weather having improved, RRS Frederick Russell weighed anchor at 09.15 and arrived off Milford Haven at 18.30, docking at 22.30 when the state of the tide was suitable. Loading started at 06.30 on 25th August and the ship left the docks at 12.30, heading for site 1, into the swell (Fig. 2b). At the entrance to the Haven the ship stopped whilst the surface sampling pump was located in the shoe on the side of the ship.

By the time site 1 was reached, at 07.30 on 26th August, the swell had died down. The buoys on rigs 3A, 3B and 4 were sighted and checked. The operators at the HF radar surface current measurement station at Old Head of Kinsale were contacted by VHF radio and reported that both stations were now functional

although a fault at the Galley Head station had delayed operations there by a couple of days. An Aanderaa meteorological station mounted on an 8 ft diameter toroid, rig 9, was deployed (08.05-08.23). After some wire tests of acoustic releases rig 6, a conventional pop-up current meter rig with four Aanderaa current meters, was deployed (09.58-10.06). Next to be deployed (11.32-11.35) was rig 11, a pop-up rig containing an Aanderaa thermistor chain connected to a Sea Data logger, followed by rig 10, a Waverider buoy (12.38-12.46). The receiving station for the Waverider was attached to the lighthouse at Old Head of Kinsale. Finally rig 7, a combined current meter and pressure recorder in a bottom frame, was moored in a 'U' shaped rig, frame last (14.56-15.15). Since the Waverider buoy was noticed to be drifting free it was recovered at 15.36 and re-attached to its mooring, marked by some pellet floats, at 16.24. The rubbercord had parted immediately beneath the buoy. After the first CTD dip had been recorded (17.00) a course was set for site 4.

On arrival at site 4 rig 19, a combined current meter and pressure recorder in a bottom frame, was deployed (23.22-00.03, 27th August). The other rig at the site, rig 18, a pop-up mooring with four Aanderaa current meters was then deployed (01.21-01.27). After the second CTD dip had been recorded (02.03) some acoustic releases were wire tested and the ship headed for Milford Haven. At 10.30 she anchored off Milford Haven and the surface sampling pump was brought inboard. At 14.45 she berthed at Milford Haven docks and the equipment was loaded. Because gales were forecast departure was delayed a day, until 15.05 on 28th August. The surface sampling pump was deployed at 16.06.

When site 3 was reached, Fig. 2c, at 21.30, some acoustic releases were wire tested. Rig 16, a teleost sea bed mounted pressure recorder was deployed at 23.30 followed by rig 15, a 'U' shaped mooring with four Aanderaa current meters (00.04-00.24, 29th August). Before heading for site 5 CTD dip number 3 was recorded (00.55).

On arrival at site 5, at 06.45, the final set of acoustic releases were wire tested. A pop-up thermistor chain mooring, rig 20, was then deployed (08.01-08.05) followed by rig 21, a 'U' shaped mooring with four Aanderaa current meters (08.37-09.10). During this deployment the rotors of two of the current meters were knocked out and were replaced. CTD dip number 4 was recorded by 09.38.

At site 1 all buoys were checked before the deployment of two short term rigs. The first, rig 2, consisted of two toroidal electro-magnetic sensors mounted 0.5 and 1m beneath a thin toroidal sea surface slope following buoy

(13.24-13.39). The second, rig 1, again with electro-magnetic sensors, was designed to measure currents at 0.1, 0.2 and 0.3m below the sea surface (15.16-15.32). The met. buoy (rig 9) was now recovered (16.06-16.38) since during the rig check it was noticed that the cup anemometer was sticking. After the anemometer had been stripped and lubricated the met. buoy was re-deployed (17.30-17.41) and a course set for site 2.

On arrival at site 2, at 22.00, rig 13, a 'U' shaped mooring with four Aanderaa current meters, was deployed (22.32-22.49) followed by a teleost pressure recorder, rig 14, at 23.46. Rig 17 was not deployed because the Sea Data logger for a thermistor chain was not working. The rig deployments were now complete.

For the next day (30th August) a CTD survey was conducted off southwest Ireland with 17 dips recorded (from number 5 at site 2 through number 17, also at site 2, to number 21). At 00.00 on 31st August RRS Frederick Russell hove to because it had become too rough to work, with 40 knot southerly winds. At 08.00 it was decided to seek shelter in Courtmacsherry Bay, where RRS Frederick Russell anchored at 12.15. The bay was convenient for site 1 and also enabled visits to the HF radar surface current measurement stations at Galley Head and Old Head of Kinsale.

Since the weather had improved on the next day, 1st September, RRS Frederick Russell weighed anchor at 07.40 and proceeded to site 1, arriving at 10.00, CTD dip number 22 having been recorded on the way. Four rigs were recovered: rig 4 (10.00-11.03), rig 1 (11.15-12.29, buoy upside down), rig 2 (12.36-12.59) and rig 0 (13.18-13.50). Rig 4 was due to be re-deployed without the VMCM and after the transferral of the data from the solid state memories of the S4s onto floppy discs and after the batteries and tape in the VAECM had been changed. After checking the other surface buoys a depth survey of the site was conducted (15.11-16.03) and some acoustic releases were wire tested. Finally rig 4 was re-deployed with four vector averaging current meters (S4, Bell, S4, VAECM), 18.59-19.38.

A dog-leg course was set for site 5 recording CTD dips on the way (number 23 at site 1 to number 30 at 05.30 on 2nd September at site 5). It was planned to continue CTD dips to site 4 but since the weather had become too rough a course was made straight for Falmouth. The surface pump was switched off at 17.00; RRS Frederick Russell anchored off Falmouth at 23.00 and docked at 07.30 on 3rd September.

All the rig deployment and recovery work had been completed and part of the

CTD survey, despite a succession of storms during each of which a day's work was lost and which were each separated by a couple of fine days.

NARRATIVE - 9/85

RRS Frederick Russell sailed from Falmouth at 10.00 on Thursday 1st October and at 10.40, after deploying the overside pump to monitor sea surface temperature and conductivity, the ship headed for site 4 (Fig. 3a). At 21.56 the ship passed site 4 but, when nothing was sighted, a course was set for site 1 which was eventually occupied at 04.25 on the following day. CTD cast no. 31 was taken at 07.00 and a search for moorings started at 07.36. Mooring 3A, the SAT buoy, was sighted at 08.44 and, after firing the acoustic release, was recovered at 09.30. The Met buoy was located on position but the weather was too rough to attempt a recovery at this time. Further searching for moorings 3B, 4, 6, 7, 11 and 12 was unsuccessful so the ship left site 1 at 13.13 and moved due east to arrive at site 5 at 16.00. After completing CTD cast no. 32 at 16.25, moorings 20 and 21 were both recovered successfully at 17.20 and 18.55 respectively, in deteriorating weather conditions.

