Scottish Marine Biological Association

Dunstaffnage Marine Research Laboratory

CRUISE REPORT

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Cruise Report

R.R.S. CHALLENGER

Cruise 25/1988

24 February - 7 March 1988

R.R.S. CHALLENGER, Cruise 25/1988

Duration of cruise: 0742h 24 February - 1645h 7 March 1988.
All times GMT.

Locality: Scottish continental shelf, Wyville-Thomson Ridge and Rockall Channel.

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Aims:

1) To make CTD transects across the shelf between the Mull of Galloway and Cape Wrath, and to collect radiocaesium samples upon selected transects for the Fisheries Radiobiological Laboratory and SURRC, East Kilbride.

2) To service SMBA current meter moorings N1 and N2 near the Wyville-Thomson Ridge and mooring Y in the Tiree Passage, and to retrieve moorings V, W and X in the Little Minch and west of Lewis.

3) To work CTD sections in the vicinity of the Wyville-Thomson Ridge and across Faroe Bank.

4) To work some or all of the CTD stations of the Anton Dohrn Seamount section.

Narrative: Sailing was delayed for a day, awaiting the arrival of an engine governor component. Staff joined the ship at 1400h 23 February and the component arrived and was installed during the evening.

CHALLENGER sailed from Troon at 0742h 24 February and proceeded to the North Channel where a surface radiocaesium sample was collected at station LS at 1221h and CTD and caesium sampling section Z begun off Donaghadee at 1415h in force 5 northerly winds. The section was completed off Portpatrick at 2030h, and followed by section Y, from Corsewall to Sanda from 2158h to 0230h 25 February. Section A, from Kintyre to Antrim was worked between 0319 and 0720h, after which the ship proceeded northwards via the west coast of Islay to the Tiree Passage. Mooring Y, between Mull and Coll was reached at 1820, but fading daylight and the start of the flood tide made conditions unsuitable for servicing the mooring. In light northerly winds the ship resumed course for the North Minch with the aim of reaching the current meter moorings south of Faroe Bank in quiet weather.

The Butt of Lewis was passed at 0659h 26 February and in increasing wind and swell passage was made to the vicinity of the Wyville-Thomson Ridge. By the morning of 27 February winds were westerly, forces 7-8, and a CTD section across the mooring sites was begun at 0715h. Both moorings responded to acoustic signals, but as the weather was unsuitable for recovery, the CTD section was continued until 1645h when further deterioration required the ship to heave to.

Winds of forces 8-9 veered north-westerly overnight, and forecasts for the following three days gave little hope of early improvement. In the absence on board of navigational charts for the Faroes, it was decided at 1145h 28 February to run to the Minches. Barra Head was passed at 0400h 29 February and courses were set for moorings W and V in the Little Minch. The northerly wind had moderated to force 7, except in snow squalls and recovery of W took place between 1003 and 1032h. Mooring V was recovered between 1309 and 1333h and CHALLENGER steamed to Loch Dunvegan to begin section N at 1526h. This was completed at Loch Maddy at 1943h, and was followed by section K from Loch Seaforth to Loch Gairloch at 2222h to 0556h 1 March. Subsurface radiocaesium sampling was not possible upon this line due to the jamming of the hydrowire in the cheek of a block, conditions overnight being unsuitable for tackling this.

The northerly wind remained at force 7, but forecasts of better weather to the north suggested an opportunity might arise to tackle the Wyville-Thomson moorings. Accordingly the ship left Barra Head at 1235h in heavy seas which moderated slowly in the passage north, winds dropping to force 4 in the course of the afternoon, though later turning west and increasing to force 7. Acoustic release tests were carried out in the vicinity of the southerly current meter mooring (N1) at 0607 to 0640h 2 March awaiting daylight, and at 0720h the release was fired and responded, but did not rise to the surface. Further investigations showed that its minimum range corresponded to the depth of the mooring position and it seemed probable that the buoyancy spheres on the mooring had become detached, leaving the release on the sea-bed. Further searches were therefore suspended at 0820h and the ship moved to mooring N2, which was released and recovered successfully between 0846 and 0932h. From 1000 to 1046h further attempts were made to release N1, but without apparent success. A replacement N2 mooring was wound up on the winches and this was deployed at 1118-1140h.

