

**I.O.S.**

**R R S CHALLENGER  
CRUISE 14/74  
(LEGS 1 AND 2)**

**29 AUGUST – 21 SEPTEMBER, 1974**

**GEOLOGICAL INVESTIGATIONS ON THE  
CONTINENTAL SHELF TO THE WEST AND  
NORTH OF SCOTLAND.**

**CRUISE REPORT NO 22**

**1975**

**INSTITUTE OF  
OCEANOGRAPHIC  
SCIENCES**

**NATURAL ENVIRONMENT  
RESEARCH COUNCIL**

INSTITUTE OF OCEANOGRAPHIC SCIENCES

R. R. S. CHALLENGER

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(Legs 1 and 2)

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Institute of Oceanographic Sciences,  
Wormley, Godalming,  
Surrey, GU8 5UB.

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## ITINERARY

Leg 1	29 August - 9 September	Greenock	-	Scrabster
Leg 2	10 September - 21 September	Scrabster	-	Aberdeen
(Leg 3	22 September - 3 October	Aberdeen	-	Leith)

## SCIENTIFIC STAFF

Mrs. G. F. Caston	IOS
T. Howarth	IOS
N. R. A. MacWhirter	IOS
D. R. Morley	IOS
C. D. Pelton	IOS
Miss A. M. Taylor	IOS
K. Tipping	IOS
A. C. Rigby	IOS
J. B. Wilson (Principal Scientist)	IOS

## SHIP'S OFFICERS

Master	P. H. P. Maw
Chief Officer	J. D. Noden
2nd Officer	D. A. Pye
3rd Officer	A. R. Neil
Chief Engineer	J. A. Lennox
2nd Engineer	J. R. Richardson
3rd Engineer	G. M. Batten
Electrical Officer	F. P. Sharpe

## CRUISE OBJECTIVES

1. To obtain grab and dredge samples for study as part of the I. O. S. Wormley investigation into biogenic carbonates and sediments on the Scottish Continental Shelf from areas not covered during previous cruises (R. R. S. John Murray, 1968, 1972; M. V. Surveyor, 1970, 1971) and for which data was required.
2. To obtain sediment and faunal samples along the sediment transport path through the Shetland-Fair Isle-Orkney Channel and into the northern North Sea.
3. To investigate localities on the shelf and upper slope known to contain the corals Caryophyllia smithii and Lophelia prolifera.
4. To obtain further side-scan sonar records to improve existing coverage on the continental shelf west and north of Scotland.
5. To obtain side-scan sonar data on the distribution and burial of iceberg plough marks in the north North Sea between 61°31.7'N 0°41.8'E (the south-eastward limit of data from R. R. S. John Murray in May, 1972) and 60°37.0'N 2°48.0'E (the westerly line obtained on R. R. S. Discovery, Cruise 50, October, 1972).
6. To obtain anchor dredge and epibenthic sledge samples from the deep station in the Rockall Trough or from Anton Dohrn Bank or from the upper stations on the Hebrides Terrace transect for Dr. J. D. Gage as part of the S. M. B. A. , B. A. B. S. programme.
7. To use the MS47 Transit Sonar to look for evidence of scouring or build up of sediment and evidence of sediment transport associated with some of the remaining wrecks of the German High Seas Fleet in Scapa Flow.

## NARRATIVE

### Leg 1

The fitting out of the ship for the cruise was largely completed in the two days prior to sailing. The power pack for the Loran-C was found to be faulty and could not be repaired or replaced prior to sailing. It was, therefore, decided to call at Dunstaffnage on 2 September to collect a replacement power pack.

The ship sailed at 0930 hours on 29 August and after compass adjusting was completed the side-scan sonar was deployed and watchkeeping was commenced. Side-scan sonar records were obtained overnight on passage round the Mull of Kintyre towards the first station. Grab and dredge samples were collected along a line working westwards and then northwards towards a position where C. smithii had been obtained by Dr. C. Edwards of S. M. B. A. in 1964. Anchor dredge and rock dredge hauls yielded several live specimens of C. smithii which were placed in aquarium tanks in the constant temperature laboratory. Attempts to sample on the Hebrides Terrace along the S. M. B. A. transect had to be abandoned as the bad weather made it impossible to launch and recover dredges over the stern. It was, however, possible to operate the grab and samples were obtained at several stations along an east-south-east line from the shelf edge. We steamed overnight towards the Sound of Mull to arrive off Dunstaffnage at 1200 hours on 2 September. Dr. Gage came on board and we obtained anchor dredge and epibenthic sledge hauls at a station (Station 30) at 140-160 metres depth in the Lynn of Morven.

On completion Dr. Gage returned to Dunstaffnage and we sailed out through the Sound of Mull and round Barra Head. A series of grab stations were worked on 3 and 4 September west of Barra Head then northwards from the Butt of Lewis toward Sula Sgeir. It was intended to operate the E. G. & G. dual channel side-scan sonar during the night in addition to the MS47 to obtain high resolution sonographs to assist in the interpretation of the transit sonar data. A number of faults were found in the system but considerable efforts by Mr. T. Hogarth and Mrs. G. F. Caston assisted by the ship's electrical officer, Mr. F. P. Sharpe over several days finally made the E. G. & G. side-scan work and overnight runs with it could recommence.

A further series of grab stations were worked towards North Rona and then along a line towards Noup Head. Station 79 was close to the position of a dan buoy left on the previous cruise and which we were asked to recover if possible. Although a search was

made for this while approaching the station no sign of it was found.