The bad weather persisted for several days forcing RRS Frederick Russell to seek shelter in Ballycotton Bay from 3rd October until 5th October, when, due to stormy winds, the anchor chain broke and the ship had to put to sea and ride out the weather hove to. Throughout Tuesday 6th October the ship made slow progress to the south into heavy seas and eventually arrived at site 4 at 05.00 on 7th October. Again nothing was sighted but, after carrying out CTD cast no. 33 at 06.00, the acoustic pinger on mooring 18 was activated and released at 07.20. After the pop-up mooring was successfully recovered an acoustic box-search for mooring 19 revealed nothing, so the ship left site 4 at 09.05 and headed for site 3. The surface buoy marking mooring 15 was sighted as the ship approached site 3, so recovery started immediately the station was occupied at 13.56, and was successfully completed by 14.41. Mooring 16 was then located on position and the pinger was switched on at 15.09. CTD cast no. 34 was taken at 18.10, but several attempts to release the pop-up frame of mooring 16 from the sea-bed failed and it was not until 07.06 the following morning, Thursday 8th October, that the release was operated and mooring 16 was successfully recovered at 07.22. On departing from site 3 a course was set for site 1 but, with worsening weather and the ship's speed down to $4\frac{1}{2}$ knots, it was decided to make for Milford Haven to discharge equipment. The surface sampling pump was brought inboard at 07.35 and the ship docked at 12.25 on Friday 9th October.

With the mid-cruise port call completed, and a new anchor fitted, the ship sailed at 13.05 on Saturday 10th October and headed for site 2, Fig. 3b, deploying the surface sampling pump whilst still inside the harbour approaches at 14.02. As the ship approached site 2 at 12.00 the following day, the surface buoy marking mooring 13 was visible on radar at a distance of 3 miles and by 13.00 the mooring was recovered complete. CTD cast no. 35 was taken at 13.37 and the pop-up frame of mooring 14 was recovered successfully by 14.43. With each of the 5 sites now visited the CTD survey was started, with stations spaced about 10 miles apart along sections running seaward from the Irish coastline (see Fig. 3b). The position and station number of each cast is given in Table 3. Site 1 was re-occupied during the survey and at 05.17 on Monday 12th October an extensive acoustic search was started, together with dragging, but this failed to find any of the missing moorings. At 14.30 the Met buoy, mooring 9, was recovered in good order and at 15.20 the ship left site 1 to resume the survey. The following day site 4 was re-occupied and after a short acoustic search, starting at 05.50, mooring 19 was located and the marker pellets sighted on position, the surface buoy having been reported missing at a previous time. The ship's inflatable boat was launched to aid the recovery of the pellet line and the mooring was successfully brought onboard at 08.20. The CTD survey continued throughout the 13th and 14th October and the ship docked at Milford Haven on schedule in the early hours of 15th October.

All the rigs (eight) at sites 2,3,4 and 5 were recovered, but of the eleven rigs left at site 1 at the end of Frederick Russell 7/85 only two were recovered (a satellite buoy and the met. buoy). Of the remaining nine rigs, five came ashore during September, October and November - three in southern Ireland, one taken to France by a trawler and one drifting to the Morecambe Bay gas field, leaving four lost, Table 2. The losses at site 1 must be ascribed to heavy fishing close to the coast - the position of the site was, however, dictated by the range (about 30km) of the surface current measuring HF radar.

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RIG REPORTS

Rig 0 - Site 1

Instruments : Upward looking 1 MHz acoustic doppler current profiler at 74m above sea bed.
Aanderaa temperature and pressure recorder at 69m above sea bed.

Mooring : Pop-up. Acoustic release 2320; four 17" glass spheres.

Deployment : 22.33 - 22.39 22nd August 1985; meter first.

Meter in water : 22.35
Water depth (m) : 96
Position/Decca 7D : 51° 25.2'N 8° 39.7'W : J20.76, -, D67.71

Recovery : 13.18 - 13.50 1st September 1985

Release fired : 13.35
Meter out of water : 13.50
Position : J20.76, -, D67.65

Rig 1 - Site 1

Instrument : Multi-level vector averaging electro-magnetic current meter with sensors 0.1, 0.2 and 0.3m below the sea surface.

Mooring : Single-point with acoustic release 2327 and 32" sub-surface buoy.

Deployment : 15.16 - 15.32 29th August 1985; surface buoy first.

Water Depth (m) : 95
Position/Decca 7D : 51° 24.8'N 8° 38.8'W : J20.21, -, D69.22

Recovery : 11.15 - 12.29 1st September 1985

Release fired : 12.15
Meter out of water : 12.29
Position : J20.27, -, D69.10

Comment : Surface buoy upside down.

Rig 2 - Site 1

Instrument : Double vector averaging electro-magnetic current meter with sensors 0.5 and 1m below the sea surface.

Mooring : Single-point with acoustic release 2506C and 34" sub-surface buoy.

Deployment : 13.24 - 13.39 29th August 1985; surface buoy first.

Meter in water : 13.24

Water depth (m) : 95

Position/Decca 7D : 51° 25.1'N 8° 38.4'W : J19.64, -, D69.54

Recovery : 12.36 - 12.59 1st September 1985

Release fired : 12.43

Meter out of water : 12.59

Position/Decca 7D : J19.55, -, D69.55

Rig 3A - Site 1

Instrument : Satellite buoy with electro-magnetic current meter 1m below the sea surface.

Mooring : Single-point with acoustic release 233 and 32" sub-surface buoy.

Deployment : 18.30 - 19.07 22nd August 1985; surface buoy first.

Meter in water : 18.30

Water Depth (m) : 96

Position/Decca 7D : 51° 25.2'N 8° 39.2'W : J20.30, -, D68.36

Recovery : 08.44 - 09.30 2nd October 1985

Release fired : 08.54

Meter out of water : 09.12

Position/Decca 7D : J20.38, -, D68.15

Comments : Rough, wind force 7.

Rig 3B - Site 1

Instrument : Satellite buoy with electro-magnetic current meter 1m below the sea surface and internal logger.

Mooring : Single-point with acoustic release 236 and 32" sub-surface buoy.

Deployment : 09.07 - 09.14 23rd August 1985; surface buoy first.

Meter in water : 09.08

Water depth (m) : 96

Position/Decca 7D : 51° 24.8'N 8° 39.3'W : J20.70, -, D68.58

Recovery : The surface buoy was cut adrift on 3rd September by a fishing vessel and later recovered from Concarnot. The remainder of the mooring was recovered by a Kinsale fishing vessel on 21st October 1985 and returned.

Rig 4A - Site 1

Instruments : Five vector averaging current meters:-
Inter Ocean S4 no. 443 (Bidston), EG&G VMCM no. 400604 (MOD), Bell no. 640.002 (SMBA), S4 no. 436 (SMBA), VAECM no. BD01 (Bidston) at 4, 7, 9, 14, 19m below the sea surface.

Mooring : Eta rig. Meters suspended beneath a tethered surface toroidal buoy no. 7. Spherical command pinger S02, 32" sub-surface buoy no. 8.

Deployment : 04.00 - 05.04 23rd August 1985; meters and surface buoy first.

Meters in water : 04.13, 04.22, 04.35, 04.35, 04.48 (bottom to top).

Water depth (m) : 94

Position/Decca 7D : 51° 24.7'N 8° 39.5'W : J20.95, -, D68.44

Recovery : 10.00 - 11.03 1st September 1985

Meters out of water : 10.13, 10.17, 10.17, 10.21, 10.22 (top to bottom)

Position/Decca 7D : J21.02, -, D68.29

Comments : During the approach to the surface buoy the buoyant polypropelene tether between the sub-surface and surface buoys caught on the underneath of the ship. The polypropelene was cut and the sub-surface end buoyed off for recovery after the surface buoy and current meters.

Rig 4B - Site 1

Instruments : 4 vector averaging current meters:-
(SMBA), Inter Ocean S4 no. 443 (Bidston), Bell no. 640-002
S4 no. 436 (SMBA), VAECM no. BD01 (Bidston) at 5, 9,
14, 19m below the sea surface.

