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Scottish Marine Biological Association

Dunstaffnage Marine Research Laboratory



CRUISE REPORT
R.R.S. CHALLENGER

CRUISE 20/87

17 October - 3 November

1987

GORDON

S.M.B.A., P.O. Box No. 3, Oban, Argyll, Scotland.

SCOTTISH MARINE BIOLOGICAL ASSOCIATION

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RRS CHALLENGER

Duration of Cruise: 17 October 1987 to 2 November 1987, Troon to Oban.

Locality: Rockall Trough

Ship's Officers:

Captain	P. McDermott
1st Officer	K. Avery
2nd Officer	R. Chamberlain
3rd Officer	D. Thompson
Chief Engineer	D. Rowlands
2nd Engineer	N. Wilson de Rose
3rd Engineer	B. Gillet
Electrical Engineer	W. Groody

Scientific Staff:

Dr J.D.M. Gordon (Chief Scientist)	SMBA
Mrs J.A.R. Duncan	SMBA
Mr R. Harvey	SMBA
Mr G. Macmillan	SMBA
Dr P. Tyler	University College Swansea
Dr J. Coleman	University College Swansea
Miss L. de Siqueira Campos	University College Swansea
Mr M. Willcox	University College Swansea
Dr M. White	BAS
Dr J. Armstrong	Aberdeen University
Dr D. Minchin	Irish Observer

Aims of the Cruise:

- (1) To sample the bottom-living fishes of the Rockall Trough at depths from 250 to 3000 m with a semi-balloon trawl.
- (2) To continue the benthic time-series at the SMBA permanent stations in the Rockall Trough using an epibenthic sledge, Agassiz trawl and box corer.
- (3) To sample the megabenthos of the Hebridean Terrace using an Agassiz trawl for reproductive, nutritional and genetic studies.
- (4) If time permitted to sample the Feni Ridge with an Agassiz trawl.

NARRATIVE (All times GMT)

The scientific equipment was loaded on the morning of 16th October and the scientific party embarked during the afternoon and evening. Sailing scheduled for the morning of the 17th was delayed by engine problems and Challenger eventually left Troon at 09.00 on 19th October.

In excellent weather conditions Challenger reached a position 10 miles short of the SMBA permanent station in the Rockall Trough by 13.5 hrs (20/10). The Agassiz trawl was deployed and the damage to the main warp inspected. The main warp was stoppered off and the tail of the long splice between the 13 and the 16 mm sections was tucked in. Payout continued and a small but interesting catch was obtained from close to the permanent station. The station was complete by 19.19 hrs and passage was made for the start of station 2 (SMBA permanent station at 2900 m) where the epibenthic sledge was deployed at 21.00 hrs and recovered successfully at 02.40 hrs (21/10). While this catch was being processed the semi-balloon (OTSB) trawl was rigged and fished at the permanent station (station 3) between 05.09 and 14.53 hrs. This was followed by another epibenthic sledge between 15.44 and 22.05 hrs (station 4). The rectangular midwater trawl (RMT 1) was then fished over the permanent station between 23.12 and 02.20 hrs (22/10). This completed the sampling scheduled for the SMBA permanent station and Challenger steamed towards the Hebridean Terrace and station M to begin a transect of trawling stations up the slope. At station 6 the OTSB was fished over a sounding of 2500 m between 12.56 and 20.15 hrs and again (station 7) over a sounding of 2250 m between 00.14 and 07.12 hrs (23/10). Challenger then steamed to the north of the Hebridean Terrace to occupy station 8 over a sounding of 2000 m where the OTSB was fished between 14.20 and 20.06 hrs. With the prospect of a deterioration in the weather and as the vessel was fairly close to station M it was decided to cease otter trawling and deploy the Agassiz trawl at this station. This was successfully accomplished between 01.36 and 08.25 (station 9) and the epibenthic sledge was deployed between 10.15 and 14.34 (station 10). By the time the sledge was inboard the wind had increased to 40 knots from the south and scientific work ceased. As it would be some time before the swell moderated sufficiently to attempt box-coring at station M it was decided to head slowly southwards towards the Hebridean Terrace until the wind and swell moderated.

