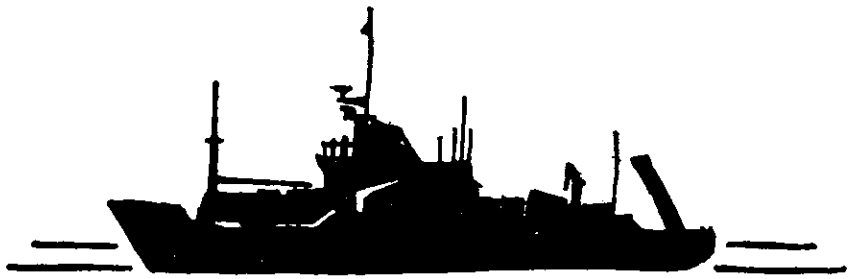
Scottish Marine Biological Association

Dunstaffnage Marine Research Laboratory



CRUISE REPORT

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DUNSTAFFNAGE MARINE LABORATORY

and the

SCOTTISH MARINE BIOLOGICAL ASSOCIATION

OBAN, ARGYLL, SCOTLAND

CRUISE REPORT

RRS CHALLENGER

Cruise 67/1990

21 June - 5 July 1990

RRS CHALLENGER, Cruise 67/1990 : Leg 1

Duration: 0732 h 21 June - 0912 h 29 June 1990

All times GMT.

Locality: Faroe-Shetland Channel, Rockall Channel and Scottish continental shelf.

Staff:

D.J. Ellett	
Dr. J.D.M. Gordon	
C.R. Griffiths	
Dr. P. Westbroek	(Univ. of Leiden)
Dr. P. Van der Wal	(NIOZ, Texel)
Dr. J. Van Bleijswijk	(NIOZ, Texel)
E. Kempers	(NIOZ, Texel)
Ms. L. de Sequera Campos	(Univ. of Southampton)
Dr. J.M. Graham	(25 - 29 July)
N. MacDougall	(25 - 29 July)
S.M. Harvey	(25 - 29 July)

Aims:

1) To sample the benthopelagic fish populations of the Faroe-Shetland Channel.

2) To work CTD stations of the Anton Dohrn Seamount section between Rockall and the shelf-edge.

3) To collect large volume water samples and CTD profiles at standard positions between the shelf-edge and the Sound of Mull.

4) To service the DML current meter mooring in the Tiree Passage.

5) To study the biology of coccolithophores of the northern Rockall Channel and continental shelf.

Narrative: CHALLENGER sailed from South Quay, Gt. Yarmouth at 0732 h 21 June and set course for the Faroe-Shetland Channel. Hourly surface samples were examined for the presence of coccoliths and good concentrations of *Emiliania huxleyi* were encountered on the afternoon of 22 June. XBT and CTD profiles were taken and large-volume Niskin samples were collected from six depths.

Deep water was reached during 23 June and the trawl was shot at 1508 h. After towing for 2 hours on the bottom the net was recovered and was found to have lost the codend. Whilst a second trawl was rigged, CTD and XBT lowerings were made and further Niskin samples obtained for coccoliths. The replacement trawl was towed for 1 hour on the bottom and retrieved at 0253 h 24 June. Although some fish and benthic material was obtained from this haul, the net had been extensively split, probably by stones and boulders, and it was decided that it would be unwise to risk the remaining nets in this area.

A coccolith bloom had been observed at the shelf-edge en route to the deep water and the ship returned to the vicinity for further water sampling between 0850 and 0938 h. Further surface sampling for the centre of the bloom followed until 1200 h, when course was set for Stornoway. In the afternoon a trial CTD lowering was made and during the evening the south to southwesterly wind increased to force 7, with an accompanying head swell. By 0700 h 25 June winds had reached forces 8 to 9, but conditions improved gradually during the day. Three staff were brought out by pilot boat from Stornoway at 1558 h and CHALLENGER steamed to the Butt of Lewis, where course was set for Rockall. During the passage westward, the new main warp was streamed on the morning of 26 June, and hourly surface sampling for coccoliths continued. A test CTD lowering was made to 200 m depth at 1500 - 1523 h. High concentrations of coccoliths were found over Rockall Bank, and large-volume water samples were collected at station A of the CTD section, close to Rockall, which was reached at 2258 h.