Mooring : Eta rig. Toroid no. 7, 32" sub-surface no. 8,
spherical command pinger S02.

Deployment : 18.59 - 19.38 1st September 1985

Meters in water : 19.07, 19.11, 19.16, 19.24 (bottom to top)
Water depth (m) : 95
Position/Decca 7D : 51° 24.8'N 8° 39.7'W : J20.98, -, D68.04

Recovery : The rig was not located despite visual, acoustic and
dragging searches on 2nd and 12th October 1985.

Rig 5 - Site 1

Instrument : VAECM no. BD02 at 81m above the sea floor.

Mooring : Pop-up. Acoustic release no. 2504; 32" sub-surface
buoy no. 15; back-up buoyancy.

Deployment : 01.27 - 01.39 23rd August 1985; sub-surface buoy first.

Meter in water : 01.34
Water depth (m) : 94
Position/Decca 7D : 51° 24.9'N 8° 39.8'W : J21.10, -, D67.76

Recovery : An Irish fishing vessel from Glandore recovered the rig
floating on the surface 6 miles offshore on 9th
September 1985 and returned it. The acoustics were
missing but the release bar was recovered - the pyros
had not fired.

Rig 6 - Site 1

Instruments : Four Aanderaa RCM 4s nos. 1865, 1749, 5525, 5523 at 24, 42, 51 and 61m above the sea bed.

Mooring : Pop-up. Acoustic release no. 2375c; 32" sub-surface buoy no. 2, back-up buoyancy.

Deployment : 09.58 - 10.06 26th August 1985; buoy first.

Meters in water : 09.59, 10.00, 10.00, 10.00 (top to bottom)

Water depth (m) : 94

Position/Decca 7D : 51° 24.8'N 8° 40.2'W : J21.50, -, D67.42

Recovery : The rig was not located despite visual, acoustic and dragging searches on 2nd and 12th October 1985.

Rig 7 - Site 1

Instrument : Current meter/pressure recorder no. 6 in a bottom frame.

Mooring : 'u' shaped. Toroidal surface buoy no. 4. Spherical command pinger no. S10.

Deployment : 14.56 - 15.15 26th August 1985; surface buoy first.

Meter in water : 15.11

Water depth (m) : 96

Position/Decca 7D : 51° 25.0'N 8° 40.5'W : J21, -, D66.70

Recovery : The rig was not located despite visual, acoustic and dragging searches on 2nd and 12th October 1985. On 25th October 1985 the surface buoy was reported at 51° 28.2'N 8° 35'W, 4.7 miles off station. An Irish fishing vessel was chartered on 15th November 1985 and the surface buoy, anchor and ground-line recovered, but no instrument.

Rig 8 - Site 1

Instrument : 250 KHz acoustic doppler current profiler.
Mooring : Pop-up, bottom frame. Acoustic release 2421.
Deployment : 14.35 - 14.43 23rd August 1985.
Meter in water : 14.41
Water depth (m) : 94
Position/Decca 7D : 51° 24.8'N 8° 40.0'W : J21.34, -, D67.53
Recovery : The instrument was recovered floating on the surface about 20 miles west of its deployed position by the Irish Navy on 11th September 1985 and returned. The pyro releases had not fired but the plastic top of the release bar had worn through.

Rig 9 - Site 1

Instrument : Aanderaa meteorological station.
Mooring : Single-point all chain. 8 ft diameter toroid.
Deployment : 08.05 - 08.23 26th August 1985.
Buoy in water : 08.08
Water depth (m) : 94
Position/Decca 7D : : J21.73, -, D67.20
Recovery : 16.06 - 16.38 29th August 1985. Anemometer sticking.
Out of water : 16.38
Deployment : 17.30 - 17.41 29th August 1985. Anemometer fixed.
Buoy in water : 17.32
Water depth (m) : 96
Position/Decca 7D : 51° 24.6'N 8° 40.4'W : J21.88, -, D67.22
Recovery : 14.00 - 14.29 12th October 1985.
Buoy out of water : 14.16
Position/Decca 7D : : J21.81, -, D67.22

Rig 10 - Site 1

Instrument : Waverider buoy no. 67407-9.
Mooring : Standard single-point.
Deployment : 12.38 - 12.46 26th August 1985.
Water depth (m) : 96
Position/Decca 7D : 51° 25.1'N 8° 40.2'W : J21.32, -, D67.04
Comment : Since the buoy was observed to be floating free it was
recovered at 15.36 and re-attached to its mooring at
16.24.
The rubbercord beneath the buoy had parted.
Recovery : The buoy came ashore at Skull, S.W. Eire on 19th
September 1985 and was returned.

Rig 11 - Site 1

Instrument : Aanderaa thermistor chain no. 476, 30-80m above the
sea bed. Sea Data logger no. 5 beneath the chain.
Mooring : Pop-up with back up buoyancy. Acoustic release no.
2367c;
32" sub-surface buoy no. 5.
Deployment : 11.32 - 11.35 26th August 1985. Buoy first.
Water depth (m) : 96
Position/Decca 7D : 51° 25.1'N 8° 39.8'W : J20.96, -, D67.44
Recovery : The rig was not located despite visual, acoustic and
dragging searches on 2nd and 12th October 1985.

Rig 12 - Site 1

Instrument : ARIES 52m above the sea floor.
Mooring : Pop-up. Acoustic release 2503c. 32" sub-surface buoy.
Deployment : 21.28 - 21.38 22nd August 1985; meter first.
: 21.28
Water depth (m) : 96
Position/Decca 7D : 51° 25.1'N 8° 39.5'W : J20.70, -, D68.02
- Recovery : Recovered by operators of Morecambe Bay Gas Field on
15th October 1985. Release had triggered prematurely.

Rig 13 - Site 2

Instruments : Four Aanderaa RCM4s nos. 5526, 1139, 4968, 5521 at
40, 75, 85, 95m above the sea floor.
Mooring : 'u' shaped. 6m spar buoy no. 2; 40" sub-surface buoy
no. 13; spherical command pinger S15.
Deployment : 22.32 - 22.49 29th August 1985.
Meters in water : 22.32 - 22.34 (top to bottom)
Water depth (m) : 122
Position/Decca 7D : 51° 08.3'N 9° 48.2'W : C15.85, -, B62.55
Recovery : 12.20 - 13.03 11th October 1985
Meters out of water : 12.54, 12.58, 13.01, 13.03 (bottom to top)
Water depth (m) : 122
Position : C16.06, -, B62.22
Comment : All current meter rotors obstructed by marine growth.

Rig 14 - Site 2

Instrument : Teleost pressure recorder, TG284.
Mooring : Pop-up, sea bed frame no. 7; acoustic release 227.
Deployment : 23.46 29th August 1985.
Water depth (m) : 120
Position/Decca 7D : 51° 08.7'N 9° 48.6'W : C15.40, -, B62.71
Recovery : 14.00 - 14.43 11th October 1985
Release fired : 14.30
Position/Decca 7D : C15.55, -, B62.84

Rig 15 - Site 3

Instruments : Four Aanderaa RCM4s nos. 7570, 4388, 6442, 5522 at
15, 30, 40, 50m above the sea floor.
Mooring : 'u' shaped. 6m spar buoy no. 3; 40" sub-surface buoy
no. 14; spherical command pinger S06.
Deployment : 00.04 - 00.24 29th August 1985.
Meters in water : 00.04 - 00.05 (top to bottom)
Water depth (m) : 71
Position/Decca 1B : 51° 44.9'N 6° 38.2'W : -, B30.50, H75.43
Recovery : 13.44 - 14.41 7th October 1985.
Meters out of water : 14.30, 14.33, 14.37, 14.41 (bottom to top)
Position/Decca 1B : -, B30.7, H75.6
Comments : Wind gusting to 50 knots.

