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 75/1991

14 Feb-3 Mar 1991

RRS CHALLENGER, Cruise 75/1991 : Leg 1

Duration: 08.00 h 14 February 1991 - 09.30 h 23 February 1991

Locality: Rockall Trough

Staff:

Dr J.D.M. Gordon	SMBA/DML
Mr R.H. Harvey	SMBA/DML
Mr P Lamont	SMBA
Dr P.A.Tyler	Univ. of Southampton
Ms L.A. Giles	Univ. of Southampton
Ms S.K. Bronsdon	Univ. of Southampton
Dr A. Gooday	IOS
Ms R. Squires	Univ. of Reading
Ms M. Spencer Jones	Natural History Museum
Dr P. Vas	US NMFS, Florida
Dr C.M. Young	Harbor Branch, Florida

Aims:

(1) To continue the seasonal benthic sampling of the Rockall Trough and investigate various aspects of the biology of benthic invertebrates.

(2) To continue the seasonal sampling of benthopelagic fishes of the Rockall Trough and collect material for trace metal and parasitological studies.

Narrative:

Challenger sailed from Barry at 08.00 hrs 14/02 and headed for the SMBA permanent station via the south of Ireland. By late afternoon the swell had increased and with a northwesterly gale forecast Challenger altered course to make passage up the Irish Sea. The PES fish was launched at 09.09 (16/2) and the Marinovitch semi-balloon trawl (OTSB) was deployed over a sounding of at 09.52. The trawl was recovered inboard at 13.34 with a good catch in the codend but the trawl itself was ripped in two as a result of both the headline and footrope parting. It was thought that this occurred shortly after hauling when the tension increased suddenly for a time. A near bottom water sample was then collected for trace metal analysis. A new trawl was rigged and shot at 15.19 over a sounding of 1015 m (station 2). The tension increased about 15 minutes before hauling and when recovered the net was again badly torn but there was a good catch in the codend. A near bottom water sample was then collected and the station was complete by 20.28 hrs.

Challenger then proceeded to the SMBA benthic station M and the epibenthic sledge (station 3) was deployed successfully between 01.52 hrs (17/2) and 05.53. The Agassiz trawl was then shot (station 4) at 06 36 hrs and recovered successfully at 12.10 hrs. By this time the wind speed had increased to about 30 knots preventing any attempt at box or multiple coring. A near bottom water sample was collected and Challenger steamed to a trawling station at 1500 m on the Hebridean Terrace. On

arrival on station at 19.12 hrs the swell was too great to safely shoot the OTSB and instead the Agassiz trawl was deployed between 19.28 hrs and 00.33 hrs (18/2). It was then decided to steam to the permanent station in the hope that the weather might improve during the passage.

On passage the wind decreased and veered to the south so it was decided to deploy the OTSB and tow it towards the station. The trawl was shot (station 6) at 12.32 (18/2) and recovered successfully at 19.46 hrs. Challenger then steamed to the permanent station and the epibenthic sledge was fished between 21.20 and 03.24 (19/2) (station 7). The door on the sledge had failed to close and the sample although good was well washed. By now the wind speed had increased to force 7 from the south and Challenger hove to until morning. At 0900 hrs. Challenger turned and steamed back to the permanent station. By midday the weather had improved sufficiently to enable the second epibenthic sledge to be deployed at 12.09 hrs (station 8). The sledge was recovered successfully at 18.18 hrs and Challenger remained hove to for a water bottle sample. This was complete by 20.00 hrs and Challenger repositioned for the final epibenthic sledge which was deployed between 21.37 hrs and 03.57 hrs (20/2) (station 9). The rectangular midwater trawl was then fished between 04.33 and 08.37 hrs (station 10). During this station the wind began to increase ruling out any possibility of deploying the multicorer or the box corer. Course was therefore set for the Hebridean Terrace to continue the trawling programme. Southwesterly winds of force 7 to 8 persisted throughout the day and although they had decreased to 6 or 7 by evening the swell was too great to deploy the OTSB trawl. Instead the Agassiz trawl was deployed over a sounding of between 0305 hrs and 08.25 hrs (21/2) (station 11). By the time this station was complete the swell had decreased sufficiently to permit the OTSB to be fished. It was deployed at 10.24 hrs over a sounding of 1500 m and recovered with an enormous catch at 14.35 hrs. After collecting a near-bottom water sample Challenger steamed eastwards to occupy another trawl station at between 500 and 600 m. The trawl was shot at 17.40 hrs and reached the bottom at 18.26 hrs but great difficulty was encountered in maintaining the required depth and when the depth became too shallow the trawl was hauled early. The trawl was inboard by 20.00 hrs. with a good catch of fish and invertebrates.