Acting upon the assumption that strong currents at mooring N1 had led to damage and loss of part or all of the buoyancy, the replacement mooring (N3) was laid after release tests at 1415 to 1428h at a position where bottom currents are less closely constrained by topography, 4.5 n.ml to eastward of N1. It was decided to attempt to grapple N1, and 3300 m of ground wire and warp was streamed with the Gifford grapnel at 1557h. However, at 1725h it was realised that the range of N1 was at a minimum and that it was not therefore in the original position where release had been attempted in the morning. This suggested that the mooring was now drifting on the surface, and the grapling gear was recovered as rapidly as possible. Unfortunately a sudden deterioration of the weather occurred at this time, and by 1822h when all gear was inboard, the wind had become forces 9-10 northerly, making any manoeuvering impossible.

CHALLENGER remained hove-to on northerly courses overnight in snow squalls with frequent 50 kt gusts. During the late forenoon of 3 March winds moderated to forces 7-8, allowing the ship to run back southward at 1408h. The ship steamed over a grid of 8 legs of 8 n.ml length at 1 n.ml spacing over the possible area of drift of the mooring during 1929h to 0630h 4 March, finally passing close to the position of the last contact before setting course for Lewis at 0730h. However, acoustic searching continued upon the southward passage, and at 0850h a response was received. By manoeuvering the ship, the minimum range at closest approach was found to correspond to the sounding depth, indicating that the mooring had sunk, and the Gifford grapnel was deployed at 0955h for three sweeps through this position. No success being forthcoming, the gear was recovered at 1425h and course was resumed for the shelf west of the Flannan Island in gradually improving wind and swell conditions.

Surface salinity was sampled en route to station 5J, and surface radiocaesium samples were collected at two positions over the slope zone. 5J was reached at 0103h 5 March, and station IJ off Loch Resort was completed at 0732h. Mooring X, laid nearby in late November was recovered between 0826 and 0814h, and the ship headed south-westward for station M of the Anton Dohrn Seamount section. This was reached at 2302h, and stations were worked eastwards to the shelf-edge in forces 5-7 westerly winds with a large swell. During the afternoon of 6 March the CTD and radiocaesium sampling stations of the shelf-edge to Mull section were worked to Barra Head, and in improving conditions eastwards to Coll during the morning of 7 March. Station 2G was completed at 0615h and the ship proceeded to mooring Y, in the Tiree Passage, in calm but misty weather. The spar buoy was recovered between 0800 and 0840h, but the ground line was found to have been cut at about the midway point. The pellets marking the subsurface end of the mooring were grappled at 0859h and the subsurface buoy raised sufficiently for a noose of wire to be slipped over and under it to take the weight of the anchor. All equipment was recovered by 0930, and a replacement mooring was deployed between 1111 and 1128h. The final sampling station 1G, was completed at 1312h and CHALLENGER set course for Oban. The ship berthed at the North Pier at 1645h and after discharging scientists and gear, left for the Clyde at 1900h.

Results:

Aim 1) The CTD and radiocaesium sampling sections worked during the cruise are given in Table 1. Apart from section D, west from Islay, all caesium sampling sections were completed, but little time was available for other CTD sections. Surface temperatures at the inshore stations were close to 7.0°C, with Atlantic water west of the shelf-edge having temperatures of 9.0°-9.4°C. East and west of Barra Head differences of about 1.6 K existed between the upper and lower mixed layers, with direct mixing occurring at the intermediate levels.

Aim 2) Dates and positions for mooring operations during the cruise are given in tables 2 and 3.

Mooring N2 was contacted and released without incident, although the anchor release ring had caused appreciable wear to the release mechanism during the six months of deployment. N2 was relaid with a new release at the same position. However, N1 did not rise to the surface after acknowledging release signals, which initially suggested whole or partial loss of the glass sphere buoyancy. After an hour, during which no change in minimum range was found, the ship proceeded to other work, returning after 1½ hrs to find no change in the situation. After a further 45 mins above N1, the site was again left whilst mooring N2 was redeployed. A new position, N3, was chosen to replace N1 in a situation where somewhat lower current velocities might be expected. Following deployment of this, a grapnel and 3300 m of warp were streamed in the hope of either recovering the N1 mooring or dislodging the release if stuck. Towing westward towards the mooring site contact was made with the release at a range of 1.5 km and it became clear that the mooring had moved since the last visit during the morning. Recovery of the warp and grapnel occupied 1 hr, during which the northerly wind greatly strengthened, making it impossible to conduct a search until the evening of the following day. As detailed in the narrative, after an abortive 12 hr grid search the release was contacted on the sea-bed in 575m depth whilst leaving the area, but a further 4½ hr dragging session failed to produce results.