Rig 16 - Site 3

Instruments : Teleost, pressure recorders TG289 and TG281.
Mooring : Pop-up, sea bed frame no. 8; acoustic release 2420.
Deployment : 23.30 28th August 1985.
Water depth (m) : 70
Position/Decca 1B : 51° 44.7'N 6° 37.1'W : -, B30.12, H75.64
Recovery : 06.18 - 07.22 8th October 1985
Release fired : 07.06
Position/Decca 1B : -, B30.07, H75.41
Comment : 15.09 - 17.54 7th October, transmitted to release pinger, switched to release mode, but unable to trigger the pyros.

Rig 17 - Site 2 - Not deployed.

Rig 18 - site 4

Instruments : Four Aanderaa RCM4's nos. 6440, 4387, 570, 1509 at 25, 45, 55, 65m above the sea floor.
Mooring : Pop-up, acoustic release 229c, 32" sub-surface buoy no. 7, back-up buoyancy.
Deployment : 01.21 - 01.27 27th August 1985, buoy first.
Meters in water : 01.22, 01.23, 01.23, 01.24 (top to bottom).
Water depth (m) : 97
Position/Decca 1B : 51° 02.7'N 7° 00.2'W: -, D38.90, F71.08
Recovery : 07.07 - 07.37 7th October 1985.
Release fired : 07.20
Meters out of water : 07.35, 07.36, 07.36, 07.37 (top to bottom)
Position/Decca 1B : -, D38.75, F70.08
Comment : Acoustic search 05.30 - 05.55, 06.30 - 07.07 to find rig.

Rig 19 - Site 4

Instrument : Current meter/pressure recorder no. 7 in a sea bed frame.

Mooring : 'u' shaped; 6m spar buoy no. 1; spherical pinger no. S17.

Deployment : 23.22 26th August - 00.03 27th August 1985; buoy first.

Meter in water : 23.58

Water depth (m) : 98

Position/Decca 1B : 51° 03.3'N 7° 01.0'W : -, D38.94, F71.40

Recovery : 07.30 - 08.20 13th October 1985.

Meter out of water : 07.46

Position/Decca 1B : : -, D38.84, F72.46

Comment : The spar buoy was washed ashore on Skolkholm on 13th September 1985 and returned. The rig was not found during a visual and acoustic search, 07.45 - 08.55 on 7th October. The search was resumed at 05.50 on 13th October and the acoustic beacon was switched on at 06.20. At 06.50 the pellet floats marking the frame were spotted; the recovery was via this line after a longer stray line (for grappling) had been attached using the rubber boat. During the recovery the frame was distorted and the logger leaked. The buoy line had been cut just below the spar buoy.

Rig 20 - Site 5

Instrument : Aanderaa thermistor chain no. 759, 27-77m above the sea bed; Sea Data logger no. 4 beneath the chain.

Mooring : Pop-up with back up buoyancy; acoustic release no. 2387c; 32" sub-surface buoy no. 1.

Deployment : 08.01 - 08.05 29th August 1985. Buoy first.

Water depth (m) : 88

Position/Decca 1B : 51° 24.2'N 7° 40.6'W : -, D40.44, G64.36

Recovery : 16.28 - 17.20 2nd October 1985.

Release fired : 17.06

Position/Decca 1B : : -, D40.4, G64.6

Rig 21 - Site 5

Instruments : Four Aanderaa RCM4's nos. 1746, 3559, 3277, 5527 at 20, 40, 50, 60m above the sea floor.

Mooring : 'u' shaped; 6m spar buoy no. 6; 40" sub-surface buoy no. 16; spherical acoustic beacon no. S14.

Deployment : 08.37 - 09.10 29th August 1985.

Meters in water : 08.38, 08.56, 08.56, 08.57 (top to bottom).
Water depth (m) : 87
Position/Decca 1B : 51° 24.6'N 7° 40.8'W : -, D40.20, G64.90

Comment : The meters were deployed between 08.38 and 08.42 but the wire was tangled. So the meters were recovered (08.50), two rotors replaced (meter nos. 3277, 3559) and deployment restarted at 08.56.

Recovery : 17.42 - 18.55 2nd October 1985.

Meters out of water : 18.27, 18.35, 18.42, 18.45 (bottom to top).
Position/Decca 1B : -, D39.48, G65.33

TABLE 1. Rig summary

Site	Position		Water Depth Below Chart Datum (m)	Rig	Description
	Latitude(N)	Longitude(W)			
1	51° 25'	8° 40'	88	0	1 MHz acoustic doppler profiling current meter
				1	Multi level VAECM, sensors at 0.1, 0.2, 0.3m below sea surface
				2	Twin VAECM, sensors at 0.5, 1m below sea surface
				3A	Satellite buoy, VAECM sensor at 1m below sea surface
				3B	Satellite buoy, VAECM sensor at 1m below sea surface
				4	Vector averaging current meters at 4, 7, 9, 14, 19m below sea surface
				5	Vector averaging current meter at 81m above sea floor
				6	Aanderaa current meters at 24, 42, 51, 61m above sea floor
				7	Current meter/pressure recorder in bottom frame
				8	250 KHz acoustic doppler profiling current meter in bottom frame
				9	Aanderaa met. buoy
				10	Waverider
2	51° 08'	9° 48'	120	13	Aanderaa current meters at 40, 75, 85, 95m above sea floor
				14	Pressure recorder in bottom frame
3	51° 45'	6° 38'	74	15	Aanderaa current meters at 15, 30, 40, 50m above sea floor
				16	Pressure recorder in bottom frame
4	51° 03'	7° 00'	91	18	Aanderaa current meters at 25, 45, 55, 65m above sea floor
				19	Current meter/pressure recorder in bottom frame
5	51° 24'	7° 40'	85	20	Thermistor chain at 27-77m above sea floor
				21	Aanderaa current meters at 20, 40, 50, 60m above sea floor

TABLE 2. Equipment not recovered

1. Inter Ocean S4 current meters nos. 443 and 436 (SMBA) on rig 4.
2. Bell acoustic current meter no. 640-002 (SMBA) on rig 4.
3. Vector averaging electro-magnetic current meter no. BD01 on rig 4.
4. Aanderaa RCM4 current meters nos. 1749, 1865, 5523, 5525 on rig 6.
5. Current meter/pressure recorder no. 6 on rig 7.
6. Sea data logger no. 5 on rig 11.
7. 50m Aanderaa thermistor chain no. 476 on rig 11.
8. Acoustic release nos. 2504, 2375c, 2376c on rigs 5, 6, 11.
9. Spherical acoustic command pingers nos. S02, S10 on rigs 4, 7.
10. Toroidal surface buoy 7 on rig 4.
11. 32" diameter steel sub-surface buoys nos. 8, 2, 5 on rigs 4, 6, 11.
12. Six sets of Aanderaa back-up buoyancy on rigs 6, 11.