On 6, 7 and 8 September, work was concentrated in the area to the east of the Shetland-Fair Isle-Orkney Channel where three lines of stations were worked using the Grab and Anchor Dredge along the probable direction of the sediment transport path from the high current area between North Ronaldsay, Fair Isle and Sumburgh Head into the North Sea. After Station 124, sea conditions became unsuitable for further work and so a course was set for Scapa Flow. We entered Scapa Flow via Hoxa Sound at 0530 hours on 9 September and proceeded towards the 'Barrel of Butter' to investigate sediment build up or scouring associated with the remains of the German High Seas Fleet scuttled on 21 June, 1919 in the vicinity of the Barrel of Butter. We circled the wrecks three times, twice using the 300 metre range on the MS47 and once using the 600 metre range. Accurate fixing was achieved by taking frequent radar ranges and bearings. High quality side-scan records were obtained showing the remains of six German ships and the British battleship 'Vanguard'. In spite of the strong currents into Scapa Flow, no clear evidence of scour or sediment build up could be detected on the side-scan records. After completion of the Scapa Flow work the side-scan sonar transducer was brought inboard and we steamed for Scrabster to dock at 1500 hours at the end of Leg 1.

## Leg 2

We sailed from Scrabster just after 0800 hours on 10 September. The side-scan transducer was rigged just outside the harbour. A course was set to reoccupy Station 124 south-east of Fair Isle. At 1330 hours the side-scan pole was seen to be bent in the water and on slowing down to investigate the pipe snapped. On bringing the transducer inboard the weld on the flange on the shipboard end of the 4ft. length of pipe below the bracket had failed and part of the pipe itself had broken. The pipe was repaired using the ship's arc welding equipment and the transducer was re-assembled and rigged.

A series of grab and dredge stations were worked on 11 September along the sediment transport path towards Sumburgh Head. On inspection the MS47 pole was found to be bent. A replacement length was ordered in Lerwick. We anchored off Lerwick on 12 September and two members of the party went ashore to obtain the pipe. The job was completed by 1530 hours. The transducer was re-rigged and we sailed to commence the side-scan sonar run in the northern North Sea.

Trouble with both generators soon after sailing forced us to return to Lerwick to anchor.



The port generator was quickly repaired but the fault on the starboard generator was more serious. It was traced to the automatic voltage regulator and arrangements were made for two electrical engineers from Lerwick to look at the fault. They came on board on the morning of 13th (Friday!) and confirmed that the fault lay in the A. V. R. We then set sail for Aberdeen where an engineer from the U. K. agents for Leroy-Somner would come and fit a replacement unit. We docked in Aberdeen at 1000 hours on the 14th. The engineer arrived at the ship at 0900 hours on the 15th. The new component was fitted and the generator was tested and found to be satisfactory. As we had lost three days working time due to the starboard generator fault the northern North Sea side-scan investigation of the eastward limit of exposed iceberg plough marks had to be abandoned.

We sailed from Aberdeen at 1300 hours and proceeded towards Rattray Head. Fog during passage reduced speed to 6 knots. The fog cleared, however, and we steamed overnight towards Foula. A series of grab stations were worked northwards and then westwards towards a coral bank identified on the Kingfisher Fisherman's Charts. Two dredge hauls failed to obtain any coral. A towed camera traverse was also made across the bank.

A line of grab stations were worked back towards Foula. Towards the end of this line weather conditions deteriorated markedly. On the morning of the 17th Force 9-10 winds forced us to heave to in the lee of Foula to try to obtain some shelter. The storm persisted all day. Although the winds had moderated slightly by the 18th, the swell prevented any further work. We steamed slowly towards Sumburgh Head and found calmer water on the east side of Mainland Shetland. A line of stations was worked northwards towards Balta Sound. Overnight we steamed towards the north west of Orkney in the hope of being able to work stations west of Orkney. The swell was too great and we therefore steamed eastwards and worked a line of stations south-westwards from Sanday along the line of the transport path. Gale warnings for the area prevented any further work after 0930 hours on the 20th. We then steamed for Aberdeen and docked at 1900 hours on the 20th.

Unloading was completed by mid-day on the 21st and the ship was taken over by Aberdeen University. Sixteen live Caryophyllia smithii were successfully transported from Aberdeen to the aquarium in the Department of Oceanography at Southampton University to be used for further measurements of growth rates.

It would not have been possible to complete as much of the projected programme as we did without the enthusiastic support given by the members of the scientific party.

Particular thanks are due to Captain Maw and the officers and crew of RRS Challenger for their willing help at all times during the cruise and for the efficient running of the ship which, in spite of difficulties, enabled us to occupy 188 stations.

The help given by the Wrecks Section of the Admiralty Hydrographic Department, Taunton in planning the Scapa Flow work is gratefully acknowledged.

JBW

## RESULTS

1. Grab and dredge samples were obtained at 49 stations from part of the west of Scotland shelf where samples were required.

Samples were only obtained from 50 stations on the northern Scottish shelf. Bad weather prevented any work on the north west of the Orkneys.

2. Samples were obtained from 75 stations along the sediment transport path through the Shetland-Fair Isle-Orkney Channel.

3. Live specimens and useful additional data on Caryophyllia smithii were obtained at stations 8 and 9 on the shelf west of Islay. Additional records were also obtained at several stations on the northern Scottish shelf.

4. Many miles of useful side-scan sonar records were obtained west and north of Scotland, particularly to the west of the Outer Hebrides and through the Shetland-Fair Isles-Orkney Channel.

Some difficulties were encountered in the fitting and running of the MS 47 due to the high midships freeboard on the port side of RRS Challenger. In the light of this experience consideration should be given to designing a system specifically for high freeboard ships rather than adapting the standard equipment such as that used on RRS John Murray by adding additional lengths of pole.

5. No side-scan sonar records of iceberg plough marks in the northern North Sea were obtained. The three days allocated for this work were lost when the starboard generator failed.

6. Weather conditions prevented work on the Hebrides Terrace but samples were obtained at Station 30 in the Lynn of Morven.

7. Useful side-scan sonar records were obtained of wrecks of the German ships 'Kohn'; 'Brummer'; 'Kronprinz Wilhelm'; 'Markgraf'; 'Konig'; and 'Dresden' and of parts of the British Battleship 'Vanguard'.

JBW

## E. G. & G. SIDE-SCAN SONAR

An E. G. & G. dual channel side-scan sonar was provided by the Hydrographic Department. It was intended to be used simultaneously with the Kelvin Hughes MS 47 side-scan sonar, to compare the appearance of bedforms on the two records. It was not proposed to use the towed side-scan during the day when the ship would be stopping frequently for stations.

