Scottish Marine Biological Association

Dunstaffnage Marine Research Laboratory

Cruise Report

R.R.S. Challenger.

Cruise 10/1977

29 June - 10 July 1977.

RRS CHALLENGER, Cruise 10/1977.

Duration of cruise: 1024 h 29 June to 0905 h 10 July 1977.

All times BST

Locality: Rockall Channel and Scottish continental shelf.

Staff: D.J. Ellett

R. Bowers

A. Edwards

D.J. Edelsten

N.D. Pascoe

A.M. Souter

C. Currie

R. Spencer (IOS, Bidston)

Aims:

1) To recover and re-lay the SMBA shelf current meter mooring in 57°N, 9°W.

2) To work the Anton Dohrn Seamount STD section.

3) To lay an IOS, Bidston tide gauge to the north-eastward of Rockall Bank for JASIN '77.

4) To work three STD sections on the continental shelf between St. Kilda and Barra Head.

5) To work a grid of STD and radiocaesium sampling stations between the Mull of Kintyre and the North Minch, in conjunction with the Nuclear Geochemistry Unit, Chemistry Department, Glasgow University.

Narrative: CHALLENGER left the Dunstaffnage pontoon at 1024 h 29 June and lay at the mooring buoys until 1120 h awaiting the return from the doctor of a crew member. Passage was made in freshening south-westerly winds from the Sound of Mull to station T of the Anton Dohrn Seamount section, which was reached at 2245 h. Three further stations were worked during the night and the spar buoy of the current meter mooring sighted, but by 0745 h 30 June winds had reached force 8 and the ship hove to. During late afternoon the wind moderated to force 6 in the col between two depressions, and it was decided at 1820 h to steam direct to Rockall Bank in order to take the opportunity of laying the Bidston tide gauge, in the intervening calmer period. Acoustic releases were tested to the west of the bank at 0845 h 1 July in easterly force 4 winds, and after an echo-survey in depths of about 400 m on the northern shoulder of Rockall Bank between 1253 and 1430 h, the tide gauge was laid and its position and acoustic interrogation checked by 1545 h.

Winds had by this time again freshened to force 7, and facsimile weather charts gave no hope of improvement within 24 hours. Course was therefore set at reduced speed for the mooring position on the shelf-edge. During the night the force 7 - 8 winds veered from east to south and on the morning of 2 July, in view of a 48 hr forecast of little change, the course was altered towards the North Channel for the southernmost line of radiocaesium sampling stations. However, winds decreased to force 6 during the evening and on receipt of a more favourable forecast chart it was decided at 2330 h 2 July to head for the mooring position, then about 30 n.ml. distant. After standing by from first light, recovery

began at 0907 h 3 July. No difficulties were encountered and the rig was retrieved by 0958 h. Because of the moderate swell and force 6 - 7 winds and the need to replace some components, it was agreed to postpone the relaying of the mooring until the early part of cruise 11.

Three lines of STD stations were worked across the shelf to the west of Benbecula, S. Uist and Barra Head, between 1242 h 3 July and 2008 h 4 July, the southerly wind decreasing towards the end of this period to force 3 and the moderate swell abating during the subsequent period of steaming to the North Channel. In the calm conditions of 5 July visibility fell to about $1\frac{1}{2}$ miles, and it was therefore thought prudent to sample at the surface only on the southernmost line of readiocaesium stations from Cushenden Bay to the Mull of Kintyre, which was occupied from 1220 to 1411 h 5 July.

STD lowerings were resumed for the line of stations from Kintyre to Islay, but at the second position faults in the instrument became apparent. After unsuccessful attempts at repair, the remainder of these stations were sampled at the surface whilst an alternative sea-unit was connected to the cable. This proved satisfactory and the five following sampling lines were completed without incident in calm weather, but in visibility seldom exceeding 4 n.ml. The passage of a cold front in the early hours of 8 July was preceeded by fog, and work stopped at 0050 h to the west of Canna, to await clearance. At 0245 h a distress call was received and the ship proceeded in visibility of 1 - 2 n.ml. Station working was resumed shortly after in clearer weather

when it became known that the distressed vessel had sunk in Mallaig harbour. The final station of the line off Loch Moidart was completed at 0912 h.