Light southerly winds gave good weather for completing the Anton Dohrn Seamount section during 27 and 28 June, station R being reached at 0753 h, 28 June. Because time was short and because of the need to service the Tiree Passage mooring during the same evening, stations L and N were worked to 1200 m only and CTD lowerings upon the shelf were made at the radiocaesium sampling stations only. Sampling at six of these stations was completed by 1819 h, when the ship proceeded to the mooring. The spar buoy was grappled at 2059 h and was found to be entangled with the current meters and subsurface float. Recovery took until 2130 h, when all equipment except the meter anchor had been retrieved. The ship returned to sample the remaining four radiocaesium stations, the last of these being completed at 0422 h 29 June.

CHALLENGER steamed to Oban via the Sound of Mull and berthed at the Railway Pier at 0912 h to disembark nine scientists and their equipment.

Results

Aim 1) On the March cruise to the Faroe-Shetland Channel (CHALLENGER Cruise 63) one trawl was damaged by a hard rocky bottom at 500 m depth but two trawls at 1000 and 1500 m were very successful. On this cruise it was decided to begin trawling at 1250 m and work up the slope. Unfortunately the trawl was very badly damaged on what appeared to be a bottom of gravel and perhaps some coral. The whole of the extension piece and the codend was missing and the remainder of the trawl was badly chaffed. The only catch was a few invertebrates caught in the meshes. It was decided not to risk the two new Marinovitch trawls in this area and instead an old DML trawl was rigged and fished at 750 m. On recovery, this net was also badly torn but the codend was intact and there was a moderate catch of fish together with a good collection of small rocks. There was no fine mesh liner to the codend and most of the invertebrate catch and any small fish were lost. The most abundant species was the Greenland halibut and otoliths were collected for Dr. Bergstad of Norway. Stomach contents were collected for Dr. Reinart of the Faroese Fisheries Laboratory (J.D.M. Gordon).

Aim 2) The Anton Dohrn Seamount CTD section was worked between 2258 h 26 June and 0804 h 28 June in good weather. Because of shortage of time, sampling at stations L and M was limited to 1200 m depth, but all other stations were fully worked.

Surface salinities were relatively high, as in March 1990. The most interesting feature of the data was a salinity minimum in the western half of the section which fell from 1400 m at station E to 1900 m at H, and which had lowest values at 1500 m at F. Further comment must await full calibration.

Aim 3) Large-volume water samples were collected for radiocaesium analysis at ten standard positions between the shelf-edge and the Sound of Mull. CTD profiles were also obtained at these stations, but due to shortage of time, CTD lowerings at three intermediate stations, usually sampled, were omitted. Samples were also collected at the two easternmost stations for SURRC, East Kilbride.

Aim 4) The Tiree Passage mooring was raised on the evening of 28 June and had been badly tangled by fishing activity. Lengths of rope attached to the gear showed where it had been lifted or stopped off. All equipment was recovered however, except for the anchor of the meter wire. The current meter tape for the upper meter suggests that the mooring, originally deployed on 12 March, had been damaged about five days before our recovery unit, so that three months' data appears to have been collected. The lower meter misfunctioned shortly after deployment, providing a few weeks' data only.

Aim 5) Blooming of the coccolithophore species *Emiliania huxleyi* was monitored along the trajectory visited during this cruise as part of a Dutch-British integrated biological and geological project on the effect of pelagic calcification on the global CO_2 cycle. Two-litre samples of surface water were taken at hourly intervals. They were filtered and the number of cells in the filtrate was counted. At four locations with high *E. huxleyi* cell densities, samples were taken of the top 40 -120 m of the water column and XBT or CTD profiles were obtained.

A selection of concentrated samples was stored in order to monitor the occurrence and distribution of particular *E. huxleyi* strains in the laboratory, using highly specific antisera made available by the Leiden group. In addition, water samples were taken for the determination of nutrient concentrations, calcium carbonate content and for systematic quantification of the plankton content.