TABLE 3. Position of CTD Profiles

Profile Number	Date	Time Started	Position		Water Depth(m)	Site
			Latitude(N)	Longitude(W)		
1	26/08/85	16.40	51° 25.4'	8° 40.0'	96	1
2	27/08	01.43	51° 2.7'	7° 00.2'	98	4
3	29/08	00.35	51° 44.7'	6° 38.8'	72	3
4	29/08	09.15	51° 24.8'	7° 40.0'	86	5
5	30/08	00.00	51° 8.5'	9° 48.3'	120	2
6	30/08	01.16	51° 15.7'	9° 55.7'	114	
7	30/08	02.12	51° 22.4'	10° 4.0'	107	
8	30/08	03.28	51° 30.1'	10° 12.8'	98	
9	30/08	05.03	51° 19.7'	10° 15.0'	125	
10	30/08	06.36	51° 10.4'	10° 17.2'	138	
11	30/08	08.10	51° 00.6'	10° 19.8'	138	
12	30/08	10.00	50° 50.5'	10° 22.3'	144	
13	30/08	11.50	50° 45.0'	10° 06.4'	150	
14	30/08	13.14	50° 40.1'	9° 47.8'	136	
15	30/08	14.41	50° 51.0'	9° 47.6'	126	
16	30/08	15.43	50° 59.8'	9° 48.5'	128	
17	30/08	17.00	51° 9.4'	9° 48.7'	121	2
18	30/08	18.00	51° 17.7'	9° 49.6'	96	
19	30/08	19.30	51° 14.3'	9° 29.5'	100	
20	30/08	20.55	51° 23.1'	9° 15.5'	70	
21	30/08	22.35	51° 14.0'	9° 11.1'	108	
22	01/09/85	08.58	51° 28.7'	8° 39.5'	89	
23	01/09	19.49	51° 25.1'	8° 39.8'	95	1
24	01/09	21.30	51° 16.3'	8° 31.7'	76	
25	01/09	22.55	51° 7.0'	8° 25.0'	104	
26	02/09	00.29	50° 57.6'	8° 18.5'	103	
27	02/09	01.44	51° 5.5'	8° 7.6'	100	
28	02/09	03.00	51° 13.4'	7° 57.7'	98	
29	02/09	04.10	51° 20.6'	7° 47.3'	93	
30	02/09	05.15	51° 25.6'	7° 40.6'	88	5
31	02/10/85	06.45	51° 25.6'	8° 38.8'	90	1
32	02/10	16.09	51° 25.3'	7° 39.8'	82	5
33	07/10	06.45	51° 2.1'	6° 55.9'	94	4
34	07/10	18.15	51° 44.8'	6° 36.8'	66	3
35	11/10	13.35	51° 8.3'	9° 47.8'	125	2
36	11/10	16.17	50° 57.6'	9° 55.4'	120	
37	11/10	17.46	51° 6.6'	9° 55.2'	119	
38	11/10	19.14	51° 15.9'	9° 55.2'	108	
39	11/10	20.35	51° 25.0'	9° 55.0'	68	
40	11/10	21.46	51° 21.8'	9° 41.2'	68	
41	12/10	00.00	51° 18.4'	9° 21.8'	70	
42	12/10	01.15	51° 21.0'	9° 15.0'	102	
43	12/10	02.45	51° 23.0'	8° 52.5'	99	
44	12/10	04.03	51° 24.6'	8° 39.3'	88	1
45	12/10	16.28	51° 33.4'	8° 39.8'	45	
46	12/10	17.27	51° 25.1'	8° 40.0'	92	1
47	12/10	19.24	51° 14.0'	8° 40.0'	100	
48	12/10	20.37	51° 2.9'	8° 40.0'	108	
49	12/10	22.19	51° 3.0'	8° 22.8'	105	
50	12/10	23.40	51° 3.0'	8° 7.0'	104	
51	13/10	01.15	51° 2.9'	7° 51.0'	104	
52	13/10	02.30	51° 3.1'	7° 35.0'	108	
53	13/10	03.59	51° 3.0'	7° 19.6'	95	

54	13/10	05.27	51° 3.0'	6° 58.6'	87	4
55	13/10	10.08	50° 57.0'	7° 20.8'	98	
56	13/10	11.17	51° 5.0'	7° 28.0'	95	
57	13/10	12.35	51° 13.0'	7° 37.0'	94	
58	13/10	13.55	51° 21.5'	7° 44.0'	90	
59	13/10	15.12	51° 29.1'	7° 52.5'	84	
60	13/10	16.20	51° 36.5'	7° 59.7'	85	
61	13/10	16.40	51° 43.9'	8° 6.9'	48	
62	13/10	19.05	51° 49.4'	7° 49.2'	36	
63	13/10	20.40	51° 54.9'	7° 32.2'	48	
64	13/10	21.53	51° 45.4'	7° 22.6'	72	
65	13/10	23.25	51° 36.0'	7° 14.5'	74	
66	14/10	00.30	51° 29.3'	7° 6.0'	75	
67	14/10	02.05	51° 20.0'	6° 57.5'	90	
68	14/10	03.22	51° 11.5'	6° 47.9'	90	
69	14/10	04.50	51° 17.1'	6° 32.7'	108	
70	14/10	06.17	51° 21.1'	6° 16.4'	112	
71	14/10	07.14	51° 29.0'	6° 23.9'	102	
72	14/10	08.40	51° 37.7'	6° 31.7'	74	
73	14/10	09.40	51° 45.0'	6° 38.0'	67	3
74	14/10	11.05	51° 53.7'	6° 45.8'	67	
75	14/10	12.15	52° 1.2'	6° 52.8'	54	
76	14/10	13.35	51° 56.9'	6° 40.5'	60	
77	14/10	15.07	51° 51.0'	6° 28.0'	66	
78	14/10	16.25	51° 45.1'	6° 14.1'	88	