Passage to the line of stations in the Little Minch was made to the north of the Small Isles. Off Morar at 1000 h a search was joined for survivors from a fishing vessel sunk in collision with the previous night's casualty, but wreckage only was sighted, and CHALLENGER proceeded when the search was abandoned by the Mallaig Coastguard at 1448 h. Patchy fog was again encountered during the evening of 8 July and upon arrival off Loch Maddy the ship was hove to awaiting clearance of fog before commencing the STD section at 0110 h 9 July. Work was twice interrupted by the need to heave to in poor visibility and the stations were terminated at 0720 h off Loch Dunvegan. Insufficient time remained for the working of the most northerly of the planned sections and course was set at reduced speed for Dunstaffnage at 0753 h. Five surface radiocaesium samples were collected en route between Skye and Canna. Visibility cleared during the morning and STD test lowerings were made in deep water to the south of Rhum. Following the completion of these at 1421 h the ship proceeded through the Sound of Mull, to anchor in Ardmucknish Bay at 1923 h. CHALLENGER berthed at Dunstaffnage at 0905 h on the following morning, 10 July.

Results: Aim 1) The SMBA shelf current meter mooring in 59°N, 9°W was recovered at 0907 - 0958 h. 3 July, having been deployed since 15 April, a total of 79 days. The meters, at 36 and 106 m depth approx. were both recording at the time of retrieval, but

the uppermost had leaked slightly, and its propellor may have jammed during the course of the observations. The mooring was not relayed in view of the desirability of renewing a number of components of the rig and the option to re-lay at the beginning of the following cruise.

Aim 2) Continuing force 7 - 8 winds during the early part of the cruise prevented the working of the Anton Dohrn Seamount STD section, apart from the four easternmost shelf stations which were completed between 2245 h, 29 June and 0626 h 30 June.

Aim 3) The IOS, Bidston tide gauge was successfully laid at a depth of about 200 m on the northern shoulder of Rockall Bank on 1 July. Good satelite navigation fixes put the gauge in latitude 58° 16.07'N, and between longitudes 13° 52.80' and 13° 52.91'W.

Aim 4) During 3 - 5 July a grid of 21 STD stations was worked on the shelf between St. Kilda and Barra Head and an additional section was worked southwards from Barra Head to Stanton Banks. Three stations within 10 miles of the coasts of Benbecula and S. Uist showed homothermal conditions, two immediately to the west of the Sound of Barra indicated a near-uniform gradient of mixing between surface and bottom, and the remainder showed a marked thermocline. Cold, saline bottom water existed on the central part of the shelf with temperature and salinity values close to those found in mid-April, but at the westernmost stations a layer of colder, but somewhat less saline water was present beneath the thermocline and appears to correspond to water found at the surface in April.

Aim 5) From 5 - 9 July surface radiocaesium samples were taken on a grid of stations between the North Channel and the Little Minch for post-cruise determination by the Nuclear Geochemistry Unit of Glasgow University. With the exception of the two south-easternmost sampling lines and an ad hoc line of samples between Skye and Canna on the homeward steam, STD lowerings were made at each position. Additional surface salinity samples were also taken as appropriate on passage between lines of the grid.

By comparison with a similar but less extensive survey carried out in May 1976 salinity values (Figures 2 and 3) were somewhat lower at both surface and bottom, and the position of the frontal zone between Atlantic water and Irish Sea/Clyde water lay about 12 - 15 n.ml. further westward. In other respects the situation was very similar. The section between Islay and Lough Foyle showed near-homothermal and isothermal conditions rising in value towards the south, and the section to the west of Islay showed this water abutting Atlantic water in a sharp front at its western end. The front continued more diffusely to the southern end of Tiree, but the coastal water had become stratified before entering the Tiree Passage. The present survey showed the coastal water continuing northwards to the Little Minch past the Small Isles and the south coast of Skye, rather than diverging westwards towards Barra from the northern exit of the Tiree Passage as could have been inferred from the more restricted data of the May 1976 survey. In July 1977 Atlantic water lay closely to the east of the Outer Hebrides, and there were no obvious indications of a

clockwise coastal flow around the islands as in some previous data.