Our elaborate monitoring procedure allowed us to detect 5 blooms or locations with high *E. huxleyi* concentrations (>100 cells per ml) in 4 different settings: in the Northern part of the North Sea shelf, along the shelf break, in the Faroe-Shetland Channel and above the Rockall platform. At the latter location, a mixed bloom was found where *E. huxleyi* occurred together with *Coccolithus pelagicus*. This encouraging result has convinced us that, as a result of its great topographical, ecological and hydrographic variation, the studied area is very suited for studying the dynamism of *E. huxleyi* blooming. (Contributed by Dr. Westbroek).

General matters. The absence of reliable metering gear upon the hydrographic winch barrels despite two strong requests in March for an operable system for this cruise must be deplored. It is to be hoped that strong efforts will be be made to provide dependable metering for Cruise 71 at the end of August.

Captain Long, his officers and crew helped us to make the most of the time available.

D.J. ELLETT

RRS CHALLENGER, Cruise 67/1990 : Leg 2

Duration: 1100 h 29 June - 0800 h 5 July 1990

All times GMT

Locality: Rockall Trough

Staff:

Dr. J.D. Gage	
Dr. J.D.M. Gordon	
Dr. J.D. McKenzie	
P. Lamont	
M. Willcox	
Dr. O.A. Bergstad	
Dr. P.A. Tyler	(Univ. of Southampton)
Ms. L. de Sequera Campos	(Univ. of Southampton)
Ms. L. Giles	(Univ. of Southampton)
G. Lawson	(Univ. of Southampton)

Aims:

1) Benthic sampling for SMBA ARP2.

2) To sample the benthopelagic fish populations of the Rockall Trough.

3) To study sub-cuticular bacteria in echinoderms.

4) Dietary studies of deep-sea echinoids and holothurians.

5) Studies of reproduction in ondarian species.

6) Sedimentary analysis.

7) To study deep-sea invertebrates.

Narrative: CHALLENGER sailed from Oban Railway Pier at 1100 h GMT on 29th June after unloading most of the gear from the previous leg, and loading much of that required for Leg 2, within one hour. She passed Dubh Artach at 1550 h in a calm sea and light northerly wind. CHALLENGER arrived at the first trawling station on the Hebridean slope at 0030 h on 30th June in excellent sea conditions. The OTSB fish trawl was shot on paired trawl warps and bottomed in about 1000 m depth at around 0145 h. Hauling was commenced after a one-hour tow with the trawl being recovered at 0340 h with a good fish catch but rather few invertebrates owing to a twist in the cod end. This was followed almost immediately by a second trawl at 1260 - 1685 m depth. The gear was inboard by 0800 h with a good fish catch but, again, rather few invertebrates. By this time the wind had noticeably freshened and the forecast was for winds 6-8.

CHALLENGER was underway to Sta. 'M' at 57°18'N, 10°11'W by 0815 h 30th June, arriving at 1230 h for the benthic work in increasing northerly seas. The multiple corer supplied by RVS could not be deployed as planned, because, despite a thorough search the clips for securing the core tubes to the pod could not be found on board. In any case, sea state had become marginal for this gear. It was decided to deploy instead the Agassiz trawl for the invertebrate sample required. The trawl was shot on the main wire at 1300 h paying out 4000 m of wire. Heaving commenced at 1550 h and the trawl was recovered with a good but rather small megafaunal catch at 1706 h. In view of the deteriorating sea state, it was decided to repeat the Agassiz trawl. CHALLENGER steamed back to a starting position and shot the trawl at 1843 h. The Agassiz was recovered at 2330 h with an excellent invertebrate catch. Further work being ruled out because of the poor weather, with the after deck being cleared by 0100 h 1st July, CHALLENGER made a southerly course in a following sea for a fish trawl on the Donegal Fan in approximately 2300 m depth. CHALLENGER hove to on position at 0930 h, shooting the single-warp otter trawl at 1000 h. The trawl was recovered at 1515 h showing no evidence of having bottomed. In view of the shortage in time, CHALLENGER then steamed for the final trawling site at about 55°N 12°W, arriving at 2318 h and shooting the single-warp trawl immediately. Payout was stopped at 0222 h 2 July and heaving commenced at 0359 h after about one hour's tow on the bottom. The trawl was eventually recovered at 0632 h with a reasonable catch of fish and a good catch of invertebrates, the latter dominated by an excellent catch of the large, football-like holothurian *Benthothuria fuebris* and some large specimens of the impressive spiny crab *Neolithodes grimaldii*.

