*Scottish Marine Biological Association*

*Dunstaffnage Marine Research Laboratory*

# CRUISE REPORT

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R.R.S. CHALLENGER

Cruise 30/1988

6 - 23 June 1988

# R.R.S. CHALLENGER, Cruise 30/1988

Duration of cruise: 1503h 6 June - 0930h 23 June 1988.

All times GMT.

Locality: Scottish continental shelf and slope, Faroe Bank and Rockall Channel.

Staff:
D.J. Ellett
R. Bowers
Dr. J.M. Graham
C.R. Griffiths
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Miss V. Machin
Dr. N. Harrison (NCC, Aberdeen)
A. Webb (NCC, Aberdeen)
P. Foden (POL, Bidston) (16-23 June)
A. Harrison (POL, Bidston) (16-23 June)
G. Ballard (POL, Bidston) (16-23 June).

Aims:

1) To make CTD transects across the Scottish continental shelf between the Mull of Galloway and the Butt of Lewis, and to collect radiocaesium samples upon selected transects.

2) To service SMBA current meter moorings N2 and N3 near the Wyville-Thomson Ridge and mooring Y in the Tiree Passage, and to retrieve five Bidston current meter moorings and two bottom pressure recorders from the St. Kilda shelf and slope.

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

4) To make observations of the distribution of seabirds, especially in relation to feeding flocks and hydrographic structure, and to collect specimens in the North Channel and an offshore area.

5) To work CTD sections on the outer St. Kilda shelf in the vicinity of the Bidston moorings.

Narrative: Staff joined the ship at Troon on 5 June, and after storing and refuelling had been completed on 6 June CHALLENGER sailed at 1503h for the North Channel. Surface samples were collected at station L8, and the CTD and radiocaesium sampling section between Copeland Is. and Portpatrick was worked between 2219h and 0514h 7 June. CTD sections Y, across the Firth of Clyde entrance, and A, between the Mull of Kintyre and Antrim were worked between 0622h and 1422h. The weather was fine with light winds and the opportunity was taken to make a seabird collection from the ship's inflatable between 1504 and 1600h. The five central stations of the CTD sections west of Islay were worked from 2100h to 0113h 8 June, after which the ship proceeded to the Sound of Mull, working CTD and radiocaesium stations 1G and 2G before retrieving the Tiree Passage current meter mooring at slack water between 1221 and 1242h. After replacement of some components the mooring was redeployed between 1413 and 1430h, and work upon the section resumed. Stations were worked to Barra Head at 2348h, when course was set for Faroe Bank in order to take advantage of favourable weather forecasts.

CHALLENGER was on passage throughout 9 June, taking surface samples for salinity en route and stopping over deep water between 1800 and 1940h for acoustic release tests. A release lost in March was interrogated in passing, and responses were obtained from the releases of sub-surface moorings N2 and N3 during the night. CTD stations A9 to A6 were worked between 0110 and 0536h 10 June, and in continuing fine weather mooring N2 was raised and recovered between 0725 and 0802h. Redeployment was completed by 0957h and the ship steamed to N3, where recovery occupied from 1038 to 1133h, and redeployment from 1225 to 1230h. Stations A5 to A1 were completed by 1915h. Section B, across the Ymir and Wyville-Thomson Ridges was occupied between 1956h and 0753h 11 June.

Section SE, from the Faroe-Shetland Channel onto Faroe Bank, was worked in continuing calm seas and light winds from 0923h to 1709h 11 June, followed by stations NE 9-11 along the crest of the bank. Return to the overflow region was via section S to Cirolana Deep at 2215h to 0609h 12 June. Sections were then worked around the three open boundaries of the deep until 0940h 13 June. Stations C7 to C5 were occupied between 1127 and 1340h, after which the ship steamed to the position of the release lost from mooring N1 during the February-March cruise. Using the precise range determination of the Oceano transponders, the ship was positioned upwind

and made four drifts between 1539 and 2117h across the site with a number of grapnels deployed from the hydrowire. Despite passing at ranges equal to the sounding depth,no contact was made with any remains of the mooring, and the ship proceeded to station C1 to complete the remaining CTD lowerings of the section between 2146h and 0207h 14 June. Stations A7 to A3 were repeated across the N2 mooring site during 0320 to 0917h to complete work in this area.