The northernmost section crossed some of the isolated deep basins of the Little Minch and gave an interesting series of stepped and sheared temperature and salinity profiles resulting from the generally narrowing and shoaling topography and the passage of the upper waters across the denser winter-formed water of the basins.

D.J. Ellett.

20 July 1977.

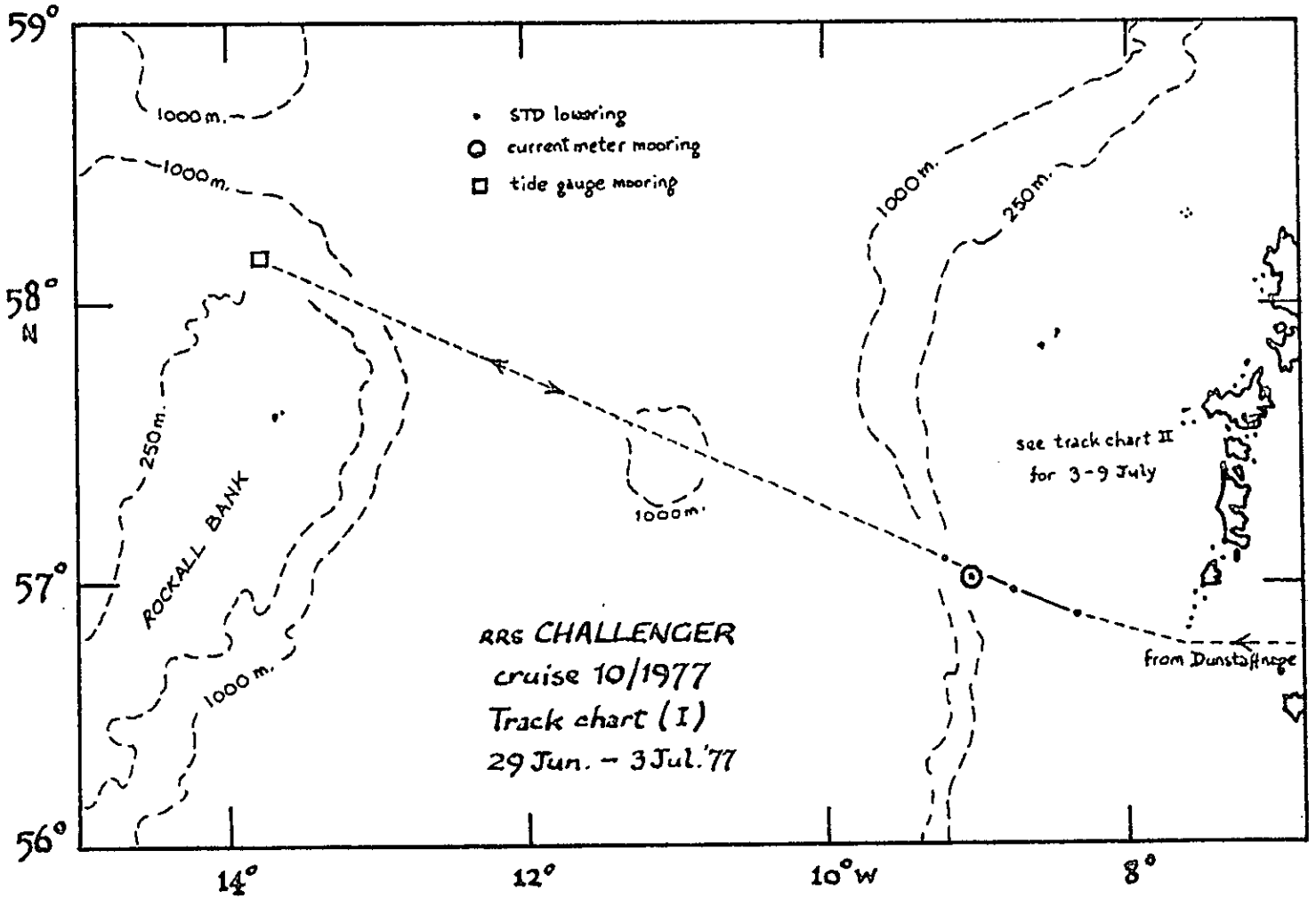

Figure 1a

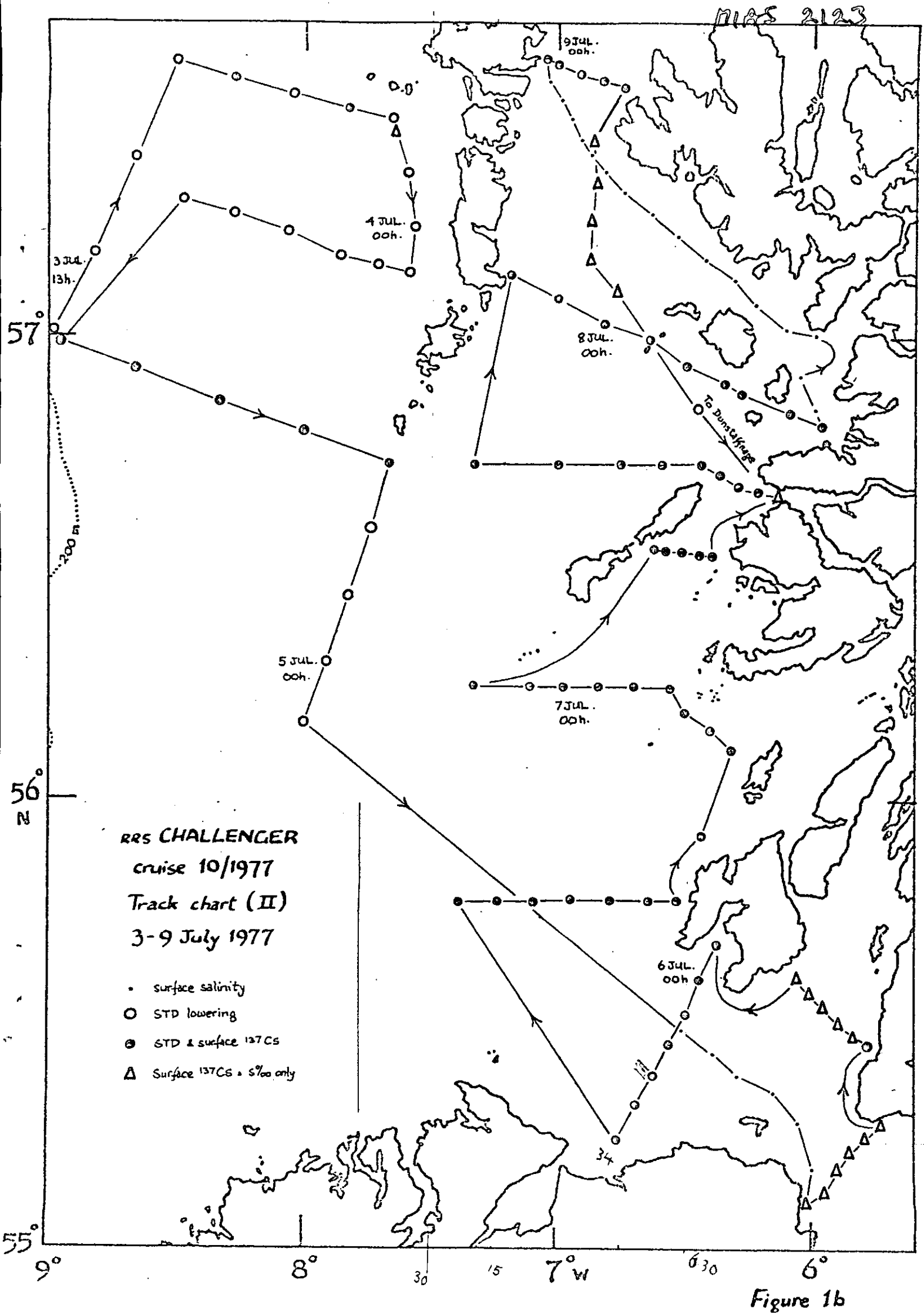
RRS CHALLENGER
cruise 10/1977
Track chart (II)
3-9 July 1977
surface salinity
STD lowering
STD & surface 137Cs
Surface 137Cs & S‰ only
3 JUL. 13h.
4 JUL. 00h.
5 JUL. 00h.
6 JUL. 00h
7 JUL. 00h.
8 JUL. 00h.
9 JUL. 00h.
To Dunstaffnage
200 m
57°
56° N
55°
9°
8°
7° W
6°
30
15
30
34