From examination of the release recovered from N2 it was concluded that it could have been possible for the open release to have not separated from the anchor if strong currents had held the mooring far from the vertical, especially if similar or greater wear had occurred between the ring and the release hook. This is obviously a point to discuss with the manufacturers, and in future an oscilloscope will be used with a view to checking whether the release is above or upon the bottom before firing the mechanism.

All three Aanderaa current meters at N2, in 710 m depth on the southern flank of Faroe Bank, provided good records over the 177 days of deployment. The following table briefly summarises the main results:

Nominal depth (m)	East component (cm sec^{-1})			Vector/scalar constancy (%)	Mean temp. (^{o}C)
	Mean	Max.	Min.		
270	14.4	64.9	-35.0	86.1	8.7
539	7.6	61.5	-60.7	67.0	8.2
690	-42.8	22.1	-97.1	98.6	5.8

Velocity values may have been affected by 'knock-down' of the mooring in these strong currents, a point which further analysis should clarify. The minimum temperature at the lowest current meter was 2.1°C.

Good records were obtained from each of the two current meters on moorings V and Y, and from the lower current meters on W and X. The upper meter at W recorded speed only and that at X gave speed throughout the record but other parameters for the first 40% only. In the Tiree Passage residual currents of the order of 45 km/day occurred during the winter.

Aim 3) Weather and time permitted the working of only one section south of Faroe Bank. CTD stations A9 to A4 were worked on 27 February across the current meter mooring positions. The temperature distribution (Figure 2) has the same pattern as that found in early September 1987, with water colder than 8°C blanketing the southern flank of Faroe Bank, although bottom temperatures were somewhat higher on this occasion.

Aim 4) Stations M to Q of the off-shelf stations of the Anton Dohrn Seamount CTD section were worked on 5-6 March. Winter mixing had reached to depths of 450-640 m at these stations, but somewhat shallower and warmer layers were evident at N, O & P. Preliminary results show that the temperatures and salinities of the upper Atlantic water were a little below mean values for 1971-80.

Miscellaneous: The Acoustic Doppler Current Profiler (ADCP) was run continuously throughout the cruise. Absolute measurements were taken on the shelf when the instrument was able to bottom track. Off the shelf, measurements were relative to the ship. Ten-minute ensembles were taken of all three velocity components, AGC and % good data.

Comparisons were made with all shelf current meter moorings, but the current meters deployed on the W/T ridge were all beyond the depth range of the instrument.

A number of problems were encountered. Although the instrument could be set up to allow the dumping of the graphics onto hard copy during operation, this proved unsatisfactory. The system crashed frequently. This is unfortunate as instant hard copies would be beneficial in a number of ways.

The satellite navigator option was not in operation. In the absence of roll and pitch sensors, the range and quality of the data seem very dependent on weather and sea conditions.

Acknowledgements: Despite the loss of one day at the start of the cruise, unpleasant weather and the need to work far from shelter, all essential work was completed. Captain Harding, his officers and crew were interested and willing at all times throughout the cruise.

D.J. Ellett
15 March, 1988.

Table 1. Stations and sections worked during Cruise 25/1988

Stations	CTD Disc/ Dip Nos.	Location	Dates 1988	Observations
LS	-	Larne-Stranraer midway	24 Feb.	Surface S‰ and Cs.
1Z-6Z	082/001-006	Copeland-Portpatrick	24 Feb.	CTD, Cs surface; Cs mid and bottom (2-5).
1Y-5Y	082/007-013	Corsewall-Sanda	24-25 Feb.	CTD.
1A-5A	082/014-018	Kintyre-Antrim	25 Feb.	CTD, Cs surface; Cs bottom (2 and 4).
A9	082/019	S. Faroe Bank-Ymir Ridge	27 Feb.	CTD
A8-A6	083/020-022			
A5-A4	084/023-024			
1N-6N	084/025-030	L. Dunvegan-L. Maddy	29 Feb.	CTD
1K-2K	084/031-032	L. Seaforth-L. Gairloch	29 Feb-1 Mar.	CTD, surface Cs.
3K-9K	085/033-039			
8JX,6JX	-	NW from L. Resort	4-5 Mar.	Surface Cs and S‰.
5J-1J	085/040-044			CTD; surface Cs (2,4); bottom Cs (2).
M-N	086/045-046	Anton Dohrn Seamount section	5-6 Mar.	CTD
O-Q	087/047-049			
16G-6G	085/050-059	Shelf-edge - Sound of Mull	6-7 Mar.	Surface S‰; CTD, Cs surface, mid and bottom (16, 15, 13, 11, 10, 9, 7, 6, 4, 2, 1).
4G-2G	087/060-061			
1G	086/062			