Although the sea conditions were not ideal it was decided to deploy the multicorer. Challenger steamed west to pick up a depth of 1400 m and the corer was deployed at 21.39 and recovered with some short cores at 22.46 hrs. Earlier weather maps combined with warnings of force 8 gales increasing to force 9 for Rockall and Malin led to an end to all scientific work. Challenger sailed for Oban and lay in the Lynn of Morven during the night of the 22/2 docking in Oban at 09.30 (23/9).

Results:

(1) Aim 1: Benthic Studies

(a) SMBA seasonal benthic invertebrate sampling.

The primary aim on this cruise was to complete the intensive seasonal suite of samples from the SMBA Permanent Station and Station 'M' begun in June 1990 using the epibenthic sled and Agassiz trawl. This will provide fine discrimination within the longer term time series begun in 1975. The cruise was largely successful although once again some difficulties were experienced. The sled haul at Station 'M' had to be cut short owing to a sudden increase in the reading on the tension meter, but a good muddy sample which filled the extension net was obtained. The Agassiz trawl which followed produced a good sample of all the species normally found at this station, and provided material for the Southampton group among the scientific complement. The fish trawl near the Permanent Station provided a good sample of the holothurians Benthothuria funebris and Benthogone rosea together with other invertebrates, the most notable of which were many echiuran worms and the asteroid Paragonaster subtilis.

The epibenthic sled sampling at the Permanent Station was generally successful, with samples taken with 1 mm, 0.5 mm and 0.3 mm nets being recovered. Some problems were encountered with the release mechanism, possibly due to the washers supplied with the IOS retractors being slightly thicker than those used previously. As a result of this and other difficulties with the closing doors on the sleds, all of the samples had suffered some wash-out of the finer material during recovery. A Rectangular Midwater Trawl fished near the bottom produced a small catch which, on preliminary examination, did not seem to contain the bivalve post-larvae which had been hoped for.

The Agassiz and fish trawls on the Hebridean Terrace provided a wealth of interesting material for on-going feeding, reproductive and distributional studies both at SMBA and Southampton. The final trawl produced a specimen of the crab Paromola cuvieri, which was kept alive and presented to the Sea Life Centre near Oban. We have only collected this species once before in Scottish waters. Another specimen of interest was a magnificent starfish tentatively identified as Nymphaster arenatus and not previously found in 15 years of sampling at the Hebridean Terrace. It was unfortunate that sea conditions did not permit the deployment of the spade box corer during the cruise.

The enormous quantities of biological material collected on this and the previous cruise (Cruise 74) will require many months to work up. We thank the many colleagues, research students and summer students who have contributed to the success of this series of cruises.

R. Harvey, P. Lamont & J.D. Gage

(b) Reproductive and feeding biology.

We were able to use a number of species from various stations for this study. At the Permanent Station we

dissected some 20 Bentothuria funebris. Each specimen was dissected into gonad, oesophagus and hind gut and the material either frozen or preserved in formalin. From Station 'M' we dissected 8 Plutonaster bifrons and 9 Bathybiaster vexillifer and from other stations we dissected an additional 10 Plutonaster, 3 Bathybiaster, 3 Pseudarchaster and 13 Persephonaster. Gonads, pyloric caeca, stomach and stomach contents were either frozen or fixed. In addition, the gorgonian Acanella and its epizoite Amphianthus, as well as the octocorals Umbellula and Pennatula were collected and either frozen or fixed. 15 specimens of Parastichopus tremulus from station 75/91/13 were dissected and the tissue and gut contents fixed or frozen. The barnacle Poecilasma kaempferi that lives epizoically on Neolithodes was also collected and preserved.