CHALLENGER steamed southward and began a CTD section running from deep water in towards the Butt of Lewis at 1430h. The last of thirteen stations was completed at 0551h 15 June and the Butt was rounded at 0700h. The ship crossed the North Minch to work the section from Loch Gairloch to Loch Dunvegan between 1206 and 1743h. Fine weather had left sufficient time in hand to work stations 2L to 5L at 2152h to 0046h 16 June before heaving-to off Stornoway to embark the Bidston staff at 0903h. A recovered sub-surface float from one of the Bidston moorings was also brought out to the ship for transport to Barry.

Upon leaving Stornoway courses were set via the Butt of Lewis to the easternmost of the moorings at the slope. Arrival here was at 2225h and CTD lowerings were made overnight at the seven southern mooring sites. Upon completion of this at 0518h 17 June attempts were made to contact the pressure recorder at the western end of the line (BP 1850) without success. The adjacent current meter mooring (CM 1500) responded and was released, being recovered between 0804 and 0849h. No response was obtained from current meter moorings CM 560 and CM 650S, but CM 450 was raised between 1244 and 1333h. Bottom pressure recorder BP 300, at the eastern end of the line,was not located.

Acoustic searches around the positions of the missing moorings proceeded during the afternoon and overnight, and at 0641h 18 June a response was obtained from the release of CM 650S, 5.5 n.mi north of its original position. Between 0849h and 2025h seven grapnel tows were made through this location upon various courses, but no equipment was recovered. The release was fired to ensure its safety if trawled. Acoustic searches at the remaining sites continued overnight and at 0700 19 June the ship hove-to above the position of pressure gauge BP 1850 in an attempt to obtain a response from a transponding beacon upon the mooring. Opportunity was taken to obtain two CTD lowerings in deep water in order to test a spare CTD for pressure effects upon conductivity recordings. A final search for BP 1850 ended at 1100h, when course was set for Anton DohrnSeamount.

An increasing southwesterly swell was met with en route to the seamount and presaged a deterioration in the excellent weather encountered to date. Station I of the section eastwards to the shelf-edge was begun at 1814h and CTD work continued with southerly winds of forces 5-6 to station Q at 1100h 20 June, and from there with the CTD and sub-surface radiocaesium shelf stations to Barra Head, where station 11G was completed at 1956h.

CHALLENGER steamed for the Mull of Kintyre overnight via the west of Islay, and laid off Sanda Is. at 0855h 21 June in quiet calm weather. The inflatable was prepared for launching and a short steam located a marked surface discontinuity with high bird concentrations. Between 1000h and 1050h a sample of birds was collected by the NCC team from the inflatable, and the ship steamed for Campbeltown, berthing alongside at 1512h. SMBA and NCC staff and gear were landed, and CHALLENGER left for Barry at 1700h. A saving of time on passage during 22 June gave the chance to grapple for a missing Bidston mooring in the Bristol Channel, but no equipment was encountered and the ship berthed at Barry at 0930h 23 June.

Results:

Aim 1) CTD transects were worked in the North Channel, Sea of the Hebrides, North Minch and northwest from the Butt of Lewis, as shown in Table 1 and Figure 1a. Surface salinity samples were taken upon the longer steaming tracks across the shelf to provide additional cover. Radiocaesium samples at the surface and at sub-surface depths were collected for the Fisheries Radiobiological Laboratory between Copeland and Portpatrick and between Mull and the Shelf-edge, and a surface sample taken between Larne and Stranraer. Similar, but acidified, samples were taken for the Scottish Universities Research and Reactor Centre to continue monthly sampling at stations 1G and 2G off Mull, and a single surface sample at 3K in the North Minch.