Figure 1b

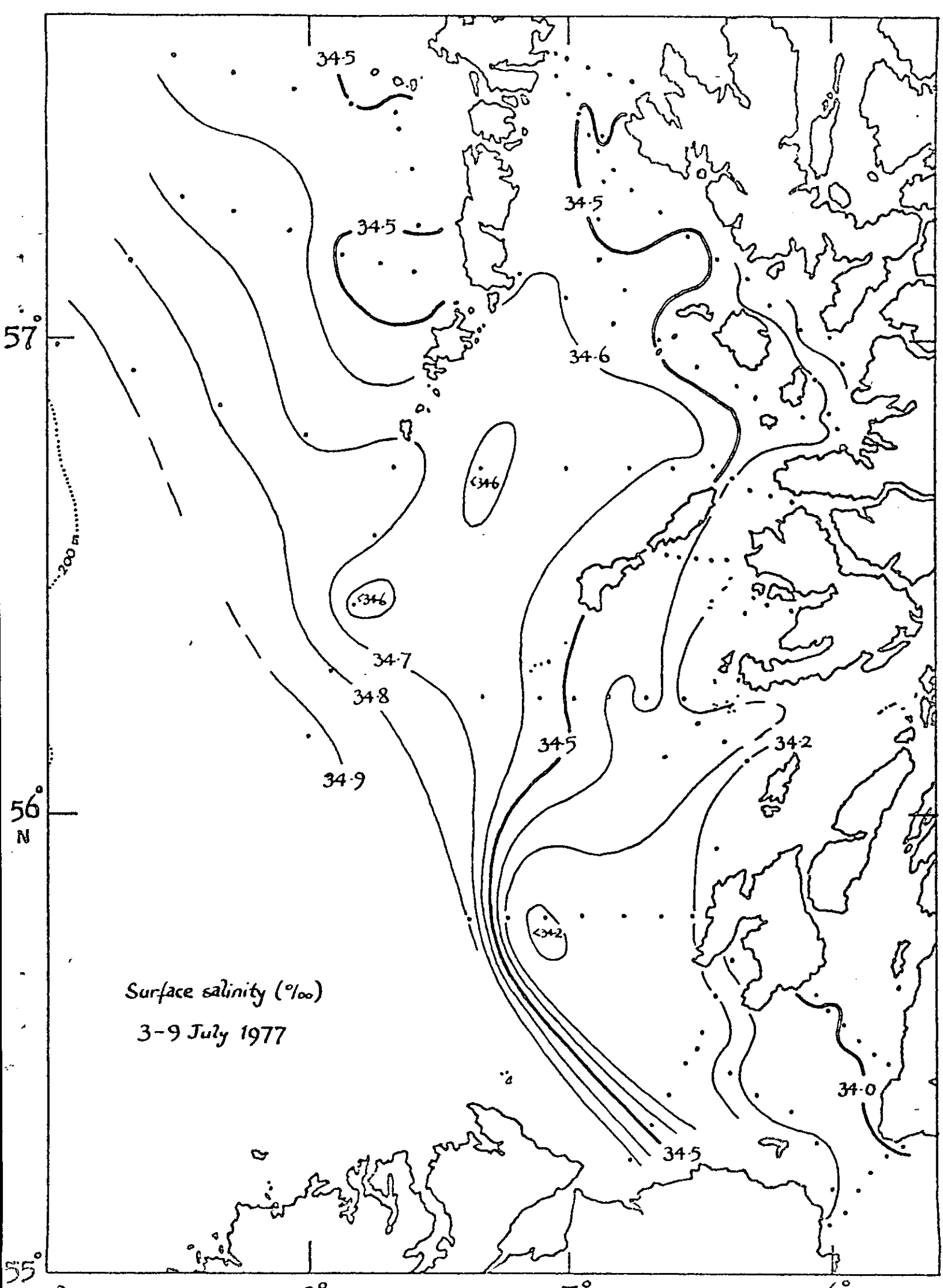
34·5
0·0
34·5
34·5
34·6
<34·6
<34·6
34·7
34·8
34·9
34·5
34·2
<34·2
34·0
34·5
200 m
57°
56°
N
55°
9°
8°
7° W
6°
Surface salinity (‰)
3-9 July 1977