By 04.00 (25/10) the wind had dropped and Challenger steamed towards a 1000 m trawling station. The OTSB was deployed on a single warp between 08.45 and 12.30 hrs (station 11). On recovery it was found that the netting on the codend had chaffed through and most of the catch had been lost. The spare trawl was rigged and the station was repeated between 14.06 and 18.07 hrs but once again the codend was holed. Challenger then steamed to occupy station 13 over a sounding of 1750 m

where the OTSB was successfully deployed on a single warp between 21.16 and 01.57 hrs (26/10). Station 14 was fished by the OTSB on a single warp over a sounding of 1500 m between 05.33 and 10.09 hrs. This was followed by stations at 750 and 1000 m where the OTSB was fished in the paired warp mode between 13.40 and 16.18 and 17.21 and 20.24 hrs respectively.

The weather had by now considerably improved and to allow the fish team time to catch up on the backlog of samples it was decided to return to station M and complete the benthic programme. The epibenthic sledge was deployed successfully between 02.50 and 07.53 hrs (27/10). There then followed two attempts to obtain samples with the box-corer but on both occasions the corer was empty almost certainly because the swell was triggering the mechanism before it penetrated the sediment.

Challenger then steamed back to the trawling transect and the OTSB was deployed on paired warps (station 19) over a sounding of 1250 m between 21.27 and 01.34 hrs (28/10). The trawl was again deployed on paired warps (station 20) over a sounding of 1500 m between 03.57 and 08.07 hrs. The trawl was then rigged in the single warp mode and stations 21 and 22 were fished over soundings of 1250 and 750 m between 10.09 and 14.27 and 17.11 and 20.34 hrs respectively. At station 23 the OTSB was fished over a sounding of 1000 m in the single warp mode between 22.22 and 01.57 hrs (29/10) but on this occasion the trawl failed to reach the bottom.

At this stage it was decided to leave the Hebridean Terrace and steam westwards to carry out the benthic sampling on the Feni Ridge. The Agassiz trawl was deployed over a sounding of 1850 m (station 24) at 18.31 but came fast on the bottom. It was eventually recovered inboard at 00.33 hrs (30/10) with no damage to the trawl but only a small catch. The Agassiz trawl was deployed again over a sounding of 1684 m at 01.04 hrs but, once more became fast on the bottom and when recovered inboard at 08.35 hrs was found to be badly damaged. Challenger then steamed to a new area and the spare Agassiz trawl was fished between 15.04 and 20.43 hrs (station 26) over a sounding of 1700 m but on recovery the net was badly ripped and there was only a small catch.

In view of the excellent weather conditions with wind speeds of less than 10 knots and a low swell it was decided to return to station M and attempt further box coring. Three excellent samples, two with the normal box and one with the sub-divided box, were obtained between

06.50 and 13.43 hrs. Challenger then hove to until 18.00 while the cores were extracted and sectioned.

We then steamed back to the Hebridean Terrace to complete the final part of the fishing transect. The OTSB was shot at 04.40 (1/11) over a sounding of 1000 m (station 28) and recovered with a long awaited sample from this depth at 09.02 hrs. Stations 29 and 30 were fished over a sounding of 500 m by the OTSB in single and paired warp mode between 10.59 and 16.19 hrs thus completing the OTSB transects. A few hours of scientific time remained and it was decided to sample the slope at a sounding of 250 m. The bottom in this area was known to be rough and so as not to risk damaging the OTSB nets an old SMBA trawl was rigged. This was shot at 18.07 but after a short time on the bottom came fast. The trawl was recovered inboard at 19.50 with little damage and a moderate catch. Challenger then steamed towards Oban to disembark the scientific party and the SMBA samples and equipment. In almost flat calm conditions Challenger made good progress and at 07.00 (2/11) she diverted to check the SMBA permanent current meter mooring in the Tiree Passage. Challenger tied up alongside the North Pier in Oban at 13.00 and sailed again for Barry at 15.00.