Unfortunately, weather conditions prevented us from using the multiple corer or RMT at station 'M' but we were able to obtain one of each of these elsewhere during the cruise.

P.A. Tyler, L.A. Giles & S.K. Bronsdon

(c)Larval Biology.

There was considerable success in the culturing of larvae during the cruise. The echinoids Echinus acutus and E. elegans responded to 0.5 M Kcl injection and spawned readily. Fertilization took place and embryos continued to develop well. These were brought ashore to the laboratory in healthy condition. Echinus affinis from 2200 m was also successfully spawned in the cold room. As an experiment, fertilized eggs were placed in a small container and sent down with the next trawl whilst a control was kept in the cold room. On recovery of the trawl the fertilized eggs were showing a cleavage furrow whereas those in the control at atmospheric pressure were not. This is the first observation that suggests pressure is necessary for embryo development in a deep-sea invertebrate. Late in the cruise we achieved successful fertilization with Cidaris. In addition, we succeeded in fertilizing Plutonaster from 2000 m but the eggs did not develop. Lastly, fertilization of the lecithotroph Pontaster was achieved and larval development proceeded for over 10 days before the larvae died. We consider this aspect of the cruise to have been very successful and it has demonstrated that fertilization and developmental biology can be studied on deep-sea invertebrates collected by trawl. Besides this being the natural reproductive season, one possible factor aiding the success was that winter-collected samples do not go through the increase in temperature that summer collected samples are subjected to.

C.M. Young & P.A. Tyler

(d) Rhizopods

Throughout the cruise, large foraminifera, mainly agglutinated forms, were fixed for Transmission Electron Microscope studies. Since conditions were unsuitable for box

coring, the epibenthic sledge provided the main source of material. Samples from Station M (ES412) and the permanent station (ES415-417) contained rich agglutinated foraminiferal assemblages. Residues (> 420 µm) were examined under the stereomicroscope and selected specimens removed and fixed in 3.5% cacodylate buffered glutaraldehyde. A particular effort was made to extract the following taxa; allogromiids, komokiaceans, chain-like forms (komokiaceans), mud-walled astrorhiziids, Pelosina and Pilulina. This material will be used in ultrastructural studies.

The one multiple corer deployment attempted (Station 75/91/14, 1420 m) yielded 9 short cores which were also sampled for rhizopods. All obvious surface dwelling or upstanding foraminifera were removed. They included several complete specimens of Marsipella elongata, Psammatodendron arborescens, Rhabdammina abyssorum, R. linearis and large Astrorhiza with branched arms (probably A. arenaria). The top 1 cm of sediment was then sliced off and passed through a 500 µm sieve. In addition to numerous agglutinated foraminifera, the residues contained pieces of the xenophyophore Syringammina fragilissima and numerous fragments of a flat, reticulate xenophyophore. Picked specimens and residues from the multiple corer were fixed in glutaraldehyde

A. Gooday & R. Squires

(2) Aim 2: Benthopelagic Fish

(a) SMBA seasonal studies of benthopelagic fish

Despite the damage to two trawls caused by the footrope and headline parting good catches were obtained from all five trawls, useful catches were also obtained from three Agassiz trawls. This was the last of the seasonal cruises and as previously, the main emphasis was placed on collecting otoliths (ear bones) for studies on age and growth. Most of the macrourid fishes were approaching maturity, confirming the view that many species of the upper and mid-slopes are seasonal spawners. As previously there was no evidence of sexual maturity in the deeper macrourids, such as Coryphaenoides (N.) armatus, at the permanent station. The catches of the dominant macrourid Coryphaenoides rupestris, at the 800 and 1000 m stations were almost entirely of male fish. By 1500 m the catch was mainly female and almost all appeared to be nearly spent. Collections of ripe ovaries and sharks heads were made for the Natural History Museum.