Aim 2) Details of all mooring work are given in Tables 2 and 3. Mooring Y, in the Tiree Passage, was serviced on 8 June and the two current meters at depths of 27 and 39m in a sounding of 50m appear to have given satisfactory data over the period of 92 days since the previous service. The highest daily mean northerly components at the upper and lower meters were 34 and 31 cm $sec^{-1}$ respectively, with overall daily mean northerly components of 13 and 19 cm $sec^{-1}$.

Both moorings monitoring Norwegian Sea inflow across the Wyville-Thomson Ridge (N2 and N3) were successfully retrieved and redeployed and provide 99 days' data. A summary of the daily mean values is given in the following table:

| Nominal depth (m) | East component (cm $sec^{-1}$) | | | Vector/scalar constancy (%) | Min. temp. (°C) |
|---|---|---|---|---|---|
| | Mean | Max. | Min. | | |
| N2 282 | 5.5 | 62.8 | -51.1 | 28.1 | 7.22 |
| 542 | -10.3 | 29.9 | -65.6 | 46.4 | 1.08 |
| 697 | -36.9 | 11.7 | -64.8 | 95.1 | 0.21 |
| N3 730 | -6.8 | 25.8 | -59.3 | 55.1 | 1.00 |
| 885 | -27.5 | 5.7 | -59.9 | 96.2 | -0.39 |

The records of the pressure sensors upon the current meters show that the moorings were affected by 'knock-down' during the periods of strongest currents and extreme values are therefore likely to be underestimated. The clearest event in both sets of records was the strong overflow of Norwegian Sea water at the end of April to early May. The moorings were redeployed for final recovery in October.

Six current meter moorings and two bottom pressure recorders had been deployed by Bidston upon Cruise 26 in March 1988. Two of these had been damaged by French trawlers prior to our cruise and four to five vessels were fishing in the vicinity on 17-19 June. As detailed in the narrative, only two current meter moorings were recovered intact. The release of a third was located upon the sea-bed several miles from its original position and despite seven tows with grapnels and creepers no instruments were brought to the surface. Acoustic searches were made at the sites of each missing mooring, covering the area 0.5 n.ml. east and west and 2 n.ml. north and south of the original positions, with additional runs from 4 n.ml. north to 4.ml. south.

Aim 3) CTD sections were worked across the region of Norwegian Sea Deep water overflow over the Wyville-Thomson Ridge as shown in Figure 1b. The two basins to east and west of the Ymir Ridge were well sampled with Section A, across the position of mooring N2, being repeated in part before the area was left. Colder water was present than in September 1987 and February 1988. Figure 3 shows Section A upon 10 June, when water of temperature below 2°C was found at depths of 500 m upon the southern flank of Faroe Bank. A second cold core of 2.3°C existed in depths of 750 m, but water in the deepest part of the section was somewhat warmer at 3.3°C. Temperatures at 1700 m in the Ciroland Deep were just below 4°C and the water available to flow southward from the southern sill of the deep into the Rockall Channel was at 4.5° to 5°C.

Aim 4) The object of the Seabirds at Sea Team participation in the cruise was to study seabird distribution in conjunction with studies by SMBA of the hydrography of the water off western Scotland and over the southern edge of the Faroe Bank. Important feeding areas with a high diversity of seabird species were found in the strongly turbulent inshore water off the Butt of Lewis, to the west of South Uist, off the northern tip of Coll and in the North Channel. The feeding concentration of seabirds at the Butt of Lewis was extremely large; birds were flying from colonies from as far away as St. Kilda (gannets), Clo Mor, Handa and the Shiants (auks) and probably other colonies also. Sandeels were the only prey identified at this site. The seabird community in the open ocean water was dominated by fulmars and to a lesser extent petrels (storm and Leach's), gannets, kittiwakes and puffins.