The E. G. & G. system comprised a recorder, model 259-3, a towfish, model 268-2 and a 600 m main tow cable. A 100 ft. cable provided by Research Vessel Base was substituted for the standard 50 ft. length of rubber cable to enable the recorder to be positioned in the scientific control room, two decks above the capstan. The helical capstan and its 8-core slip ring assembly were used so that the position of the towfish relative to the sea surface and sea floor could be observed on the record whilst paying out or hauling in cable.

Upon leaving Greenock on the 29th the system was tested on deck then launched but shortly afterwards the F6 fuse in the recorder was blown. A second attempt again failed. A split in one core of the rubber tow cable between the fish and armoured cable was located, and taped up; all cable connections were taped with self-vulcanising tape; a cracked resistor was replaced on the Transducer driver replacement board.

On 31 August, reasonably good records were obtained but on 1 September again a fuse was blown soon after launching. Water was found to be leaking into the joy pin connections within the fish but even after they were dried, greased and taped as tightly as possible, the system ceased working soon after the fish and rubber cable were placed in water. All cable connections from the recorder to the electronics bulkhead in the fish were disconnected and each length of cable was tested. The slip rings were found to be leaking current and required cleaning. The short length of cable from the E. O. connector to the eight joy pins was found to have poor insulation between the cores, especially the lead with the taped split. The slip ring unit was rewired to use a spare core instead of the split lead. Upon testing the fish case was found to be live with 750 volts. Further investigation proved that the colour coding of the rubber cables adjacent to the fish did not agree with that given in the manual. All cores were identified and new connections made accordingly. The joy plugs within the fish were wired to prevent water seeping in. The transducer plugs were sealed with tape. The equipment functioned correctly on all subsequent occasions that it was used - 4 to 11 September, inclusive.

The proximity of the fish to the sea floor (optimum 25 - 50 m for the range scale used) was determined by the amount of cable out and the ships speed. However, with all cable payed out, at 4 knots, the fish did not sink enough to show the sea floor deeper than 200 m. Where unexpected shoal areas occurred the ship's speed was increased to lift the fish because hauling in cable was a slow process, due partly to the lack of communications to the capstan room. The capstan could not be driven from the bridge because the spooling mechanism (designed for larger diameter cable) had to be moved by hand. Also the number of turns used had to be counted to calculate the length of cable payed out. All alterations in ship's speed and cable out were logged, and marked on the records. The fish towed steadily in calm conditions but above sea state 6 undulations were observed. One night undulations as great as  $\pm 15m$  occurred.

The system was not designed for unattended operation and it was necessary to adjust the various settings on the recorder quite frequently. Some records obtained were of inferior quality due to the inexperience of the operations in making these fine adjustments.

GFC

## KEY TO STATION LIST

SMG	0.1m <sup>2</sup> Smith McIntyre Grab
RD	I. O. S. Rock Dredge
AD	S. M. B. A. Anchor Dredge
ES	S. M. B. A. Epibenthic Sledge
Camera	I. O. S. 16mm Towed Camera
UCM	Uncorrected metres

## TRACK CHART (Figures 1 and 2)

Full line denotes Precision Echo Sounder and Side Scan Sonar tracks (Kelvin Hughes MS47 and occasionally E. G. & G. dual channel towed side scan).

Dotted line denotes Precision Echo Sounder track only.

R. R. S. CHALLENGER CRUISE 14 - 1974: STATION LIST

Station No.	Gear Used	Date	Time (BST) From To	Lat. Long.	to	Lat. Long.	Depth UCM	No. of Hauls
1	SMG	30. 8. 74	0845 1009	55°36. 19'N 07°01. 62'W	-	-	38	3
2	SMG	30. 8. 74	1048 1100	55°36. 57'N 07°10. 49'W	-	-	49	2
3	SMG	30. 8. 74	1134 1147	55°36. 51'N 07°19. 34'W	-	-	56	2
4	SMG	30. 8. 74	1232 1255	55°36. 56'N 07°28. 35'W	-	-	68	2
5	SMG	30. 8. 74	1345 1400	55°36. 56'N 07°36. 58'W	-	-	63	2
6	SMG	30. 8. 74	1555 1620	55°48. 81'N 07°36. 60'W	-	-	108	2
7	SMG	30. 8. 74	1700 1725	55°49. 24'N 07°40. 92'W	-	-	124	2
8	SMG, AD, RD, Camera	30. 8. 74	1815 2207	55°48. 94'N 07°46. 82'W	55°49. 00'N 07°53. 40'W		130	7
9	SMG	31. 8. 74	0900 0930	55°48. 84'N 07°57. 08'W	-	-	144	3
10	SMG	31. 8. 74	1007 1020	55°49. 04'N 08°00. 48'W	-	-	130	2
11	SMG	31. 8. 74	1120 1145	55°49. 12'N 08°10. 00'W	-	-	149	3
12	SMG	31. 8. 74	1225 1251	55°48. 60'N 08°13. 85'W	-	-	140	3

13	SMG	31.8.74	1347	1403	55°49.30'N 08°27.68'W	-	118	2
14	SMG	31.8.74	1503	1519	55°49.33'N 08°37.06'W	-	120	2
15	SMG	31.8.74	1615	1630	55°44.22'N 08°37.09'W	-	100	2
16	SMG	31.8.74	1721	1745	55°40.75'N 08°29.04'W	-	92	2
17	SMG	31.8.74	1840	1858	55°38.38'N 08°37.64'W	-	92	2
18	SMG	31.8.74	1955	2005	55°40.68'N 08°46.29'W	-	102	2
19	SMG	31.8.74	2040	2108	55°42.76'N 08°54.11'W	-	109	2
20	SMG	31.8.74	2200	2212	55°47.03'N 08°50.83'W	-	116	2
21	SMG	31.8.74	2309	2320	55°51.73'N 08°47.59'W	-	125	2
22	SMG	1.9.74	0010	0030	55°56.45'N 08°44.68'W	-	130	2
23	SMG	1.9.74	1017	1038	56°30.18'N 08°49.66'W	-	140	2
24	SMG	1.9.74	1154	1215	56°29.31'N 08°40.30'W	-	134	2
25	SMG	1.9.74	1350	1407	56°28.76'N 08°31.69'W	-	137	2
26	SMG	1.9.74	1500	1515	56°27.94'N 08°24.00'W	-	148	2