RESULTS

Aim (1)

The Marinovitch semi-balloon trawl is rapidly becoming the standard otter trawl for sampling the deep-sea bottom living fishes. In the eastern Atlantic it has been used by IOS to sample the fishes of the West African slopes and jointly by IOS and SMBA in the Porcupine Sea Bight. Unlike the Granton trawl used by SMBA in earlier work the OTSB is fished on a single deep warp. This trawl was used for the first time in Rockall on Challenger cruise 13/83 but time did not permit a full coverage of all bathymetric zones. However the results showed conclusively that certain families, notably the synphobranchid eels, had been inadequately sampled by the trawls used on earlier cruises. It was our intention on Challenger cruise 9/84 to carry out a comprehensive sampling programme with the OTSB but the failure of the deep trawling winch meant that only the paired trawl warps were available. Paired warp trawling with the OTSB showed that although it was a much smaller trawl it was almost as effective as the Granton trawl at capturing the larger, highly mobile

fishes not normally sampled by single warp trawls. The OTSB can be towed at a slower speed than is possible with the Granton trawl and this enabled us to sample to depths of 1750 m compared with the previous limit of 1250 m for paired warp trawling. One of the aims of Challenger cruise 3/85 was to carry out comparative surveys using the OTSB fished on single and paired warps. Single comparisons were achieved at depth increments of 250 m from 500 to 1500 m but other work prevented replicate hauls and single warp trawling at greater depths. The cancellation of the 1986 cruise meant that this was the first opportunity to carry out further comparative trawling.

Excellent samples were obtained at 250 m depth increments from the SMBA permanent station (almost 3000 m) to 500 m on the Hebridean Terrace using the OTSB in the single warp mode. Stations between 500 and 1500 m were also sampled with the same trawl in the paired warp mode. Unfortunately the loss of two days at the start of the cruise and the requirement to do other work meant that replicate samples were not possible on the upper slopes. On the positive side we were extremely fortunate in only losing about 8 hours because of bad weather. The efficiency of the OTSB at sampling megabenthos also saved time because there was no need to use the Agassiz trawl on the Hebridean Terrace for aim (3).

Full details of the station data are given in Appendix 1 and some preliminary results are shown in Table 1. There is a decrease in abundance below 2000 m for the single warp trawl and a considerable proportion of the high abundance between 1000 and 1750 m is attributable to the deep-sea eel Synaphobranchus kaupi. The abundance of S. kaupi in paired warp trawls is considerably reduced. Estimates of total biomass are not yet available but the differences in the biomass of the common alepocephalid, Alepocephalus bairdii, between the two methods of fishing demonstrates the greater efficiency of the paired warp trawl at catching this species.

This was the first time that the OTSB had been used in the Rockall Trough at the 2000, 2250 and 2500 m bathymetric zones. Although these depths had previously been fished by a small box trawl the OTSB added several new records to the fauna of the Rockall Trough notably in the family Alepocephalidae. Some large specimens of the deep-water chimaerid Hydrolagus affinis were caught and at one station four

specimens were captured which were much paler in colour. It now appears that these belong to an as yet undescribed species of which only twelve other specimens are known.

J.D.M. GORDON and MRS J.A.R. DUNCAN

Aim (2)

SMBA Invertebrate Sampling at the permanent stations

The samples taken with the Agassiz Trawl and epibenthic sled at the SMBA Permanent Station extend the time series at this station to 13 years. Repeat hauls were made with the sled in order to quantify the variability (if any) from haul to haul, as a precursor to a detailed analysis of observed changes in size-frequency distributions over the years.

Samples taken with the same two gears at station M east of the Anton Dohrn Seamount extend the time series at this contrasting station to 10 years. Good samples of megafaunal animals, particularly the regular urchin Echinus affinis and the large ophiuroid Ophiomusium lymani were obtained for studies on growth and population structure. Poor weather prevented the initial sled from fishing effectively, but a later haul in good conditions produced a large, rich sample. The remarkably calm conditions on the 31st October allowed the deployment of the large 0.25 m spade box corer. Three excellent samples were obtained, much to the surprise of those sceptics on board! One of these was taken using a subdivided box in order to investigate small scale spatial pattern in the burrowing fauna.