Table 2. Current meter moorings recovered during Cruise 25/1988

Mooring	Depth (m)	Lat. N, °	Long. W °	Date deployed 1987	Date recovered 1988	No. of current meters	Remarks
W	123	57 41.9	6 50.0	25 Nov.	29 Feb.	2	Surface spar
V	78	57 41.8	6 36.8	25 Nov.	29 Feb.	2	Surface spar
X	123	58 12.0	7 13.9	26 Nov.	5 Mar.	2	Surface spar
Y	57	56 37.8	6 24.6	29 Nov.	7 Mar.	2	Surface spar
N2	710	60 17.4	8 46.8	6 Sep.	2 Mar.	3	Acoustic release, glass floats

Table 3. Current meter moorings deployed during Cruise 25/1988.

Mooring	Depth (m)	Lat. N, °	Long. W, °	Date deployed 1988	No. of current meters	Remarks
N2	712	60 17.4	8 46.1	2 Mar.	3	Acoustic release, glass floats
N3	900	60 13.5	8 37.0	2 Mar.	2	Acoustic release, glass floats
Y	50	56 37.5	6 24.9	7 Mar.	2	Surface spar

Figure 1a : Track chart (1).

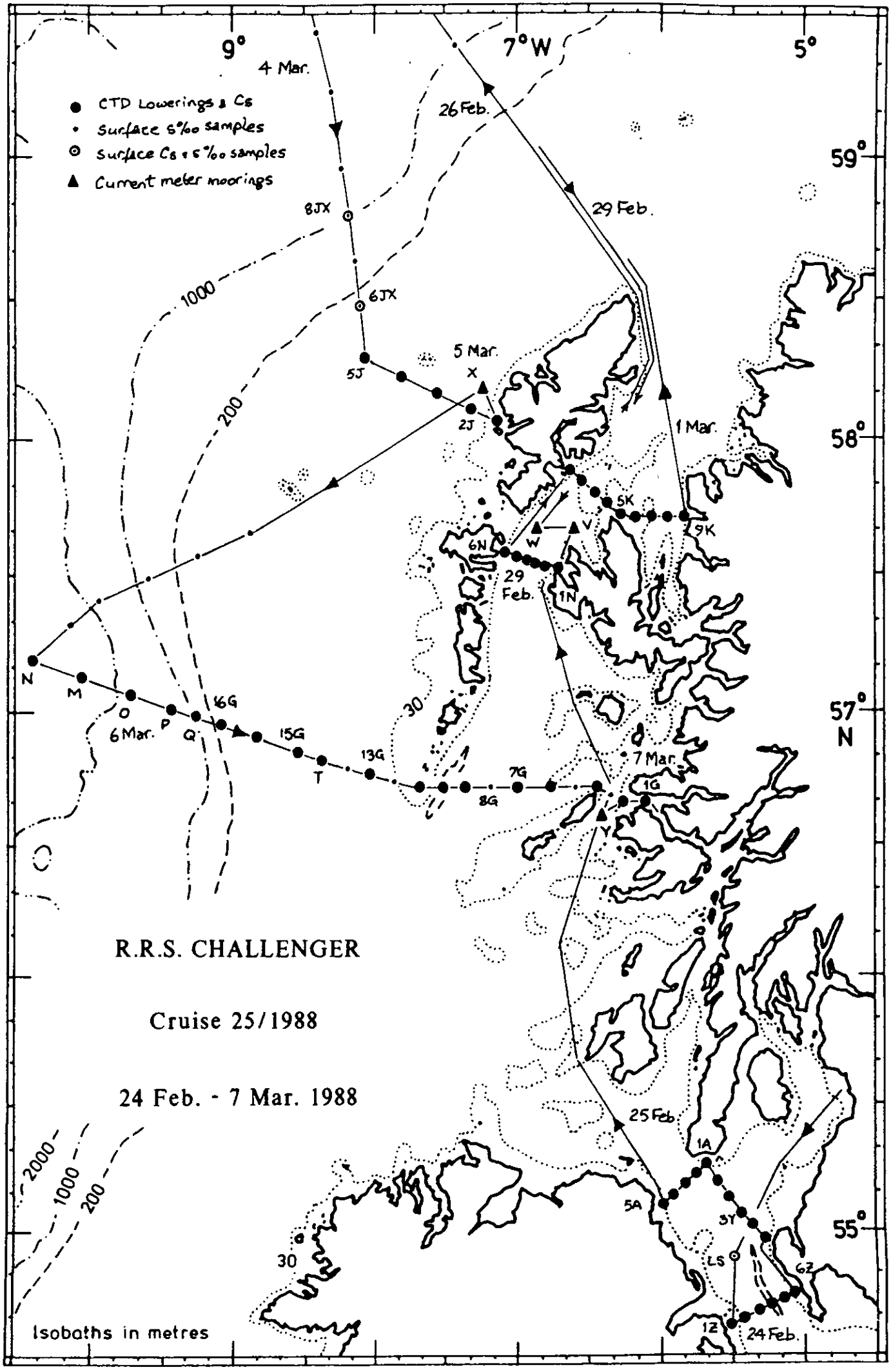
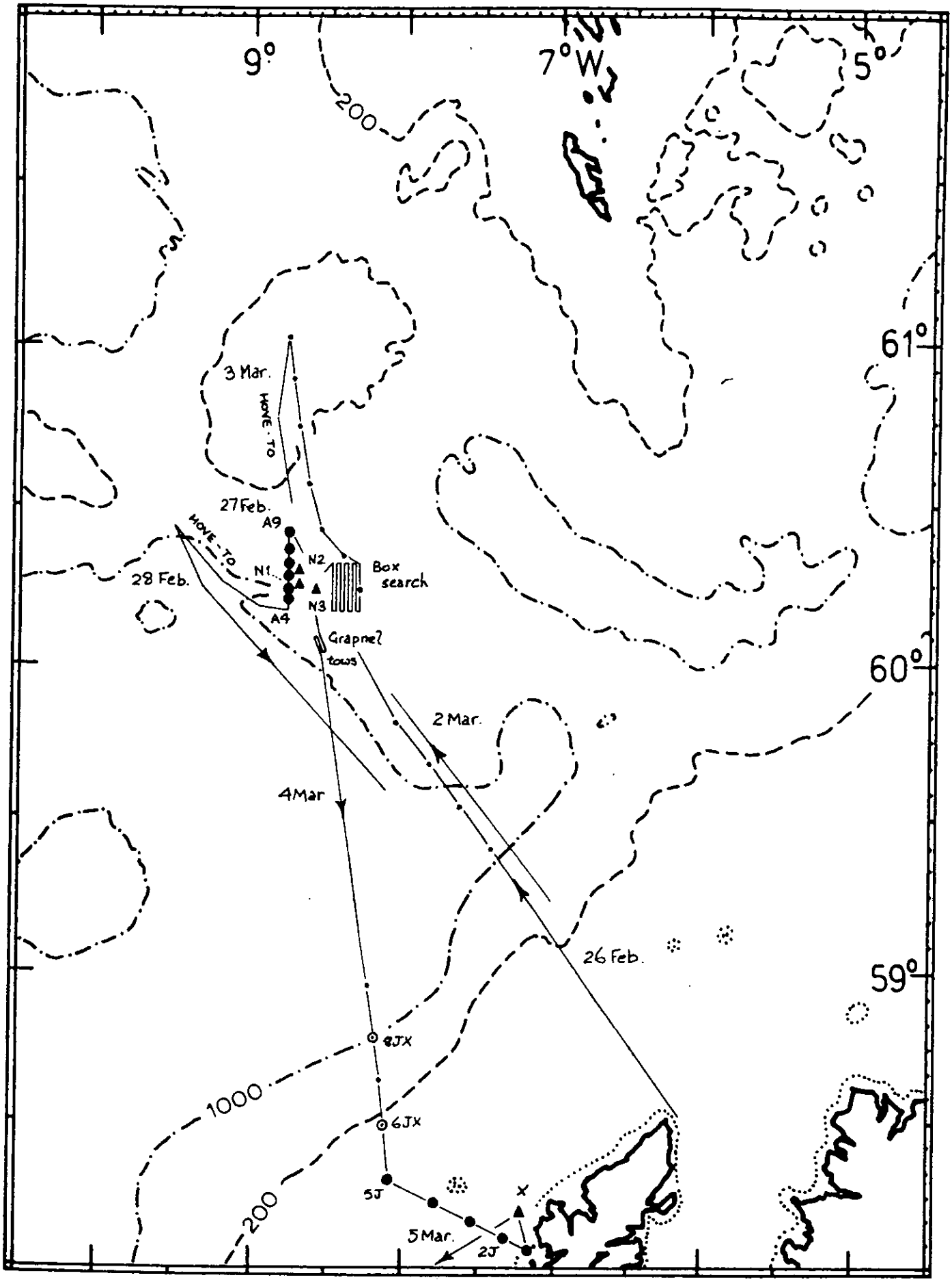