CHALLENGER then steamed to the start position, heaving to at 0800 h for the first epibenthic sled haul required on the SMBA Permanent Station at 2900 m depth. A good, but washed, catch was collected at on recovery of the gear at 1336 h after a one-hour two on the bottom and a pay out of 5500 m. After steaming back to the start position, heaving to at 1440 h, the second haul was undertaken along roughly the same track, with one of the new RVS sleds rigged with a 0.5 mm main bag and extension. The gear was recovered at 2031 h with a large catch entirely filling the extension. This proved on washing to be much muddier than the previous haul, with a surprisingly large amount of sand-sized sediment particles that made the sample difficult and time-consuming to wash. CHALLENGER again steamed back to the start position, arriving at 2130 h for the third and final haul along this track, this time using the second RVS sled rigged with a 0.3 mm main bag and extension. This was recovered in good sea conditions and very little wind at 0330 h 3 July with a large catch resembling that from the 0.5 mm haul that was again time-consuming and demanding to wash. It was decided to immediately deploy the multiple corer near the Permanent Station, rigged with 4 core tubes fastened to the pod by means of tape and jubilee clips, in the absence of the correct fastenings. Although sea conditions were reasonable, the operation was difficult and somewhat risky, because the pinger return monitoring the position of the gear in relation to the bottom rapidly became faint and soon disappeared despite having the PES fish deployed for this drop. The signal strength from the ship's hull transducer, as might be expected, provided no improvement. Some indication of bottoming with a payout of 3040 m was obtained from a drop in tension noticed by the winchman, although there was no indication of this on the paper record from the flat-bed recorder. The multiple corer was eventually recovered at 0710 h with one good and three poorer cores.

For the last deployment on the Permanent Station before we had to start steaming back, it was decided to try the USNEL box corer, the seabed camera being ruled out because of the unsatisfactory acoustic monitoring on board. The box corer was put over at 1019 h and 3060 m of wire payed out before the winchman reported a drop in tension that might have reflected the gear bottoming. (As for the multiple corer drop, the paper record from the flat-bed recorder was not helpful, the constant, rather than gradually increasing, tension recorded, and the lack of correspondence noticed between the observed surge on the wire and the pen record, suggesting that it was not connected up correctly. Unfortunately, there was no one on board who could check up on this). The box corer was eventually brought to the surface at 1318 h, having closed, but with no sample. With recovery of the PES fish, CHALLENGER then made course for the trawling station on the Donegal Fan for a repeat of the earlier, abortive, trawl, arriving at 2330 h. The OTSB trawl was put over at 2345 h on a single warp, the gear bottoming at about 0215 h 4 July. Recovery was commenced at 0306 h and the trawl inboard at 0529 h. This recovered a good fish catch with reasonable numbers of invertebrate megafauna.

CHALLENGER then made course for Troon, apparently tracking the eye of a depression causing near gale-force winds further south, with excellent sea conditions and generally light winds. She passed Malin Head at 1700 h, berthing as scheduled at Troon 0800 h 5 July 1990.

Results

Aim 1) Benthic sampling for SMBA ARP2 (Gage) - Although poor weather earlier in Leg 2 prevented obtaining an epibenthic sled haul from Sta. 'M', the Agassiz haul was satisfactory, with reasonable numbers of the usual megafauna present that have been monitored for several years now. Useful samples were also obtained from the two OTSB fish trawls on the Hebridean slope. At the Permanent Station, the new epibenthic sleds worked satisfactorily, although gussets in the extensions of two, new fine-meshed nets had started to split, indicating that these nets probably require replacing. The samples obtained will require sorting in the laboratory over several months before the differences in the samples attributable to mesh size can be properly assessed.

It is important for future cruises to Rockall on CHALLENGER during 1990/91 that the acoustics equipment for pinger monitoring are brought up to scratch, and that the wire-tension recorder is set up correctly.

Aim 2) Fishing Stations - The main aim of previous bottom trawling cruises to the Rockall Trough was to attempt to quantify the changes in fish abundance by depth and over a period of years examine seasonal aspects of their biology. On this and the subsequent cruises in September, December and February, the aim is to collect a broad spectrum of the fish species for seasonal studies of age, growth and reproduction.