Much of the smaller material collected, particularly polychaetes, crustacea and echinoderms will be used by specialists at a number of Universities and Institutes as part of continuing taxonomic and population studies associated with the SMBA benthic time series.

R. HARVEY

Aim (3)

Reproductive, nutritional and genetic studies of megainvertebrates

Our aim of participating in the cruise was to obtain samples of deep-sea megainvertebrates over a wide depth range for use in reproductive, nutritional and genetic studies. The genetic studies are in

collaboration with Prof. J.A. Beardmore whilst the reproductive/nutritive studies are an extension of the SMBA/UCS programme. The material obtained from both OTSB and Agassiz trawl samples was magnificent resulting in the cruise being an unqualified success from our point of view.

The main species taken, together with their zonation, is shown in Table 2. The asteroid Pseudarchaster parelli was obtained over a 2000 m depth range although the total numbers were low. Amongst the other asteroid species Plutonaster was found in large numbers over a 1000 m depth range and the 'small' and 'large' forms of Zoroaster fulgens were also found over a 1000 m depth range. It would appear that the slope zonation started at c. 2500 m upwards as the species found at 2900 m were rarely found in the other samples. Echinothurids and regular urchins of known reproductive biology were collected for nutritional studies into the effects of seasonal pulses of organic matter into the deep sea on seasonally and continually breeding species. Ophiomusium was collected extensively and these specimens will be compared genetically with those taken off Portugal in 1986. Hermit crabs were collected over a wide depth range and their enzyme systems will be assessed also. The deep sea fish Synaphobranchus and Coryphaenoides were collected for the same purpose (see table).

The guts of specimens of Echinus affinis and Phormosoma placenta were fixed in 10% glutaraldehyde in seawater for EM studies. All other megafauna were fixed in 5% seawater formalin, and comprised a wide range of all classes of echinoderms except the crinoids. This material will complement material collected on previous cruises as part of the SMBA/UCS collaboration.

Overall this has proved to be one of the most successful sampling cruises in which we have been involved.

L. DE SIQUEIRA CAMPOS and P.A. TYLER

Aim (4)

The Agassiz trawls on the Feni Ridge (at the foot of Rockall Bank) produced some interesting material from what is clearly a difficult bottom to sample effectively. The presence of numerous gorgonians and specimens of black coral, together with evidence from previous box core and sled samples, suggests a high energy environment with thin sediment cover on a consolidated chalk base.

R. HARVEY

(5) Other Investigations

(a) Specimens of Chlamys septemradiata collected at three stations, ranging from 750 m to 250 m are currently being examined and compared with inshore populations. This study is being done in conjunction with Dr A. Ansell, SMBA. Photographs of selected fish and benthos were taken. Many specimens were photographed while immersed, using a Nikonos II camera and strobe.

D. MINCHIN

(b) Dr J. Armstrong, who is currently employed on a NERC grant to study the movements of deep-sea fish, joined the cruise to gain first hand experience of the northeast Atlantic deep-water fishes and to assess the capabilities of NERC vessels for future fish tracking work.

(c) Dr M. White participated in the cruise to gain experience in deep-water bottom trawling. This will be of particular value for the planning of the new BAS research vessel.

(d) Deep frozen specimens of sharks were collected for Dr Vas of Salford University.

Acknowledgements

We are grateful to Captain McDermott, his officers and crew for all their help and advice. Mr G. Macmillan, mate of RV Calanus, spent long hours on deck maintaining the trawls and without his expertise we could never have achieved the amount of trawling that we did. The normal fish team was much depleted on this cruise and I thank all the scientists who under Mrs Duncan's guidance soon became expert in identification, measuring and dissection. Finally we must thank Dan Minchin for his excellent company, he never missed a trawl coming in, photographed everything in sight and kept us entertained with his repartee.