(b) Trace metal studies

As part of a continuing study of the trace metal ecology of sharks in the north-east Atlantic, tissue samples were taken from 28 sharks from four species, (Centroscyllium fabricii, Deania calcea, Etmopterus princeps and Galeus murinus), three of which were previously unsampled. Additionally, samples of gill, liver and muscle were taken from the most abundant and widely distributed teleost species at each station to determine the relative importance of diet to the trace metal ecology of sharks. Water samples were

taken at depths of 820 - 2850 m to provide a preliminary record of dissolved concentrations of trace metals at depth. This work is partially supported by an SMBA bursary.

P. Vas

(c) Parasitological studies

Deep-sea fish from Marinovich Semi-balloon trawl stations 75/91/1, 2, 6, 12, and 13 and from Agassiz trawl stations 413, 414 and 419 were examined. Sixty-one fresh specimens of nineteen species were dissected and the helminth parasites removed. Material was fixed mainly in analar 80% alcohol with a view to undertaking DNA sequencing. Ten samples (4 digenean, 1 cestode, and 5 liver tissue control) were fixed in liquid nitrogen. No helminths were harboured by the species Chimaera monstrosa (4 specimens), Hydrolagus mirabilis (10 specimens), Histiobranchus bathybius (1 specimen) and Centroscyllium fabricii (1 specimen). Helminths were found in specimens of all other species. The results are summarised in Table 2.

M. Spencer Jones

Acknowledgements:

We are grateful to Captain Maw, his officers and crew for all their help on this and earlier cruises which has made this such a successful new time-series.