Station No.	Gear Used	Date	Time (BST) From To	Lat. Long.	to Lat. Long.	Depth UCM	No. of Hauls
27	SMG	1.9.74	1620 1635	56°31.96'N 08°18.70'W	- -	162	2
28	SMG	1.9.74	1719 1740	56°36.09'N 08°15.61'W	- -	135	2
29	SMG	1.9.74	1832 1855	56°39.33'N 08°22.79'W	- -	138	3
30	AD, ES.	2.9.74	1500 1636	56°30.50'N 05°35.80'W	56°30.38'N 05°35.88'W	160-140	2
31	SMG	3.9.74	0800 0816	57°08.73'N 07°37.52'W	- -	38	3
32	SMG	3.9.74	0908 0925	57°09.19'N 07°45.96'W	- -	72	3
33	SMG	3.9.74	1006 1016	57°10.14'N 07°55.58'W	- -	94	2
34	SMG	3.9.74	1055 1108	57°11.33'N 08°05.95'W	- -	116	2
35	SMG	3.9.74	1142 1152	57°12.73'N 08°11.88'W	- -	110	2
36	SMG	3.9.74	1232 1245	57°13.84'N 08°21.61'W	- -	120	2
37	SMG	3.9.74	1330 1345	57°17.19'N 08°14.72'W	- -	134	2
38	SMG	3.9.74	1420 1438	57°17.50'N 08°05.99'W	- -	140	2
39	SMG	3.9.74	1508 1515	57°17.60'N 07°58.36'W	- -	100	2

40	SMG	3.9.74	1550	1605	57°17.15'N 07°49.42'W	-	80	3
41	SMG	3.9.74	1642	1655	57°16.65'N 07.39.58'W	-	48	3
42	SMG	3.9.74	1735	1750	57°22.02'N 07°40.41'W	-	56	3
43	SMG	3.9.74	1835	1850	57°26.70'N 07°46.74'W	-	72	3
44	SMG	3.9.74	1938	2000	57°32.97'N 07°52.63'W	-	80	3
45	SMG	3.9.74	2035	2055	57°35.82'N 07°45.84'W	-	48	4
46	SMG	3.9.74	2136	2145	57°39.04'N 07°39.53'W	-	36	2
47	SMG	3.9.74	2215	2224	57°42.43'N 07°42.24'W	-	39	2
48	SMG	3.9.74	2305	2315	57°43.07'N 07°32.60'W	-	36	2
49	SMG	3.9.74	2348	2400	57°52.05'N 07°27.07'W	-	58	2
50	SMG	4.9.75	0045	0054	57°56.67'N 07°26.72'W	-	50	2
51	SMG	4.9.74	0903	0915	58°50.57'N 07°14.87'W	-	116	2
52	SMG, RD	4.9.74	0953	1120	58°50.51'N 07°04.50'W	58°50.13'N 07°04.38'W	152	3
53	SMG	4.9.74	1205	1225	58°50.61'N 06°52.82'W	-	160	2

Station No.	Gear Used	Date	Time (BST) From To	Lat. Long. to	Lat. Long.	Depth UCM	No. of Hauls
54	SMG	4. 9. 74	1250 1305	58°50. 61'N 06°45. 64'W	- -	136	2
55	SMG	4. 9. 74	1343 1356	58°50. 73'N 06°36. 81'W	- -	138	2
56	SMG	4. 9. 74	1435 1450	58°58. 93'N 09°54. 07'W	- -	112	2
57	SMG, AD	4. 9. 74	1532 1600	58°46. 44'N 06°19. 79'W	58°45. 70'N 06°20. 80'W	119	4
58	SMG	4. 9. 74	1717 1731	58°46. 99'N 06°10. 27'W	- -	115	2
59	SMG	4. 9. 74	1809 1818	58°52. 10'N 06°09. 84'W	- -	116	2
60	SMG	4. 9. 74	1855 1909	58°57. 23'N 06°10. 08'W	- -	80	3
61	SMG	4. 9. 74	1943 1959	59°02. 13'N 06°09. 96'W	- -	63	3
62	SMG	4. 9. 74	2030 2038	59°04. 33'N 06°09. 04'W	- -	54	2
63	SMG	4. 9. 74	2119 2125	59°07. 79'N 06°10. 69'W	- -	80	2
64	SMG	4. 9. 74	2204 2215	59°12. 77'N 06°10. 68'W	- -	112	2
65	SMG	4. 9. 74	2249 2300	59°17. 90'N 06°10. 50'W	- -	126	2
66	SMG	4. 9. 74	2345 2400	59°22. 91'N 06°10. 51'W	- -	160	2

67	SMG	5.9.74	0831	0852	58°47.77'N 04°58.86'W	-	83	2
68	SMG	5.9.74	0935	0944	58°47.50'N 05°09.58'W	-	85	2
69	SMG	5.9.74	1030	1040	58°47.34'N 05°19.47'W	-	88	2
70	SMG	5.9.74	1119	1126	58°47.33'N 05°29.06'W	-	86	2
71	SMG	5.9.74	1205	1214	58°52.06'N 05°32.72'W	-	94	2
72	SMG	5.9.74	1250	1307	58°57.09'N 05°35.71'W	-	101	3
73	SMG	5.9.74	1345	1355	59°01.43'N 05°39.16'W	-	86	2
74	SMG	5.9.74	1438	1452	59°07.34'N 05°43.39'W	-	68	2
75	SMG	5.9.74	1530	1540	59°12.61'N 05°44.01'W	-	92	2
76	SMG	5.9.74	1624	1634	59°12.93'N 05°33.70'W	-	94	2
77	SMG	5.9.74	1710	1720	59°13.31'N 05°24.29'W	-	96	2
78	SMG	5.9.74	1755	1805	59°13.69'N 05°14.80'W	-	108	2
79	SMG	5.9.74	1850	1906	59°14.33'N 05°02.37'W	-	116	2
80	SMG	5.9.74	1943	1951	59°15.63'N 04°53.13'W	-	107	2