Two collections of auks were made at two sites in the North Channel. Both sites were important feeding sites for razorbills but the first site, off the coast of Northern Ireland, was important for guillemots also. At the site off Northern Ireland both guillemots and razorbills were feeding on 18 month-old sandeels but in addition razorbills were feeding on lower quality prey such as larval sandeels. The birds collected at the Clyde Front were feeding on very low quality prey: larval fish, fish eggs and copepods (crustacea) which, presmably had been concentrated by the front to form easily exploited prey patches. (Andy Webb and Nancy Harrison).

Aim 5) Seven CTD lowerings were made at the Bidston mooring sites in 58° 10'N on 16-17 June and appeared to show a deepening of the warmer upper waters over the slope in depths of about 500 m. A section on to the shelf in 19°N showed a similar but narrower feature in 600 m, and another to the south of the mooring sites in 57°N had a broader core of warm water extending down to 1000 m. It is possible that these three sections captured the slope current without complications from wind forcing due to a previous fortnight of anticyclonic weather.

Miscellaneous

1) The Acoustic Doppler Current Profiler (ADCP) was run continuously throughout the cruise.

However, from an early stage, it became obvious that all was not well. Two separate problems were identified:

i) The input of heading information was sometimes very erratic. There was no pattern as to when the instrument would lose the heading information.

ii) The instrument would lose its ability to bottom tracks, even on the Shelf. Once lost, only a system reboot would recover the bottom tracking.

Due to these two errors, there was little point in recording data. (C.R. Griffiths).

2) Numerous cetaceans were seen, notably large numbers of Pilot Whales and Common Dolphins over the southern edge of Faroe Bank and White-beaked Dolphins in the Minch. These were recorded in detail by the Seabirds at Sea Team members.

D.J. Ellett.
30 June 1988.

Table 1. Stations and sections worked during Cruise 30/1988.

| Stations | CTD Disc/ Dip Nos. | Location | Dates 1988 | Observations |
|---|---|---|---|---|
| LS | - | Larne-Stranraer midway | 6 Jun | Surface Cs and s‰ |
| 1Z-6Z | 088/001-006 | Copeland-Portpatrick | 6-7 Jun | CTD, surface Cs; sub-surface Cs (2-5) |
| 1 -5Y | 088/007-011 | Corsewall-Sanda | 7 Jun | CTD |
| 1A-5A | 088/012-016 | Kintyre-Antrim | 7 Jun | CTD |
| 6D-2D | 088/017-021 | West of Islay | 7-8 Jun | CTD |
| 1G-11G | 089/022-029 | Sd. of Mull-Barra Hd. | 8 Jun | Surface s‰; Cs surface and sub-surface (1, 2, 4, 6, 7 and 9) |
| A9-A6 | 089/030-033 | S. of Faroe Bank- Ymir Ridge | 10 Jun | CTD |
| A5-A1 | 090/034-038 | | | |
| B1-B5 | 092/039-043 | Ymir Ridge - Faroe-Shetland Channel | 10-11 Jun | CTD |
| B6-B9 | 093/044-047 | | | |
| SE6 | 093/048 | Faroe - Shetland Channel - SE Faroe Bank | 11 Jun | CTD |
| SE5-SE1 | 091/049-053 | | | |
| NE9-NE11 | 091/054-056 | Crest of Faroe Bank | 11 Jun | CTD |
| S1-S2 | 089/057-058 | S. Faroe Bank - Cirolana Deep | 11-12 Jun | CTD |
| S3 | 090/059 | | | |
| S4 | 092/060 | | | |
| S5-S7 | 094/061-063 | | | |