TABLE 1 CHALLENGER CRUISE 75 LEG 1 STATION POSITIONS

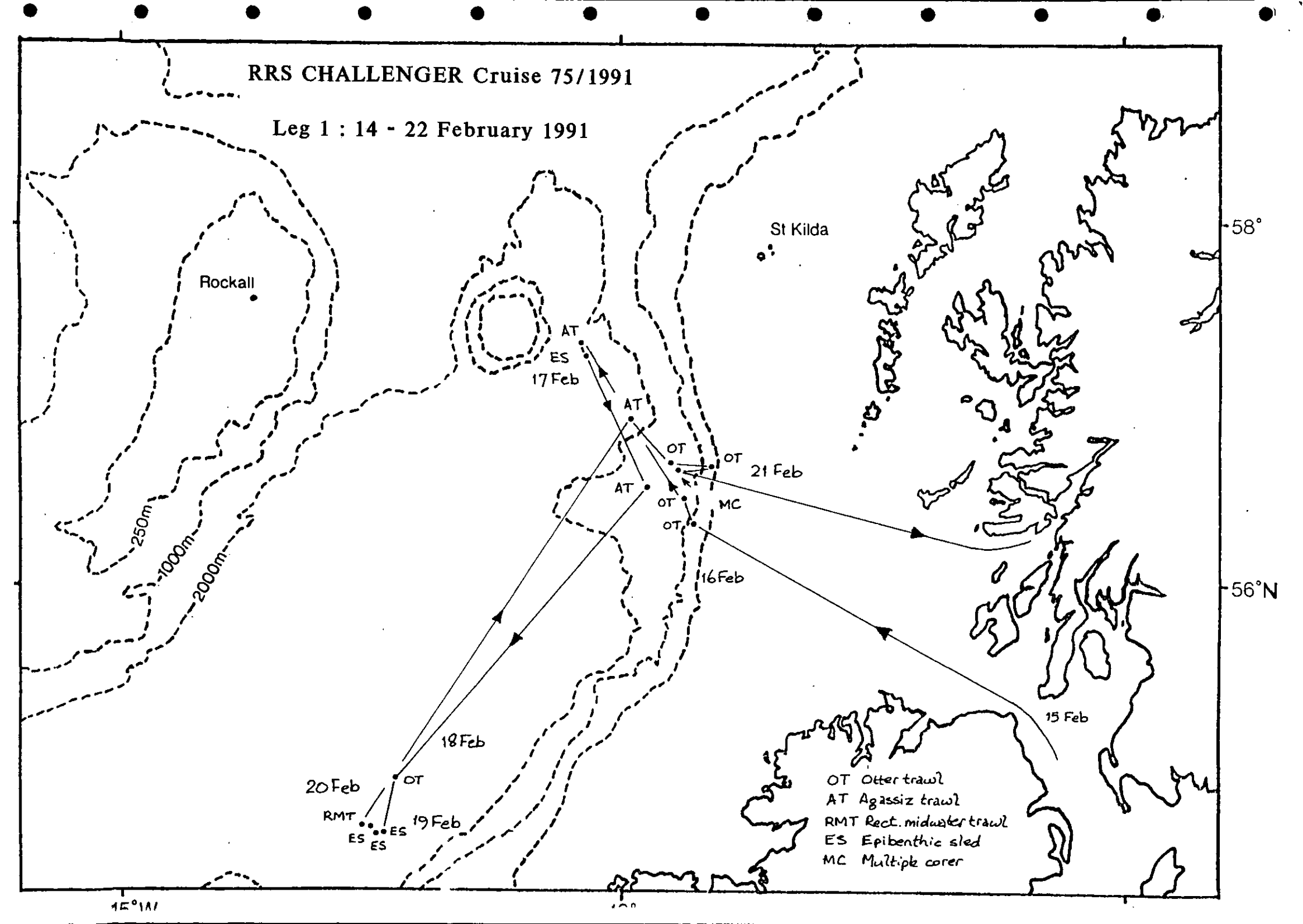
Station No.		Date	Gear	Position	Min	Max	Mean		Remarks
75/91/1		16/2/91	OTSB (P)	56° 23.7'N 09° 13.9'W	725	870	825		Both headline and footrope parted - but good catch
71/91/2		16/2/91	OTSB (P)	56° 30.7'N 09° 18.7'W	1015	1075	1037		" " " " "
71/91/2	ES 412	17/2/91	Epibenthic Sled	57° 18.5'N 10° 17.7'W			2195	Track midpoint	" " " Sled fast, short haul. Good sample
75/91/4	AT 413	17/2/91	Agassiz Trawl	57° 19.2'N 10° 22.8'W			2195	"	Good catch
75/91/5	AT 414	17/2/91	Agassiz Trawl	56° 35.0'N 09° 49.0'W			1690	"	Good catch
75/91/6		18/2/91	OTSB (S)	54° 59.4'N 12° 07.8'W	2880	2880	2880	"	
75/91/7	ES 415	18/2/91	Epibenthic Sled	54° 39.0'N 12° 15.3'W			2903	"	Sled door failed to close. Good sample
75/91/8	ES 416	19/2/91	Epibenthic Sled	54° 38.0'N 12° 18.7'W			2910	"	Sled door failed to close. Small sample
75/91/9	ES 417	19/2/91	Epibenthic Sled	54° 39.6'N 12° 21.5'W			2908	"	Sled door only half closed. Small sample
75/91/10	ES 418	20/2/91	RMT	54° 40.0'N 12° 28.0'W			2910	"	3900 metres wire out. Net tangled, small catch
75/91/11	AT 419	21/2/91	Agassiz Trawl	56° 56.4'N 09° 49.7'W			1908	"	Good catch of fish and invertebrates
75/91/12		21/2/91	OTSB (2)	56° 42.9'N 09° 25.9'W	1360	1520	1448	"	
75/91/13		21/2/91	OTSB (2)	56° 40.9'N 09° 02.8'W	500	600	559		Uneven bottom-trawl hauled early - large stone in net
75/91/14		21/2/91	Multiple Corer	56° 41.8'N 09° 24.5'W		1398			9 cores