Station No.	Gear Used	Date	Time (BST) From To	Lat. Long.	to	Lat. Long.	Depth UCM	No. of Hauls
81	SMG	5. 9. 74	2028 2038	59°17.06'N 04°43.78'W	-	-	128	2
82	SMG	5. 9. 74	2112 2120	59°18.08'N 04°34.80'W	-	-	98	2
83	SMG	5. 9. 74	2153 2203	59°19.33'N 04°24.79'W	-	-	86	2
84	SMG	5. 9. 74	2234 2242	59°20.58'N 04°15.75'W	-	-	97	2
85	SMG	5. 9. 74	2315 2330	59°21.73'N 04°06.28'W	-	-	112	3
86	SMG, AD.	6. 9. 74	0845 0950	59°49.20'N 02°46.16'W	59°50.00'N 02°46.89'W	-	76	2
87	SMG	6. 9. 74	1050 1105	59°43.92'N 02°41.33'W	-	-	80	3
88	SMG, AD.	6. 9. 74	1135 1230	59°40.13'N 02°34.63'W	59°40.00'N 02°33.16'W	-	80	2
89	SMG	6. 9. 74	1308 1325	59°36.45'N 02°27.07'W	-	-	89	2
90	SMG	6. 9. 74	1412 1440	59°32.04'N 02°21.36'W	-	-	80	2
91	SMG	6. 9. 74	1512 1521	59°27.77'N 02°15.11'W	-	-	80	2
92	SMG	6. 9. 74	1548 1601	59°24.11'N 02°10.26'W	-	-	75	3
93	SMG	6. 9. 74	1640 1649	59°20.40'N 02°03.33'W	-	-	80	2

94	SMG	6. 9. 74	1725	1740	59°16. 46'N 01 °57. 46'W	-	98	2
95	SMG	6. 9. 74	1820	1830	59°12. 84'N 01 °50. 75'W	-	80	2
96	SMG	6. 9. 74	1910	1920	59°08. 87'N 01 °44. 58'W	-	84	2
97	SMG	6. 9. 74	2000	2013	59°04. 88'N 01 °38. 44'W	-	98	2
98	SMG	6. 9. 74	2055	2101	59°01. 23'N 01 °32. 14'W	-	105	2
99	SMG	6. 9. 74	2143	2155	58°57. 23'N 01 °25. 91'W	-	114	2
100	SMG	6. 9. 74	2235	2246	58°53. 35'N 01 °19. 75'W	-	109	2
101	SMG	6. 9. 74	2326	2338	58°49. 45'N 01 °13. 76'W	-	112	2
102	SMG	7. 9. 74	0015	0030	58°45. 27'N 01 °07. 53'W	-	105	2
103	SMG, AD.	7. 9. 74	0830	0945	58°58. 43'N 00°38. 50'W	58°57. 71'N 00°38. 75'W	134	3
104	SMG	7. 9. 74	1015	1030	58°59. 75'N 00°41. 68'W	-	132	2
105	SMG	7. 9. 74	1113	1123	59°02. 98'N 00°48. 96'W	-	134	2
106	SMG	7. 9. 74	1200	1215	59°06. 33'N 00°56. 04'W	-	130	2
107	SMG, AD.	7. 9. 74	1255	1344	59°09. 35'N 01 °02. 71'W	59°09. 02'N 01 °02. 09'W	130	3

Station No.	Gear Used	Date	Time (BST) From To	Lat. Long.	to Lat. Long.	Depth UCM	No. of Hauls
108	SMG	7.9.74	1433 1448	59°12.74'N 01°10.32'W	- -	114	2
109	SMG, AD.	7.9.74	1527 1611	59°15.84'N 01°17.53'W	59°15.70'N 01°16.84'W	107	3
110	SMG	7.9.74	1703 1723	59°19.31'N 01°25.94'W	- -	100	2
111	SMG, AD.	7.9.74	1755 1845	59°22.89'N 01°32.29'W	59°23.08'N 01°32.46'W	86	3
112	SMG	7.9.74	1920 1945	59°26.26'N 01°40.72'W	- -	80	3
113	SMG	7.9.74	2013 2027	59°29.34'N 01°46.57'W	- -	96	2
114	SMG	7.9.74	2100 2115	59°32.37'N 01°53.85'W	- -	96	2
115	SMG	7.9.74	2145 2158	59°35.73'N 02°00.82'W	- -	102	2
116	SMG	7.9.74	2237 2255	59°39.37'N 02°08.14'W	- -	100	2
117	SMG	7.9.74	2330 2350	59°42.80'N 02°15.22'W	- -	117	3
118	SMG	8.9.74	0030 0040	59°45.74'N 02°21.76'W	- -	90	2
119	SMG	8.9.74	0121 0133	59°49.51'N 02°28.46'W	- -	85	2
120	SMG, AD.	8.9.74	0916 1004	59°28.39'N 01°03.37'W	59°28.48'N 01°04.69'W	128	2

121	SMG	8.9.74	1054	1110	59°25.05'N 00°55.44'W	-	128	3
122	SMG	8.9.74	1148	1200	59°21.65'N 00°48.02'W	-	128	2
123	SMG, AD.	8.9.74	1243	1335	59°17.91'N 00°39.92'W	59°17.74'N 00°41.21'W	130	4
124	SMG	10.9.74	2328	2350	59°15.09'N 00°33.59'W	-	130	4
125	SMG	11.9.74	0040	0056	59°11.73'N 00°25.94'W	-	142	2
126	SMG	11.9.74	0148	0219	59°07.70'N 00°17.01'W	-	140	3
127	SMG	11.9.74	0829	0844	59°16.96'N 00°00.32'E	-	128	2
128	SMG	11.9.74	0922	0944	59°19.85'N 00°06.95'W	-	128	2
129	SMG	11.9.74	1023	1039	59°22.92'N 00°15.13'W	-	140	2
130	SMG	11.9.74	1120	1135	59°26.33'N 00°23.00'W	-	130	2
131	SMG	11.9.74	1205	1230	59°29.31'N 00°30.84'W	-	128	3
132	SMG	11.9.74	1305	1320	59°32.36'N 00°38.39'W	-	136	2
133	SMG, AD.	11.9.74	1355	1450	59°35.82'N 00°46.17'W	59°35.42'N 00°47.97'W	128	3
134	SMG	11.9.74	1530	1541	59°38.44'N 00°54.52'W	-	126	2
135	SMG, AD.	11.9.74	1617	1705	59°42.19'N 01°01.57'W	59°42.05'N 01°01.09'W	124	3