J.D.M. GORDON

JANUARY 1988

TABLE 1

Bathymetric Zone	No. Species	Single warp OTSB			Paired warp OTSB			
		No/1000 m ² Total	No/1000 m ² <u>S. kaupi</u>	Kg/1000 m ² <u>A. bairdii</u>	No. Species	No/1000 m ² Total	No/1000 m ² <u>S. kaupi</u>	Kg/1000 m ² <u>A. bairdii</u>
500	23	15.21	0.81	0	19	26.80	0.09	0
750	19	5.86	1.19	0	20	5.71	0.25	+
1000	19	15.45	10.43	0.003	14	5.94	0.08	0.75
1250	20	13.62	5.98	0.06	23	16.71	1.60	10.13
1500	17	10.29	2.57	0.19	19	16.47	2.86	4.33
1750	17	14.37	5.35	0				
2000	19	5.66	0.61	0				
2250	17	4.27	0.12	0				
2500	17	1.52	0	0				
3000	8	2.53	0	0				

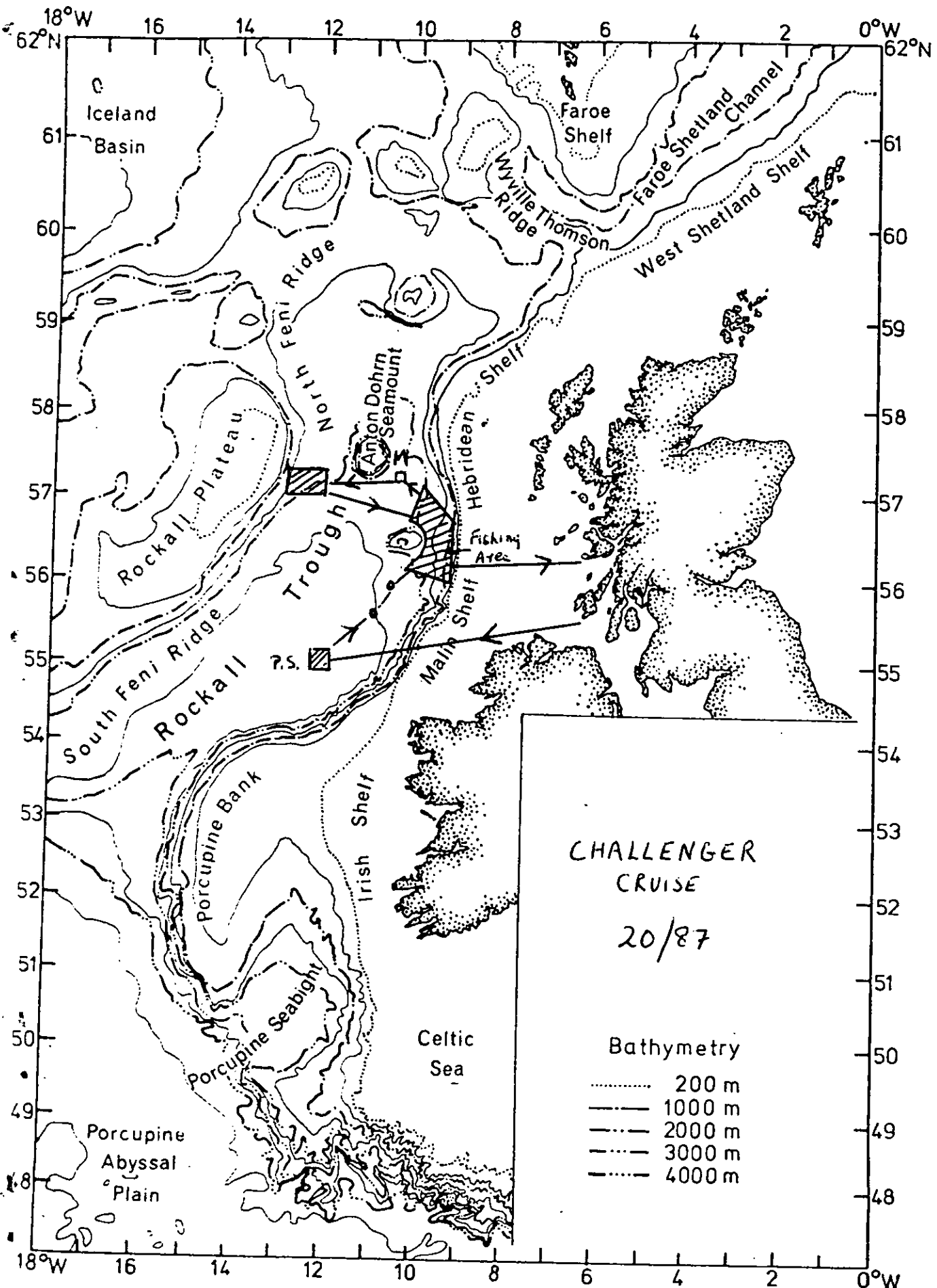
TABLE 2 All data await final confirmation.