The Marinovitch semi-balloon trawl was used successfully to sample the fish populations at depths of approximately 1000, 1500, 2400 and 2800 m. In general, the catches were good and representative size ranges of all the important macrourid fishes were collected. The catches of *Alepocephalus bairdii* were disappointing, despite the fact that paired warp trawling was

carried out at the shallower stations. Otoliths for age determinations were collected from all the larger species on board ship, and the remainder of the catch was deep frozen for later processing in the laboratory.

Tissue samples from the macrourid, *Nematonurus armatus*, and the synaphobranchid, *Histiobranchus bathybius*, were collected for electrophoretic studies by N.R. Merrett of the Natural History Museum.

Aim 3) Dr. J.D. McKenzie participated in the cruise to collect samples for his work on sub-cuticular bacteria in echinoderms. A diversity of echinoderm material was collected using the balloon trawl and epibenthic sledge and fixed for electron microscopy. Around fifteen species were treated in this way. These specimens will be processed for electron microscopy and then examined for the presence of sub-cuticular bacteria. In addition to the EM work, specimens of holothurians found during the cruise were taken for Dr. McKenzie's taxonomic collection.

Aim 4) Dietary studies of deep-sea echinoids and holothurians - Samples of *Echinus affinis*, and echinothurids were collected by Agassiz trawl at Station 'M' and by otter trawl at other stations. These echinoids were dissected to separate the contents of the oesophagus, stomach and intestine from the gut. This gut content material was frozen and the gut tissue fixed for ultrastructural studies.

Samples of the holothurian *Benthothuria funebris* were collected by otter trawl at 2800 m. This was the largest sample of *Benthothuria* that we have collected in the Rockall Trough. 20 specimens of this species were dissected and the gut contents of the pharynx, descending intestine, ascending intestine and rectum removed and frozen. Some of the gut tissue was preserved in glutareldehyde. Of the remaining specimens, the gonads were removed and fixed for ultrastructure or paraffin histology.

Aim 5) Reproduction in onidarian species - Samples of the gorgonian *Acanella arbuscula* were collected at or near Station 'M' whilst *Paramuricium* was taken at 1500 m and *Chrysogorgia* at 2500 m. Colonies of *Acanella* were photographed to compare the different colour colonies. Individual polyps of *Acanella* and *Paramuricium* were fixed for ultrastructural studies and colonies frozen for calorific analysis. Other material was fixed in seawater formalin. The deep water anemone *Phelliactis* was taken in a number of trawls and specimens were either frozen or fixed in 5% seawater formalin.

Aim 6) Sedimentary analysis - A successful multicore was taken at the Permanent Station. Once retrieved, this was sectioned at 1 cm intervals and frozen for later analysis and ATP content.(Reports of Aims 4 to 6 contributed by L.S. Campos, L. Giles, G. Lawson, P.A. Tyler).

Aim 7) Deep invertebrates - Two attempts of catching fish with the use of otter trawl were made during the first leg of the cruise in the area of the Faeroe Shetland Channel. Two nets were damaged, probably because of the rocky bottom. Only a few invertebrates were caught, and these were preserved in 8% seawater formalin: (1) on station 67/90/1 - depth: 1250 m - 1285 m - two ophiuroids, one sea star, two pycnogonids, sponge, and some corals; (2) on station 67/90/2 - depth: 740 m - 705 m - four sea stars (astropectinids), two basket stars (ohpiuroids), a considerable number of small pycnogonids, some gastropods, two medusae-like jelly-fish, some pieces of coral.

On the second leg of the cruise 46 echinoids were dissected on board ship. All of them were collected with the use of Agassiz trawl and otter trawl (OTSB - with paired or single warp) in the area of Rockall Trough: Station 'M', Permanent Station and other fishing stations. Oesophagus, stomach, intestine and gut contents of *Echinus affinis: Phoromosoma placenta* and other echinothurids were either frozen for organic analyses or preserved in 8% sea water formalin and in EM fixative for ultrastructural studies. (Lucia S. Campos).

Acknowledgements

The scientific party on Leg 2 are most grateful to Captain Long, his officers and crew for their co-operation and help at sea, that allowed us to make best use of the facilities available over the short time period.

J.D. GAGE.