TABLE 2

Fish host	No. dissected	Major helminth groups found C	N	D	A
Chimaera monstrosa	4				
Hydrolagus mirabilis	10				
Coryphaenoides rupestris	3			*	
Aphanopus carbo	6		*	*	
Helicolenus dactylopterus	2	*	*		
Antonogadus macrophthalmus	1	*	*		
Antimora rostrata	5	*	*	*	
Chalinura mediterranea	9	*	*	*	
Coryphaenoides guentheri	5		*	*	*
Chalinura brevibarbus	2	*		*	
Chalinura leptolepis	2		*	*	
Histiobranchus bathybius	1				
Coryphaenoides armatus	2	*	*	*	
Halosauropsis macrochir	1			*	
Bathypterois dubius	2		*	*	
Synaphobranchus kaupii	2		*		
Etmopterus princeps	1	*			
Centroscyllium fabricii	1				
Scomber scombrus	2		*		
TOTAL	61				

Kay

C - Cestoda
N - Nematoda
D - Digenea
A - Acanthocephala


RRS CHALLENGER Cruise 75/1991
Leg 1 : 14 - 22 February 1991
Rockall
St Kilda
250m
1000m
2000m
AT
ES
17 Feb
AT
AT
OT
OT
21 Feb
AT
OT
MC
OT
16 Feb
15 Feb
18 Feb
20 Feb
OT
RMT
ES
ES
ES
19 Feb
OT Otter trawl
AT Agassiz trawl
RMT Rect. midwater trawl
ES Epibenthic sled
MC Multiple corer
58°
56°N
15°W

RRS CHALLENGER, Cruise 75/1991 : Leg 2

Duration: 1253h 23 February - 1038h 3 March 1991
All times GMT

Locality: Rockall Trough and Scottish continental shelf

Staff: D.J.Ellett
Dr.J.M.Graham
G.Duncan
N. MacDougall

Aims: 1) To work the Anton Dohrn Seamount CTD section to maintain a WOCE time series.

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

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

Narrative: CHALLENGER sailed from Oban Railway Pier at 1252h 23 February in freshening southerly winds. Upon arrival at station 1G at the western entrance of the Sound of Mull the wind was gusting to 45 kt, and it was agreed to return to the Lynn of Morvern for shelter, and here the ship remained hove-to overnight. With moderating wind and swell, course was set at 0600h 24 February for the radiocaesium sampling section, station 1G being begun at 0821h. 4G was completed at 1129h and the ship proceeded to the Tiree Passage mooring, which was raised between 1335 and 1400h. The equipment was heavily entangled with light rope and monofilament long-lines, but was recovered intact except for the loss of the rotor of one current meter. A new mooring was rigged and re-laid between 1527 and 1540h, after which the ship resumed station work running westward to Barra Head and beyond. A heavy swell and increasing southerly wind made CTD work difficult at 13G and upon completion of the station at 0242h 25 February course was set for the north coast of Tiree for shelter. The ship remained hove-to here from 0730h in south to southeast force 8 winds until 0854h 26 February. In heavy swell, but improving conditions, stations were worked westward from 14G at 1328h to the shelf-edge at 1919h. Hereafter winds continued mainly southerly force 5 during the working of the Anton Dohrn

Seamount CTD section across the Rockall Trough, which was completed at Rockall at 1400h 28 February.

In continuing quiet weather with northwesterly force 3-4 winds the return to the Scottish shelf was made upon the line of the Rockall-Malin Head section. XBT drops were made at all the off-shelf stations and CTD lowerings were made at stations LS, IS, and across the shelf-edge at stations ES to CS to join the shelf CTD section running into Islay in 9°W at 1539h 1 March. This latter line was completed at station 8D at 0208h 2 March and was followed by the section between Loch Indaal, Islay and Lough Foyle between 0436 and 0932h. Winds had increased to force 8, southeasterly off the Irish coast, and CHALLENGER was hove-to at 1155h en route to the CTD section between Red Bay and the Mull of Kintyre.

The ship made slow eastward progress during the afternoon, and by 1800h it became clear that no further opportunity for CTD work would arise during the night. Surface salinity samples were collected across the North Channel and outer Firth of Clyde. The Ayrshire coast was reached in the early hours of 3 March, and the ship berthed at Troon at 1038h.