Cont. Table 1

| Stations | CTD Disc/ Dip Nos. | Locations | Dates 1988 | Observations |
|---|---|---|---|---|
| G8-G7 | 094/064-065 | W. of Cirolana Deep | 12 Jun | CTD |
| G6-G3 | 095/066-069 | | | |
| G2-G1 | 096/070-071 | | | |
| F5-F4 | 096/072-073 | S. of Cirolana Deep | 12 Jun | CTD |
| F3-F1 | 097/074-076 | | | |
| E8-E5 | 098/077-080 | E. of Cirolana Deep | 13 Jun | CTD |
| E4-E1 | 099/081-084 | | | |
| C7-C5 | 099/085-087 | Ymir Ridge - Wyville-Thomson Ridge | 13-14 Jun | CTD |
| C1-C4 | 100/088-091 | | | |
| A7 | 100/092 | S. of Faroe Bank - Ymir Ridge | 14 Jun | CTD |
| A6-A3 | 101/093-096 | | | |
| 12M-10M | 102/097-099 | NW from Butt of Lewis | 14-15 Jun | CTD |
| 9M-1M | 103/100-109 | | | |
| 9K-1K | 103/110-118 | L. Gairloch - L. Seaforth | 15 Jun | CTD; surface Cs (3) |
| 2L-5L | 104/119-122 | Stoerhead - Tiumpan Ltd. | 15-16 Jun | CTD |
| BP300 | 104/123-128 | Slope mooring positions | 16-17 Jun | CTD |
| - BP1850 | 105/129 | | | |
| BP1850 | 106/130-131 | CTD tests, 58° 10'N 9° 47'W | 19 Jun | CTD |
| I-J | 106/132-133 | Anton Dohrn Seamount section | 19-20 Jun | CTD |
| K-M | 107/134-136 | | | |

Table 1 cont.

| Stations | CTD Disc/ Dip Nos. | Location | Dates 1988 | Observations |
|---|---|---|---|---|
| N, O, Q | 108/137-138, 140 | | | |
| P | 109/139 | | | |
| 16G, S, 15G | 108/141-143 | Shelf-edge - Barra Hd. | 20 Jun | Surface s‰; CTD (16, S, 15, T, 13, 11); surface and sub-surface Cs (16, 15, 13). |
| T, 13G, 11G | 109/144-146 | | | |

Table 2. Current meter moorings recovered during Cruise 30/1988

| Mooring | Institute | Time GMT | Date 1988 | Lat. N. ° ' | Long. W. ° ' | Decca coords. | Current meters | Remarks |
|---|---|---|---|---|---|---|---|---|
| Y | SMBA | 1221 | 8 Jun | 56 37.5 | 6 24.9 | - | 8217<br>7229 | Surface spar. Deployed 7 March 1988 |
| N2 | SMBA | 0725 | 10 Jun | 60 17.4 | 8 46.1 | - | 3589<br>4593<br>7148 | Sub-surface, acoustic release |
| N3 | SMBA | 1100 | 10 Jun | 60 13.5 | 8 37.0 | - | 7141<br>8580 | Sub-surface, acoustic release |
| CM450 | POL | 1316 | 17 Jun | 58 06.8 | 9 31.5 | H46.05 C66.27 | 1509<br>6941<br>5913 | Sub-surface, acoustic release |
| CM1500 | POL | 0810 | 17 Jun | 58 09.1 | 9 44.6 | H46.60 C73.90 | 7570<br>3559<br>4387<br>8243 | Sub-surface, acoustic release |
| CM650S | POL | 0822 | 18 Jun | 58 13.0 | 9 35.9 | I36.05 C64.94 | - | Release located, but no equipment recovered despite 7 grapnel hauls. |

Two current meters and the sub-surface buoy from mooring CM650N had been returned by a French trawler prior to the cruise.
One current meter and the acoustic release from mooring CM950 had been returned by a French trawler prior to the cruise.

Table 3. Current meter moorings deployed during Cruise 30/1988

| Mooring | Institute | Depth (m) | Date 1988 | Lat. N. ° ' | Long. W. ° ' | Current meters | Remarks |
|---|---|---|---|---|---|---|---|
| Y | SMBA | 48 | 8 Jun | 56 37.7 | 6 24.2 | 9177<br>8263 | Surface spar |
| N2 | SMBA | 692 | 10 Jun | 60 17.8 | 8 47.7 | 6888<br>7144<br>5580 | Sub-surface acoustic release |
| N3 | SMBA | 892 | 10 Jun | 60 13.3 | 8 37.3 | 7140<br>7143 | Sub-surface acoustic release |

Figure 1. Ship's track (1).