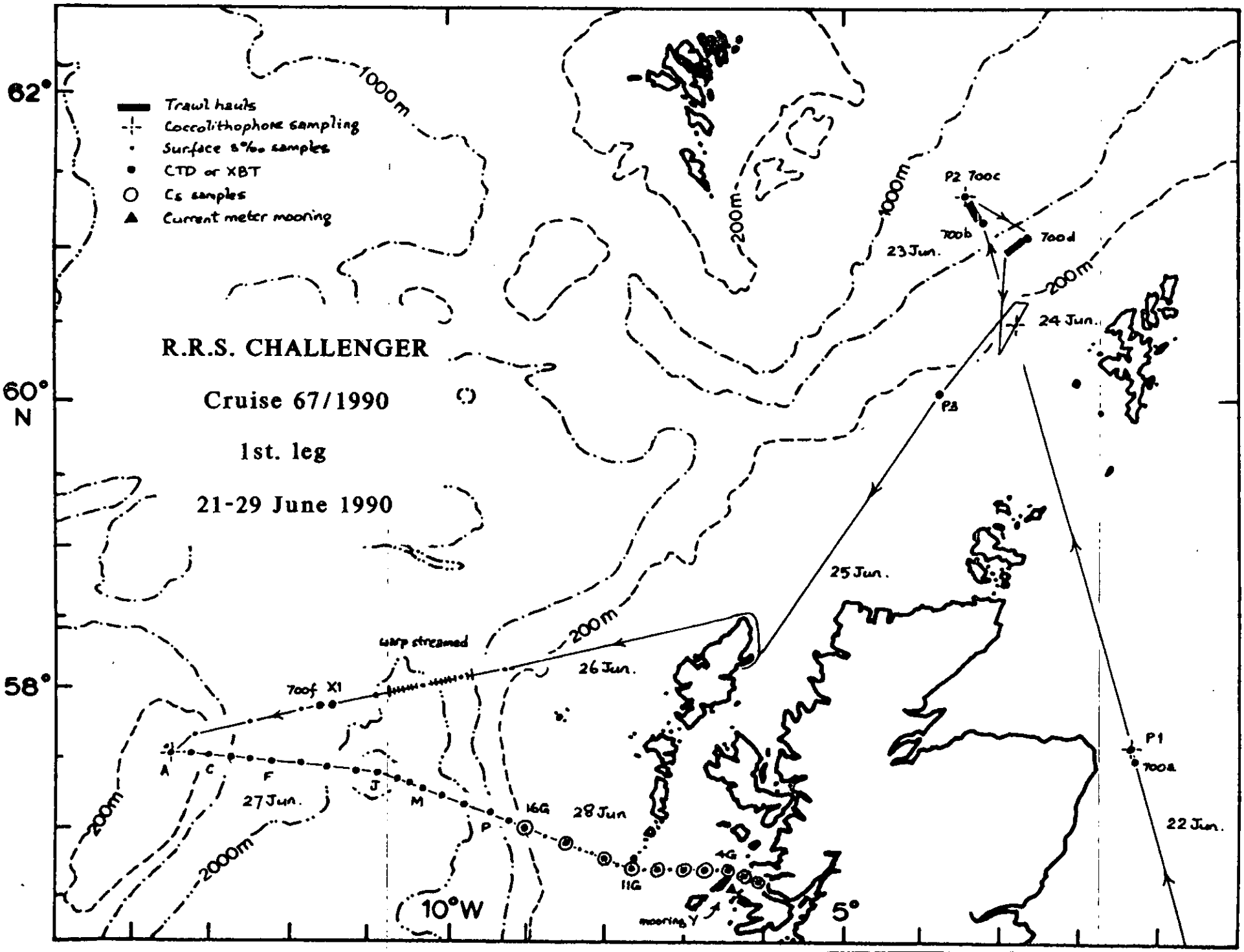
Table 1. CTD and XBT Stations worked during Cruise 67/1990 (Leg 1)