Results:

Aim 1) All stations of the Anton Dohrn Seamount CTD section were worked between 1833h 26 February and 1109h 28 February. Details are given in Table 3. High salinities were encountered in the upper water column over the shelf-edge and over the eastern half of the section. At depth, salinity in the Labrador Sea water levels was again low, though not so markedly as in September 1990. Some severe spiking occurred in the CTD salinity data at station L, and despite remaking the tail joint and the resoldering of joints upon the salinity board of the 9040 instrument, spiking continued to be a problem at the deeper stations.

Aim 2) Surface, mid-water and bottom samples for radiocaesium analysis were collected at all ten standard positions between the Sound of Mull and the shelf-edge west of Barra, and CTD profiles were obtained at these and intermediate stations.

Aim 3) The Tiree Passage current meter mooring was recovered and redeployed between 1335 and 1540h 24 February. The recovered mooring, deployed on 10 December 1990, was entangled in light rope and long lines, presumably jettisoned by a passing homeward bound liner. Subsequent examination of the current meter records showed that meter 7148 lost its

rotor early on 3 January, but data from 6979 continued to the recovery, and may be retrievable.

Miscellaneous

Fourteen XBT probes were launched and the data transmitted to the GTS by the automatic coding and transmission system. Apart from a minor problem in the automatic assignment of consecutive file numbers, the system worked very sucessfully. Temperature of the upper 750m of the Malin Head - Rockall section was sampled by XBT to provide a comparison with data from this line during the 1960s and 1970s.

The CTD sections across the shelf west of Islay and from Islay to Lough Foyle were worked to provide comparison with North Channel conditions in earlier years.

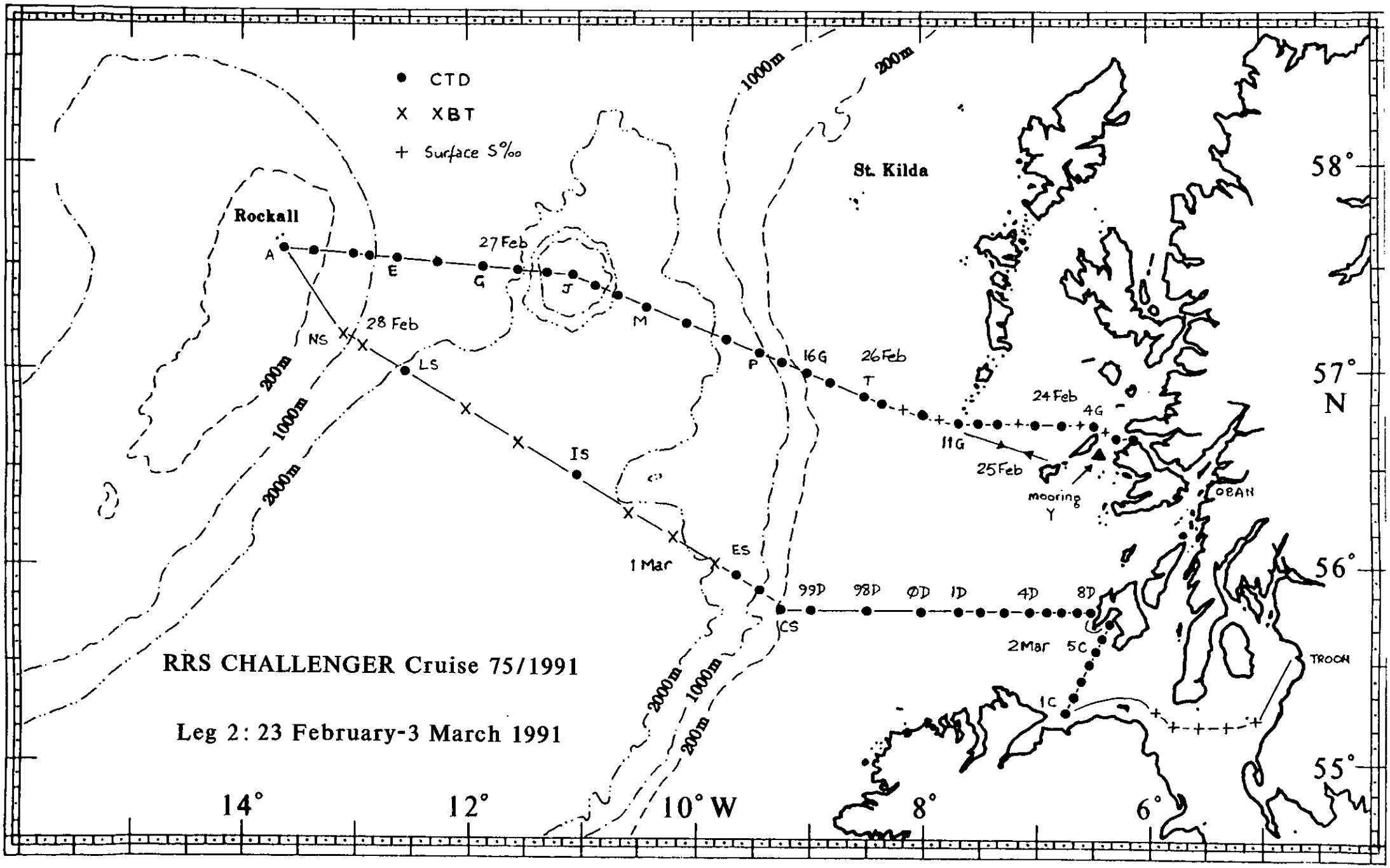
Acknowledgements:

Captain Maw, his officers and crew once again enabled us to complete our aims despite the interruptions of seasonable bad weather.

D. J. Ellett

Table 3. Hydrographic Stations, Cruise 75/1991 (Leg 2)

Stations	CTD disc/ dip nos.	Dates 1991	Observations
		Shelf-edge - Sound of Mull	
1G-16G	164/001-014	24-26 Feb.	Surf. sal; CTD, Cs surface & subsurface (1,2,4,6,7,9,11,13, 15,16)
		Anton Dohrn Seamount section	
Q	164/015	26 Feb	CTD
P-O	165/016-017	26-27 Feb	CTD
N	166/018	27 Feb	CTD
M	167/019	27 Feb	CTD
L-J	168/020-023	27 Feb	CTD
I-H	169/024-025	27 Feb	CTD
G	170/026	27 Feb	CTD
F-E	171/027-028	28 Feb	CTD
D	166/029	28 Feb	CTD
C-A	167/030-032	28 Feb	CTD
		Malin Head - Rockall section	
NS,MS	-	28 Feb	XBT
LS	172/033	28 Feb	CTD & XBT
KS,JS	-	28 Feb	XBT
IS	173/034	1 Mar	CTD & XBT
HS,GS,FS	-	1 Mar	XBT
ES,DS	174/035-036	1 Mar	CTD & XBT
CS	174/037	1 Mar	CTD
		West of Islay shelf section	
98D,99D,0D	174/038-040	1 Mar	CTD
1D	174/041	1 Mar	CTD
2D-8D	173/042-048	1-2 Mar	CTD
		Loch Indaal - Lough Foyle section	
7C-6C	173/049-050	2 Mar	CTD
5C-1C	169/051-055	2 Mar	CTD


CTD
XBT
+ Surface S‰
Rockall
St. Kilda
A
E
G
J
M
P
27 Feb
28 Feb
NS
LS
Is
ES
CS
1 Mar
16G
26 Feb
T
24 Feb
4G
11G
25 Feb
mooring
Y
OBAN
99D
98D
ØD
1D
4D
8D
2Mar
5C
1C
TROON
200m
1000m
2000m
58°
57° N
56°
55°
14°
12°
10° W
8°
6°
RRS CHALLENGER Cruise 75/1991
Leg 2: 23 February-3 March 1991