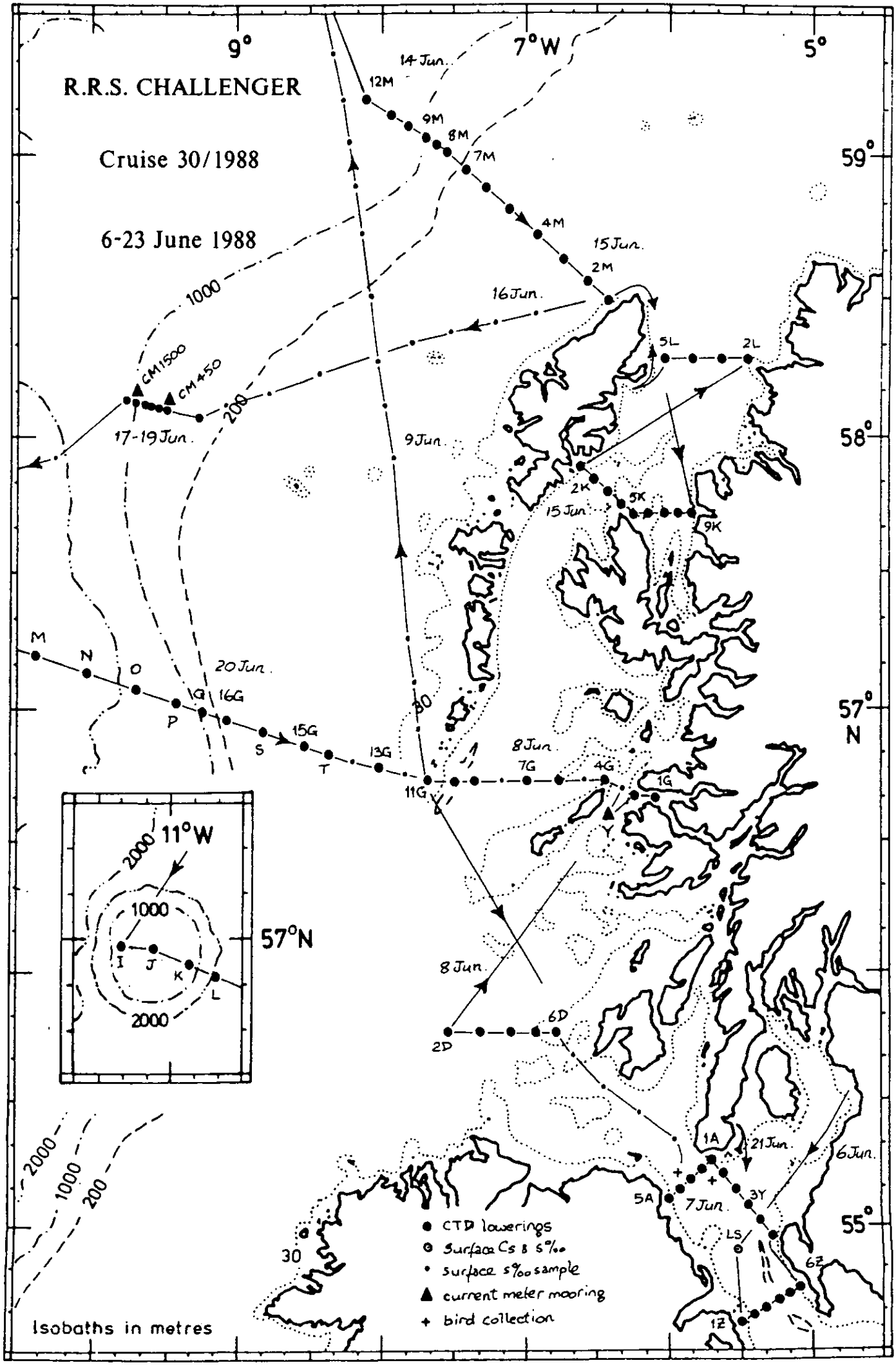