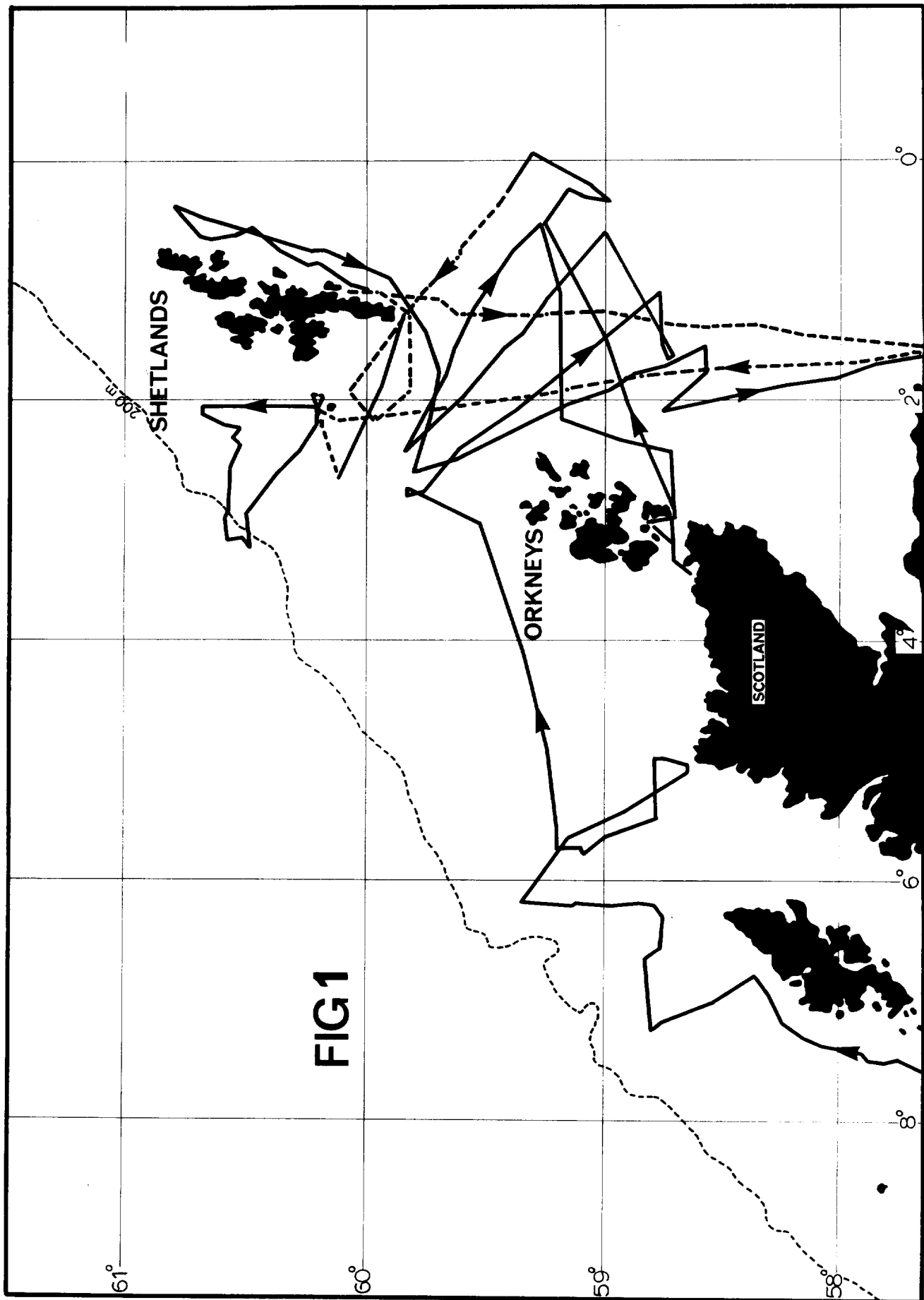


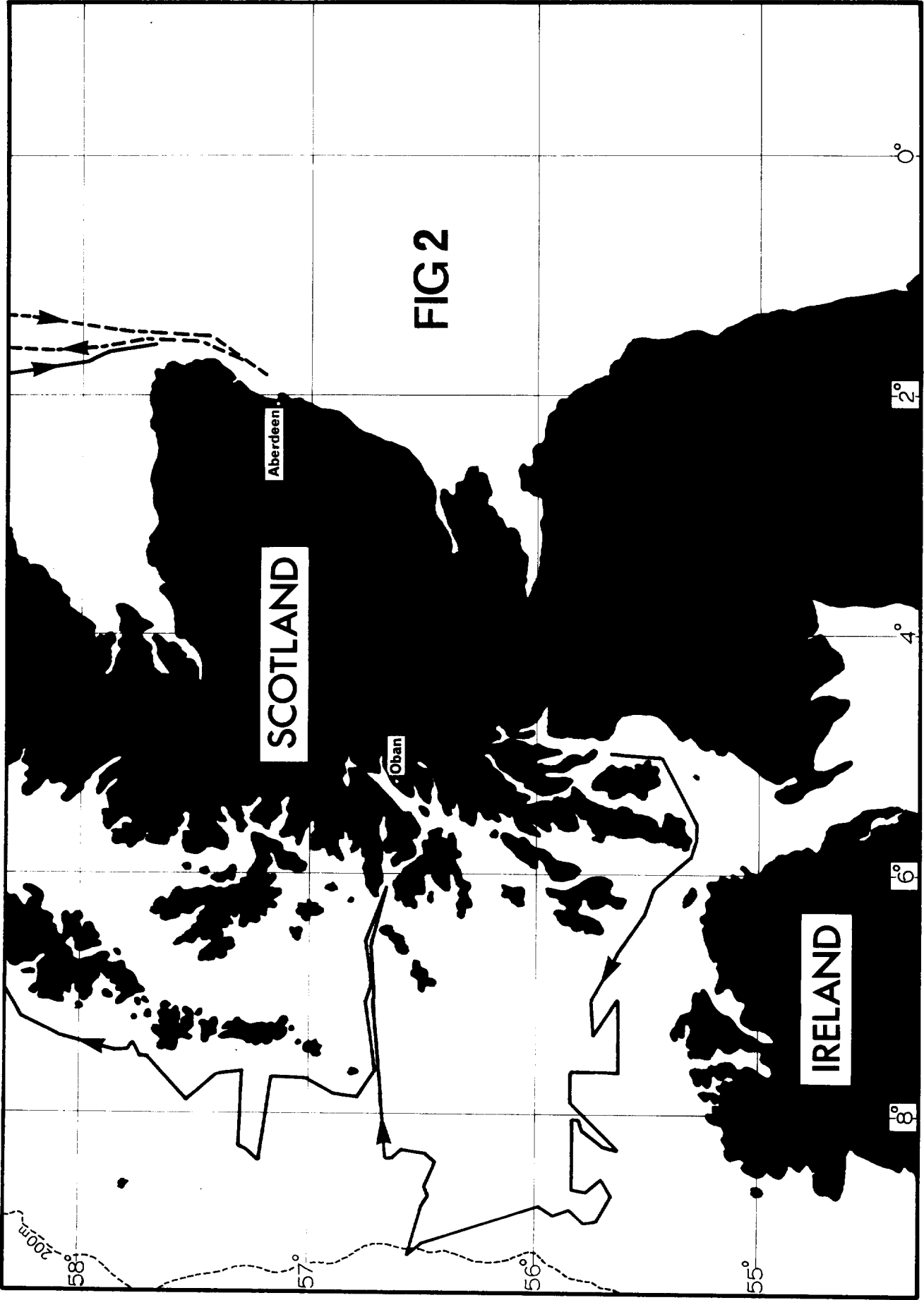
Station No.	Gear Used	Date	Time (BST) From To	Lat. Long.	to	Lat. Long.	Depth UCM	No. of Hauls
136	SMG	11.9.74	1750 1811	59°44.98'N 01°09.68'W	-	-	104	3
137	SMG	11.9.74	1850 1910	59°48.03'N 01°17.73'W	-	-	84	3
138	SMG	11.9.74	1956 2014	59°51.06'N 01°25.48'W	-	-	60	3
139	SMG	11.9.74	2055 2115	59°54.25'N 01°33.40'W	-	-	109	2
140	SMG	11.9.74	2148 2202	59°57.40'N 01°41.07'W	-	-	104	2
141	SMG	11.9.74	2236 2250	60°00.27'N 01°49.52'W	-	-	92	2
142	SMG	11.9.74	2325 2338	60°02.98'N 01°56.54'W	-	-	92	2
143	SMG	12.9.74	0043 0103	59°57.13'N 02°10.91'W	-	-	86	2
144	SMG	12.9.74	0142 0155	59°53.06'N 02°04.03'W	-	-	92	2
145	SMG	12.9.74	0235 0250	59°49.46'N 01°56.91'W	-	-	100	2
146	SMG	16.9.74	0830 0847	60°12.44'N 02°04.82'W	-	-	77	2
147	SMG	16.9.74	0929 0945	60°17.35'N 02°05.07'W	-	-	85	2
148	SMG	16.9.74	1028 1045	60°22.46'N 02°04.75'W	-	-	115	2