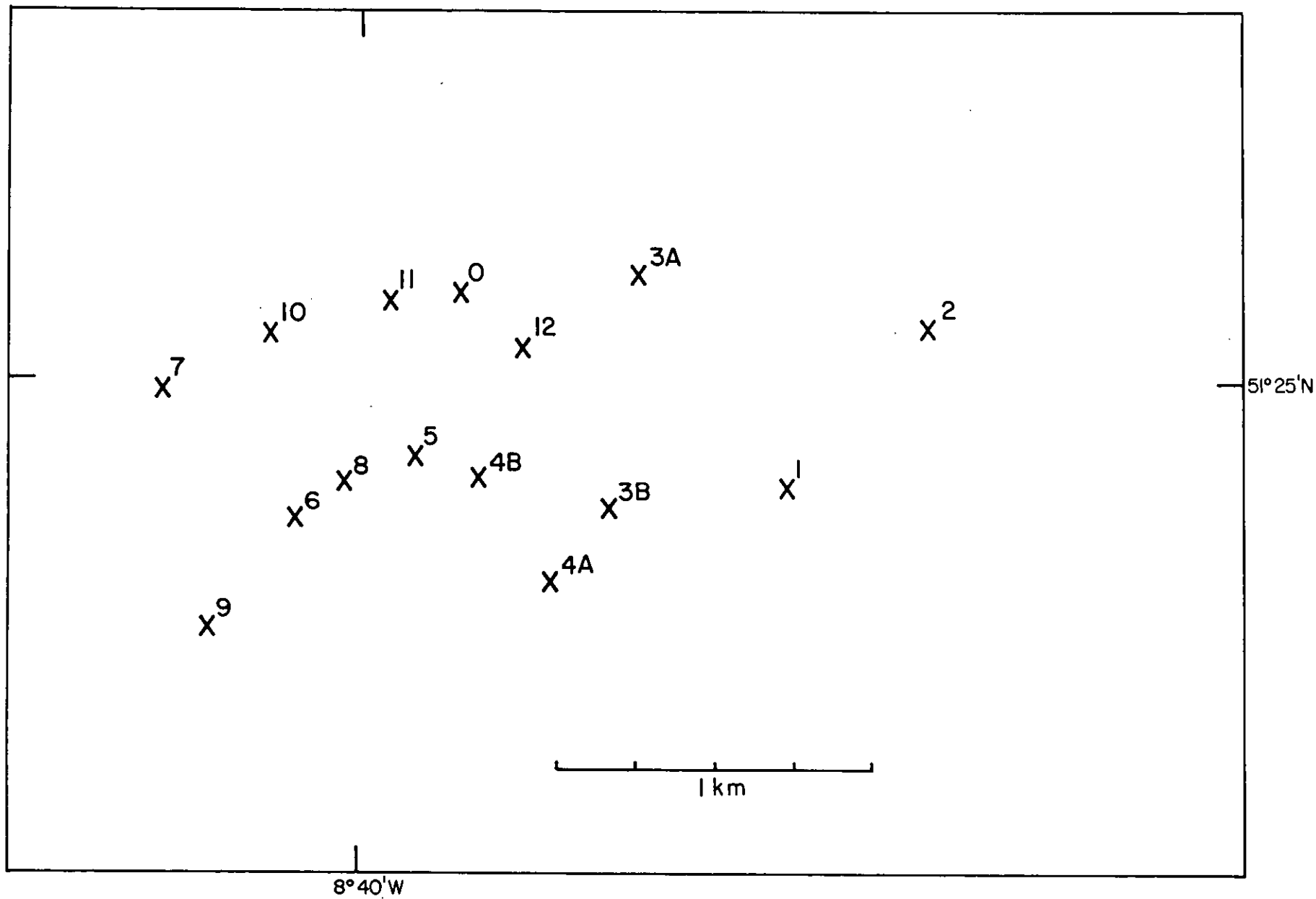


Figure 1. The position of rigs at site 1. See Table 1. for rig description

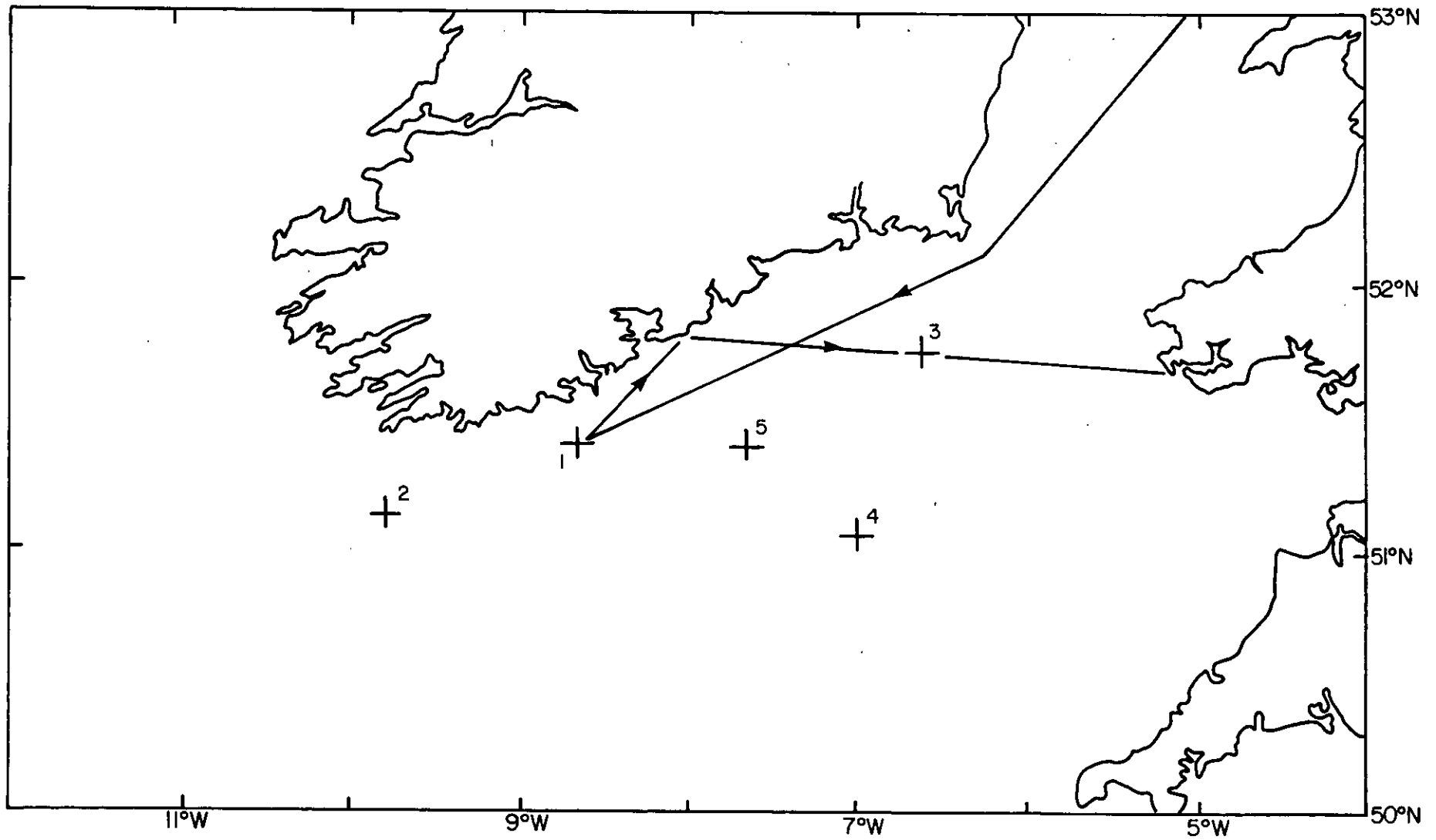


Figure 2a. Frederick Russell 7/85 21-24 August 1985.