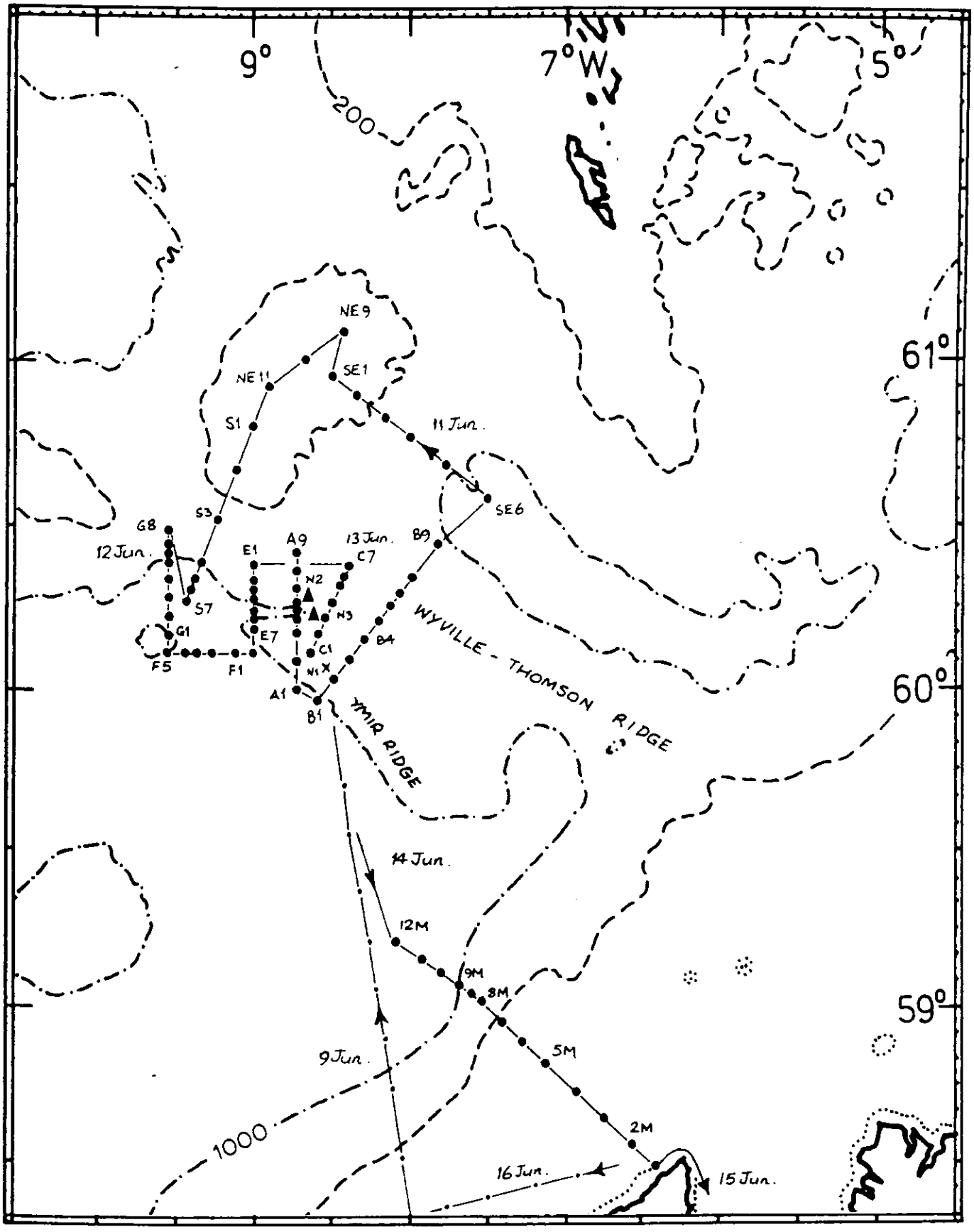