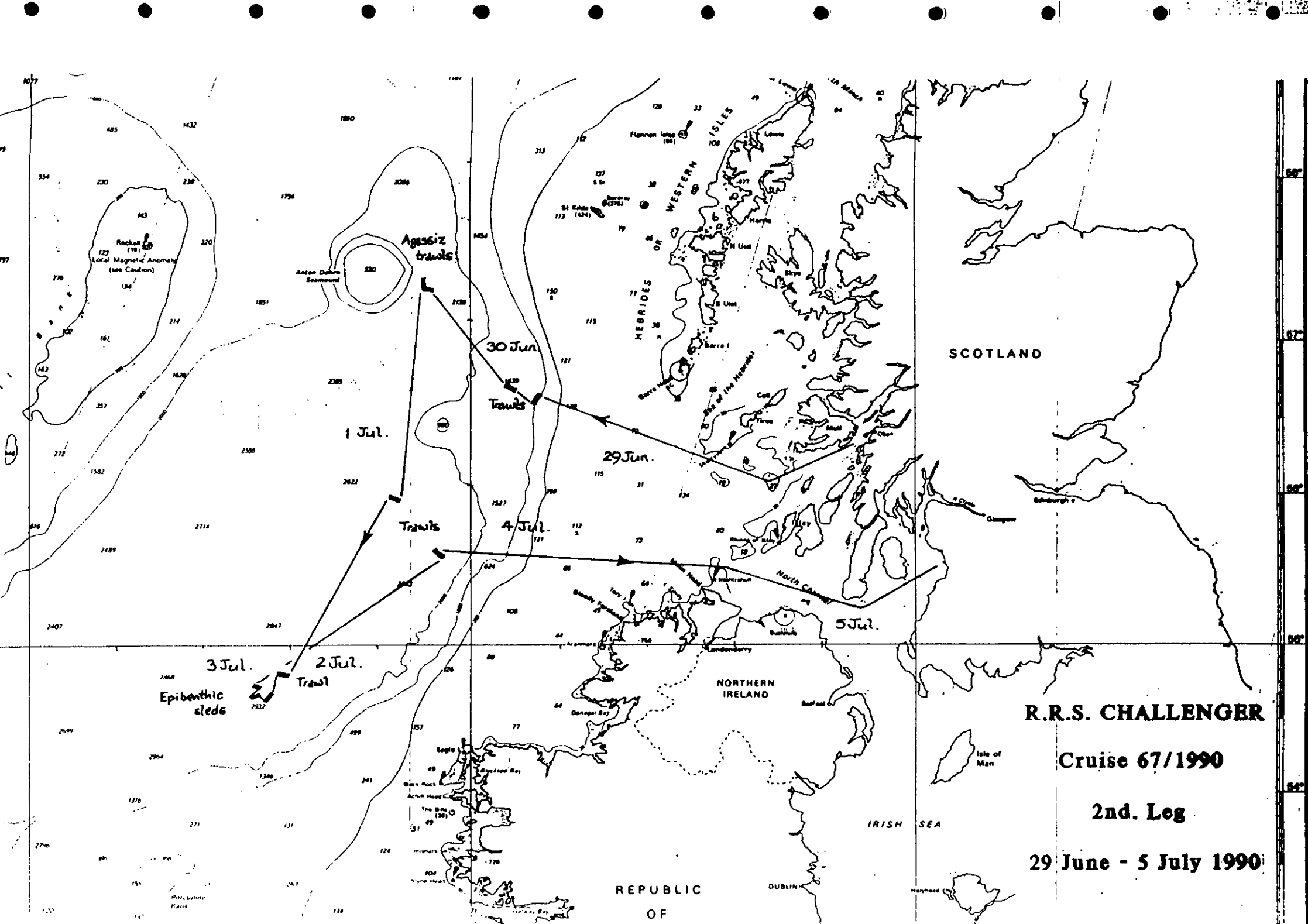
Stations	CTD disc/ dip nos.	Location	Dates 1990	Observations
700a	-	57° 28.1′ N 01° 13.8′ W	22 Jun	XBT
P1	151/001	57 34.1 01 17.5	22 Jun	CTD, Niskin bottles
700b	-	61 11.9 03 10.3	23 Jun	XBT
700c	-	61 20.2 03 23.1	23 Jun	XBT
P2	151/002	61 20.9 03 23.6	23 Jun	CTD, Niskin bottles
700d	-	61 05.4 02 45.0	23 Jun	XBT
-	-	60 33.1 02 57.9	24 Jun	Niskin bottles
P3	151/003	60 02.1 03 44.8	24 Jun	CTD
X1	151/004	57 52.8 11 30.0	26 Jun	CTD
700f	-	57 51.8 11 35.9	26 Jun	XBT
A	151/005	Near Rockall	26 Jun	CTD, Niskin bottles
B-D	151/006-008		27 Jun	CTD
E-F	152/009-010	Anton Dohrn Seamount section	27 Jun	CTD
G-I	153/011-013		27 Jun	CTD
J-M	154/014-017		27 Jun	CTD
N-Q	155/018-021		28 Jun	CTD
16G-13G	155/022-024	Shelf-edge - Sd of Mull	28 Jun	Surface S‰; Cs surface and sub-surface (16, 15, 13, 11, 9, 7, 6, 4, 2, and 1)
11G-1G	152/025-031		28-29 Jun	