Figure 2

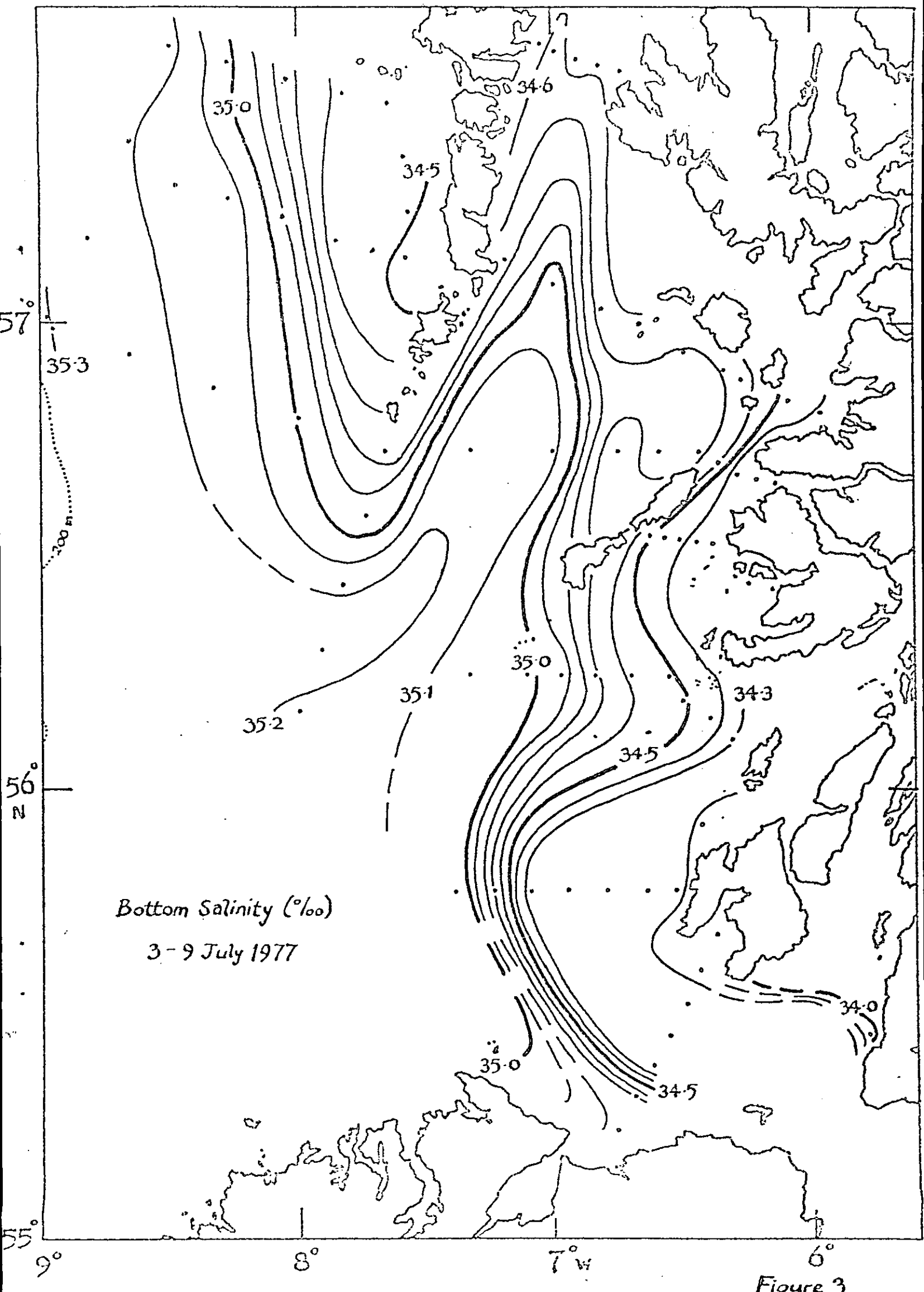
35·0
34·6
34·5
57°
35·3
200 m
35·0
35·1
35·2
34·3
34·5
56°
N
Bottom Salinity (‰)
3 - 9 July 1977
34·0
35·0
34·5
55°
9°
8°
7° W
6°

Figure 3