Figure 1b : Track chart (2).



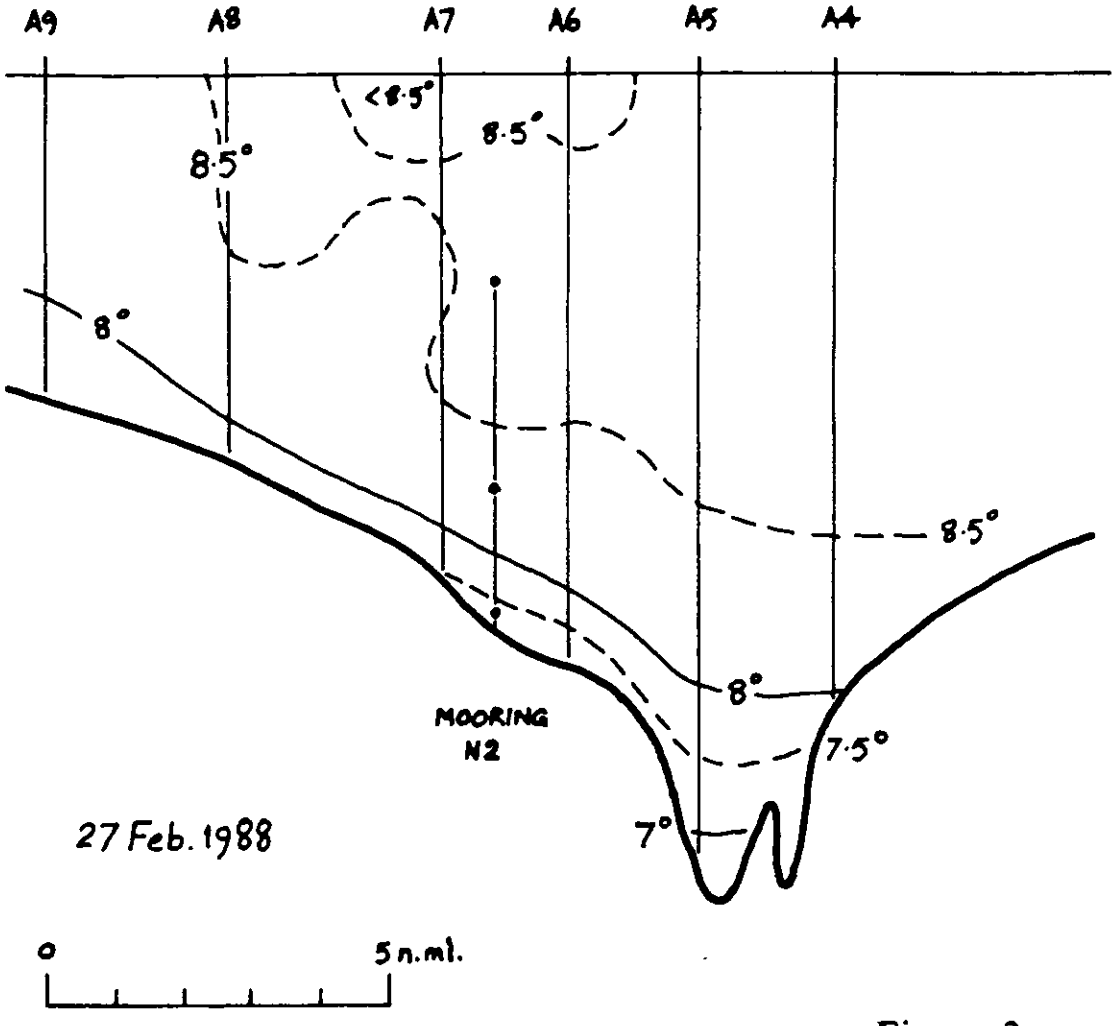


Figure 2.