Figure 2. Ship's track (2).



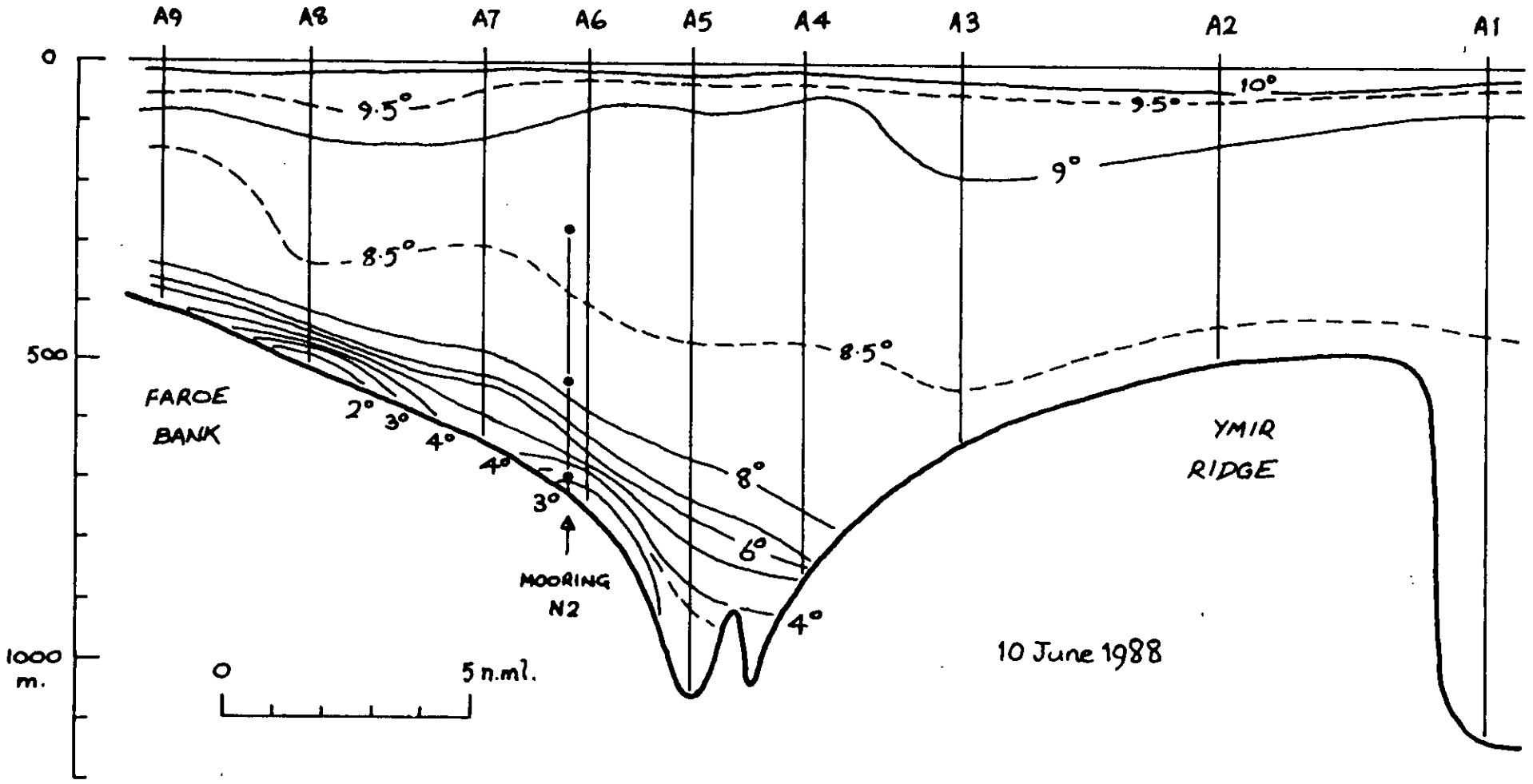



Figure 3. Section of temperature (°C) through Mooring N2.