Table 2. RRS Challenger Cruise 67/1990

Biological Samples

Station No.	Date	Time on bottom		Position		Depth			Mean speed (knots)
		start	finish	start	finish	min	max	mean	
67/90/1	23.06.90	1705	1906	61° 15.8'N 03° 17.0'W	61° 19.2'N 03° 21.8'W	1250	1285	1269	2.5
67/90/2	24.06.90	0052	0155	61° 02.8'N 02° 51.0'W	61° 01.0'N 02° 54.8'W	710	730	721	2.5
67/90/3	30.06.90	0145	0254	56° 39.9'N 09° 13.7'W	56° 38.1'N 09° 18.0'W	1050	1115	1081	2.5
67/90/4	30.06.90	0547	0656	56° 43.1'N 09° 29.8'W	56° 44.5'N 09° 34.7'W	1560	1685	1579	2.5
AT391	30.06.90	1445	1615	57° 20.2'N 10° 23.8'W	57° 23.4'N 10° 29.1'W			2285	1.7
AT392	30.06.90	2030	2215	57° 21.5'N 10° 26.4'W	57° 24.2'N 10° 31.2'W			2200	1.9
67/90/5	01.07.90	1210	1350	55° 58.0'N 10° 44.5'W	55° 59.0'N 10° 54.2'W		trawl not on bottom sounding ca 2450 m		
67/90/6	02.07.90	0234	0400	54° 48.4'N 12° 05.8'W	54° 48.8'N 12° 12.8'W	2870	2880	2875	2.6
ES393	02.07.90	1045	1227	54° 39.4'N 12° 19.2'W	54° 38.4'N 12° 23.0'W			2905	1.0
ES394	02.07.90	1715	1916	54° 39.9'N 12° 25.5'W	54° 39.1'N 12° 29.7'W			2920	1.0
ES395	03.07.90	0045	0215	54° 40.4'N 12° 22.6'W	54° 41.3'N 12° 27.6'W			2910	1.0
67/90/7	04.07.90	0218	0306	55° 38.3'N 10° 25.8'W	55° 36.3'N 10° 24.3'W	2410	2410	2410	2.5


Trawl hauls
Coccolithophore sampling
Surface s‰ samples
CTD or XBT
Cs samples
Current meter mooring
R.R.S. CHALLENGER
Cruise 67/1990
1st. leg
21-29 June 1990
62°
60° N
58°
10°W
5°
1000m
200m
2000m
P2 700c
700b
700d
23 Jun.
24 Jun.
P3
25 Jun.
P1
700a
22 Jun.
warp streamed
26 Jun.
700f X1
A
C
F
J
M
P
27 Jun.
16G
28 Jun
11G
4G
mooring Y


Agassiz trawls
30 Jun.
Trawls
29 Jun.
1 Jul.
Trawls
4 Jul.
5 Jul.
3 Jul.
2 Jul.
Trawl
Epibenthic sleds
Rockall (18)
(Local Magnetic Anomaly (see Caution))
Anton Dohrn Seamount
HEBRIDES
WESTERN ISLES
SCOTLAND
NORTHERN IRELAND
IRISH SEA
REPUBLIC OF
North Channel
Isle of Man
DUBLIN
Londonderry
Belfast
Glasgow
R.R.S. CHALLENGER
Cruise 67/1990
2nd. Leg
29 June - 5 July 1990