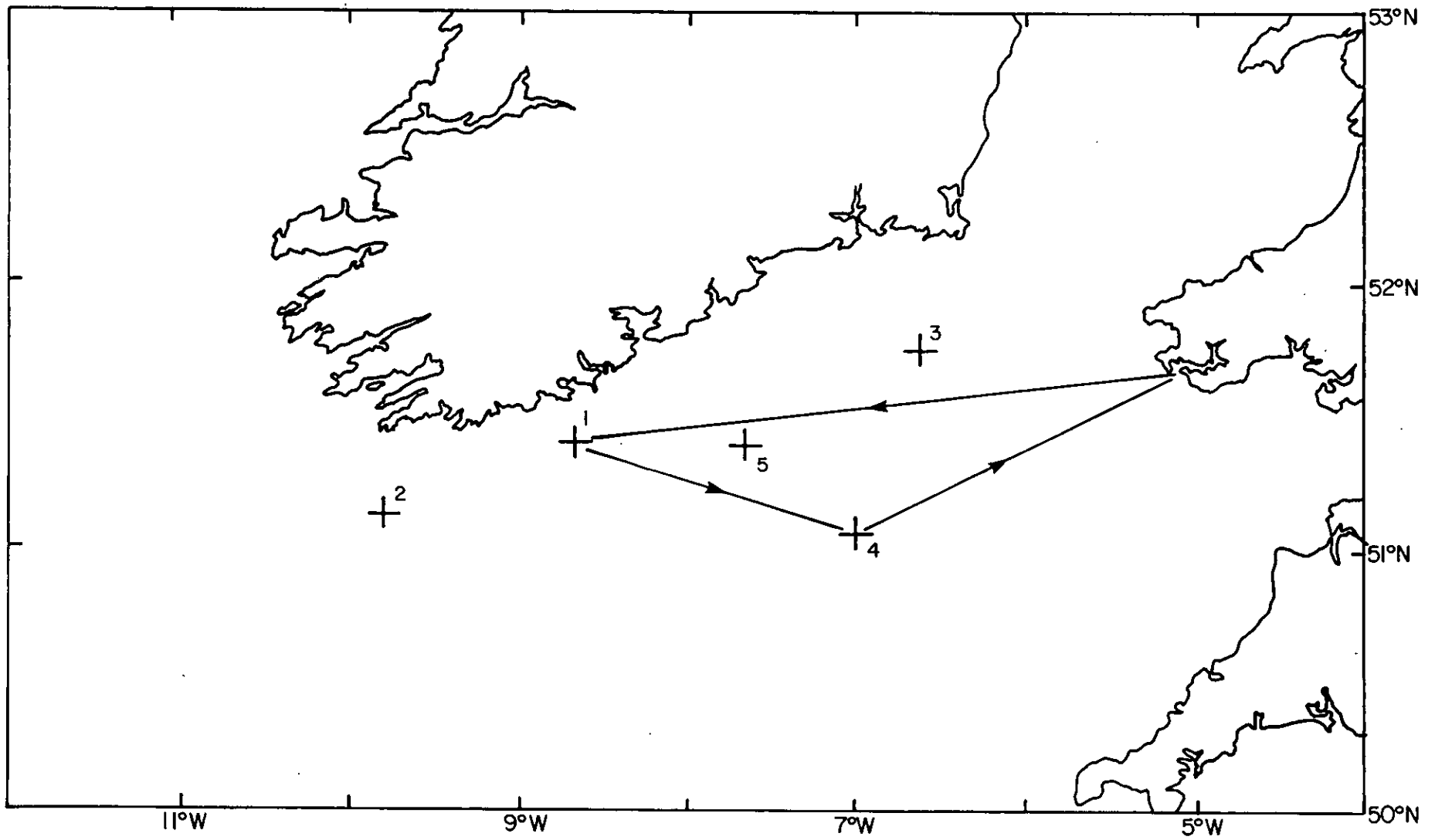


Figure 2b. Frederick Russell 7/85 25-27 August 1985.

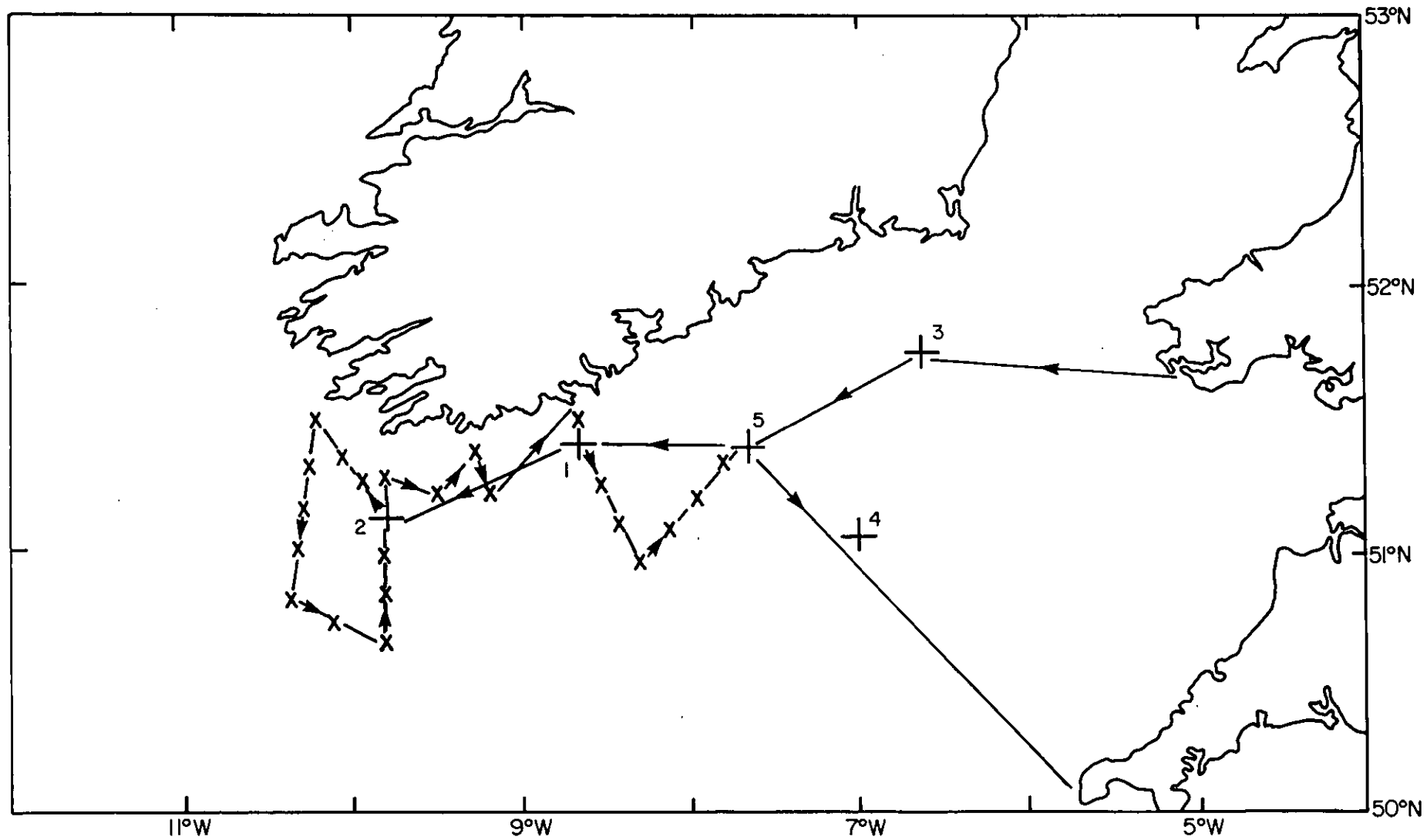


Figure 2c. Frederick Russell 7/85 28 August-3 September 1985. X marks CTD stations.