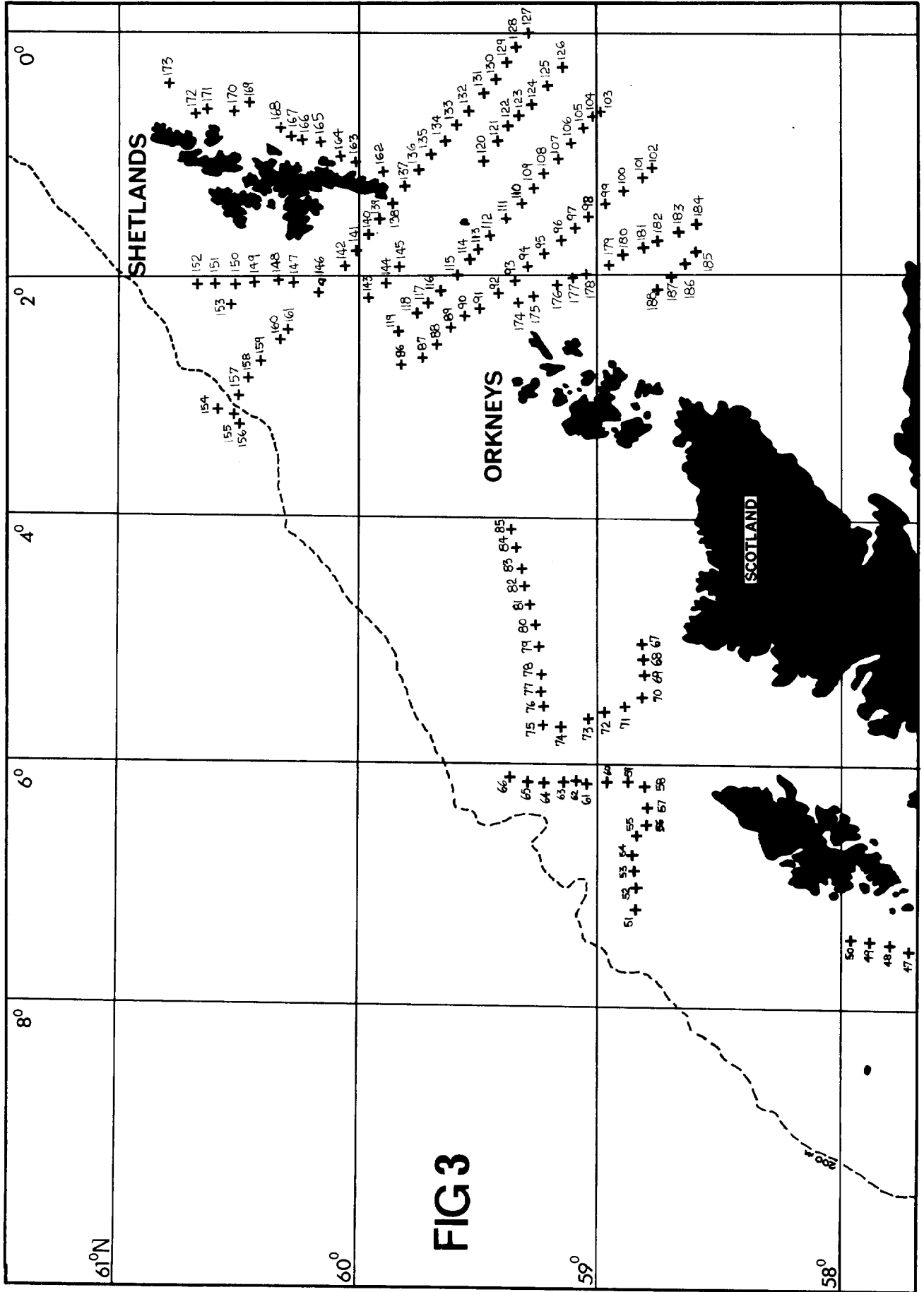
149	SMG	16.9.74	1120	1145	60°27.37'N 02°05.04'W	-	103	2
150	SMG	16.9.74	1210	1223	60°32.39'N 02°05.02'W	-	128	2
151	SMG	16.9.74	1305	1317	60°37.73'N 02°05.14'W	-	142	2
152	SMG	16.9.74	1358	1400	60°42.15'N 02°05.52'W	-	136	2
153	SMG	16.9.74	1536	1552	60°32.79'N 02°14.85'W	-	148	2
154	RD	16.9.74	1952	2032	60°33.99'N 03°08.75'W	60°33.80'N 03°09.76'W	260	1
155	RD	16.9.74	2115	2152	60°30.69'N 03°09.57'W	60°30.25'N 03°09.46'W	230	1
156	Camera	16.9.74 17.9.74	2212	0017	60°30.07'N 03°10.28'W	60°29.36'N 03°13.97'W	232 - 236	1
157	SMG	17.9.74	0121	0137	60°29.84'N 02°59.97'W	-	200	2
158	SMG	17.9.74	0221	0315	60°26.76'N 02°52.29'W	-	162	2
159	SMG	17.9.74	0355	0420	60°23.57'N 02°44.48'W	-	172	2
160	SMG	17.9.74	0520	0537	60°19.31'N 02°33.63'W	-	134	2
161	SMG	17.9.74	0631	0644	60°16.42'N 02°25.51'W	-	100	1
162	SMG	18.9.74	1600	1614	59°54.87'N 01°08.64'W	-	102	2

Station No.	Gear Used	Date	Time (BST) From To	Lat. Long. to	Lat. Long.	Depth UCM	No. of Hauls
163	SMG	18.9.74	1711 1720	60°00.30'N 01°05.77'W	-	81	2
164	SMG	18.9.74	1808 1818	60°05.03'N 01°01.18'W	-	84	2
165	SMG	18.9.74	1907 1913	60°08.84'N 00°54.59'W	-	165	2
166	SMG	18.9.74	2011 2021	60°13.53'N 00°51.07'W	-	116	2
167	SMG	18.9.74	2057 2106	60°18.16'N 00°47.10'W	-	91	2
168	SMG	18.9.74	2143 2152	60°22.73'N 00°42.57'W	-	88	2
169	SMG	18.9.74	2233 2242	60°26.43'N 00°35.75'W	-	83	2
170	SMG	18.9.74	2327 2338	60°31.00'N 00°37.68'W	-	136	2
171	SMG	19.9.74	0021 0031	60°35.90'N 00°38.20'W	-	104	2
172	SMG	19.9.74	0122 0131	60°40.48'N 00°37.71'W	-	112	2
173	SMG	19.9.74	0244 0305	60°46.12'N 00°24.27'W	-	136	3
174	SMG	19.9.74	1812 1820	59°20.20'N 02°14.50'W	-	83	3
175	SMG	19.9.74	2245 2259	59°15.60'N 02°11.00'W	-	80	2

176	SMG	19.9.74	2337	2352	59°10.72'N 02°07.11'W	-	96	3
177	SMG	20.9.74	0023	0037	59°06.16'N 02°03.28'W	-	74	2
178	SMG	20.9.74	0106	0118	59°01.52'N 02°00.22'W	-	75	2
179	SMG	20.9.74	0151	0207	58°56.96'N 01°55.83'W	-	90	2
180	SMG	20.9.74	0238	0253	58°52.64'N 01°52.12'W	-	92	2
181	SMG	20.9.74	0322	0336	58°48.11'N 01°48.17'W	-	94	2
182	SMG	20.9.74	0413	0422	58°43.18'N 01°44.15'W	-	96	2
183	SMG	20.9.74	0502	0522	58°38.95'N 01°40.46'W	-	105	2
184	SMG	20.9.74	0600	0610	58°34.12'N 01°36.32'W	-	128	2
185	SMG	20.9.74	0705	0718	58°33.83'N 01°50.10'W	-	95	2
186	SMG	20.9.74	0750	0805	58°37.46'N 01°56.65'W	-	94	2
187	SMG	20.9.74	0840	0850	58°41.20'N 02°02.97'W	-	84	2
188	SMG	20.9.74	0925	0935	58°44.76'N 02°09.43'W	-	80	2







**FIG 3**