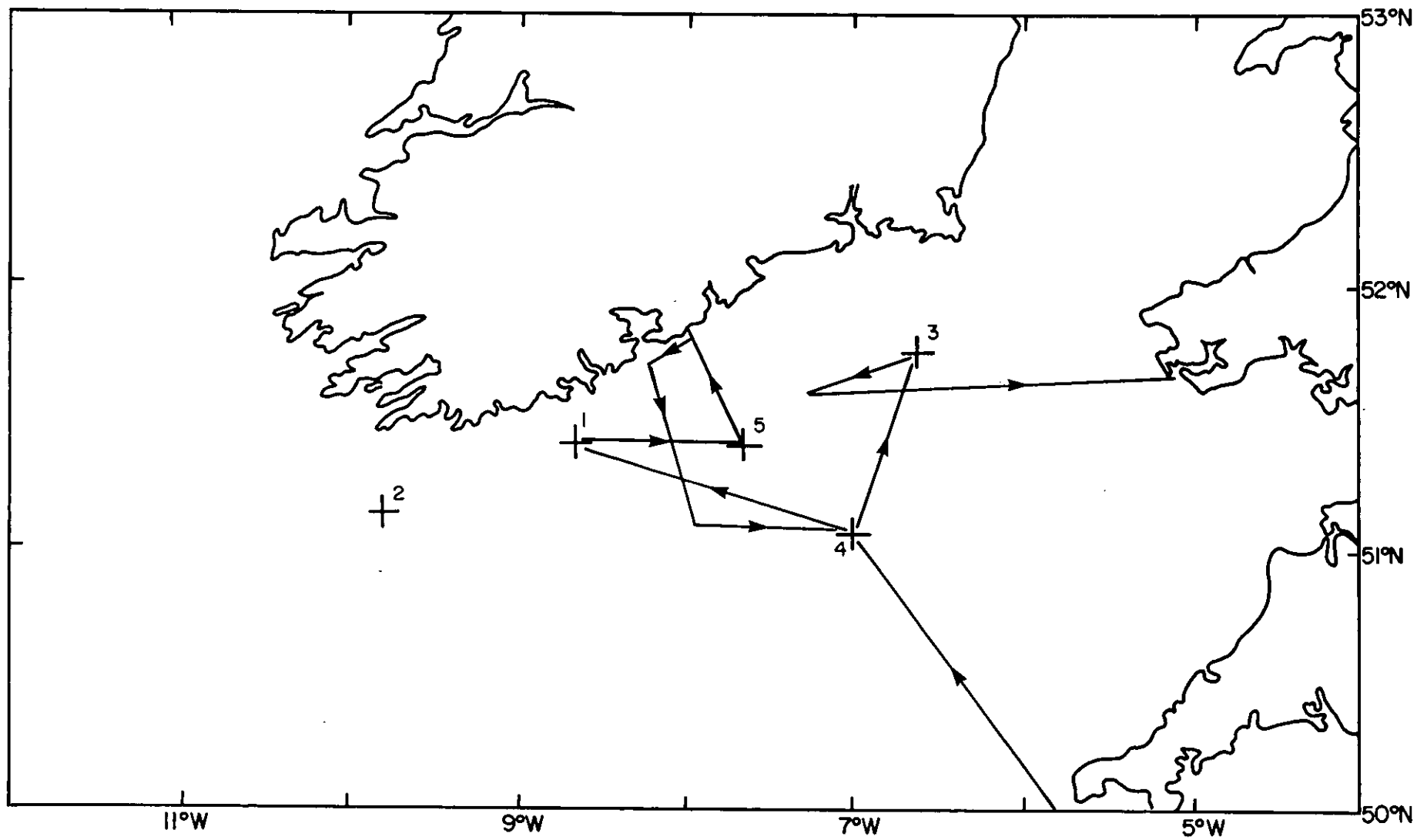


Figure 3a. Frederick Russell 9/85 1-9 October 1985.

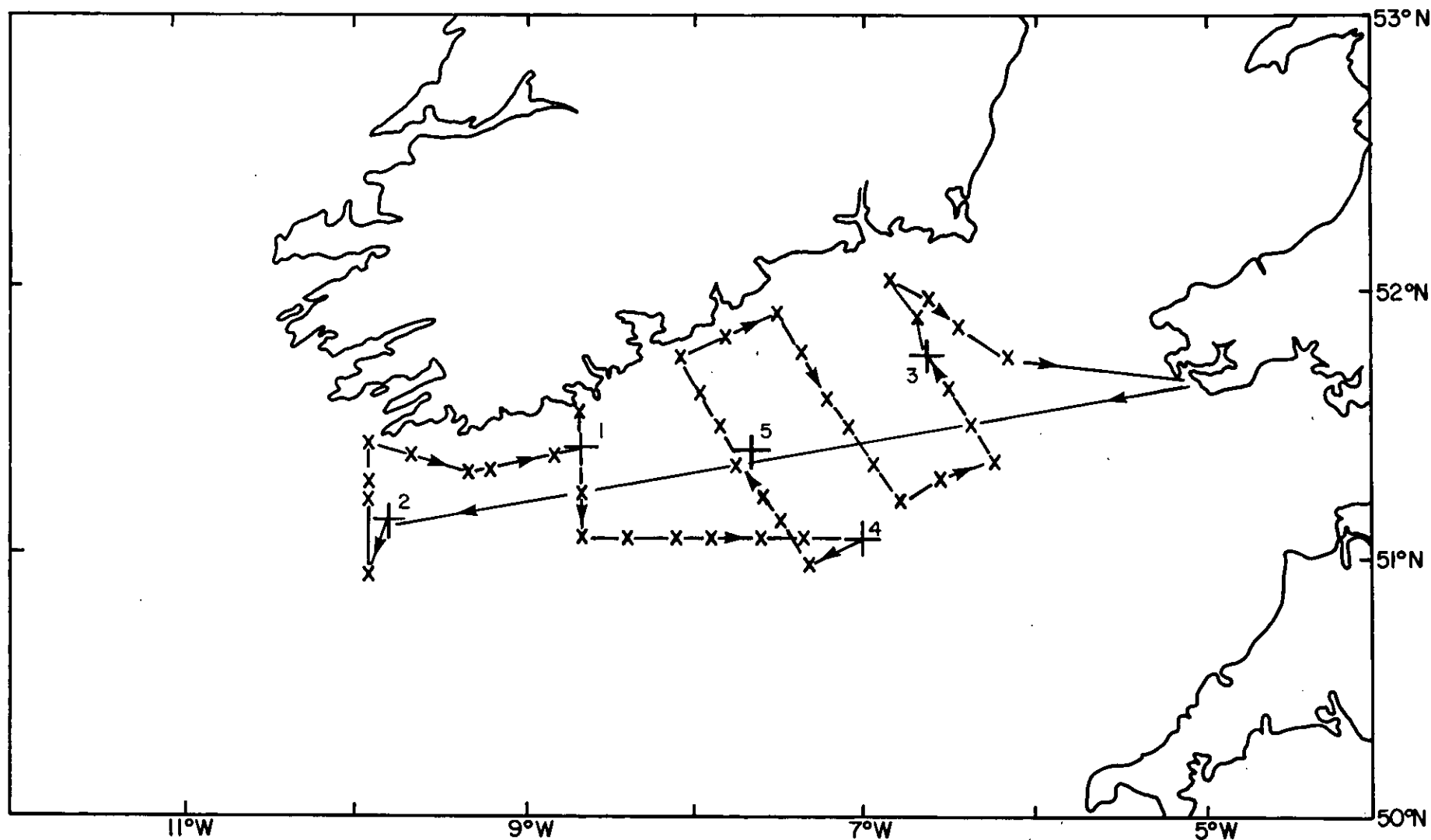


Figure 3b. Frederick Russell 9/85 10-15 October 1985. X marks CTD stations.