Depth (m)	500	750	1000	1250	1500	1750	2000	"M"	2250	2500	2900
Species											
Plutonaster					Y		Y	Y	Y		
Bathybiaster							Y	Y	Y	Y	
Zoroaster					Y	Y	Y	Y	Y		
Pseudarchaster	Y	Y			Y	Y	Y	Y	Y	Y	
Phormosoma		?		Y				Y	Y		
Sperosoma		Y	Y	Y	Y						
Ophiomusium						Y	Y	Y	Y		
Parapagurus	Y	Y		Y		Y					Y
Coryphaenoides	Y	Y	Y	Y	Y	Y	Y				
Synaphobranchus	Y	Y	Y	Y	Y	Y	Y				

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TABLE III

Station No.	SMBA Ref. No.	Gear	Position (start)	Depth range	Mean depth	Date and Time start	Duration (mins)	Wire out (metres)	Remarks
20/87/1	AT 351	Agassiz trawl	54°40'N 12°12'W	2898	2898	16.00 20.10.87	75	6000	Splice repaired
20/87/2	ES 352	Epibenthic Sledge	54°42'N 12°19'W	2885	2885	23.30 20.10.87	75	6010	Excellent haul
20/87/3		OTSB(S)	54°42'N 12°16'W	2875-2900	2887	07.50 21.10.87	144	8500	
20/87/4	ES 353	Epibenthic Sledge	54°42'N 12°21'W	2890	2890	18.30 21.10.87	90	6000	Moderate haul - Sledge bent
20/87/5	RMT 354	RMT 1	54°42'N 12°20'W	-	-	23.12 21.10.87	45	3000	
20/87/6		OTSB(S)	55°43'N 10°47'W	2480-2500	2490	18.06 22.10.87	135	7007	
20/87/7		OTSB(S)	55°52'N 10°06'W	2165-2210	2187	02.40 23.10.87	134	6000	
20/87/8		OTSB(S)	56°58'N 09°46'W	1800-1940	1870	16.24 23.10.87	132	5000	
20/87/9	AT 355	Agassiz trawl	57°18'N 10°24'W	2200	2200	03.30 24.10.87	90	5500	Splice stranded, good catch
20/87/10	ES 356	Epibenthic Sledge	57°20'N 10°22'W	2170	2170	12.15 24.10.87	60	4570	Poor haul
20/87/11		OTSB(S)	56°34'N 09°15'W	890-1005	947	10.14 25.10.87	64	3000	Codend torn, most catch lost
20/87/12		OTSB(S)	56°35'N 09°16'W	950-1035	992	15.28 25.10.87	56	3000	Codend torn, most catch lost
20/87/13		OTSB(S)	56°52'N 09°34'W	1725-1750	1717	23.20 25.10.87	60	4400	
20/87/14		OTSB(S)	56°30'N 09°39'W	1460-1480	1470	07.11 26.10.87	60	4000	
20/87/15		OTSB(P)	56°20'N 09°11'W	715-840	777	14.31 26.10.87	59	2000	
20/87/16		OTSB(P)	56°31'N 09°16'W	825-960	892	18.25 26.10.87	60	2500	Headline parted on recovery
20/87/17	ES 357	Epibenthic Sledge	57°21'N 10°30'W	2215	2215	05.00 27.10.87	60	5200	
20/87/18		Spade box corer	57°20'N 10°21'W	-	-	09.30 27.10.87	-	-	No samples
20/87/19		OTSB(P)	56°27'N 09°25'W	1160-1175	1167	22.47 27.10.87	60	2900	
20/87/20		OTSB(P)	56°25'N 09°41'W	1535-1555	1545	05.20 28.10.87	60	2900	
20/87/21		OTSB(S)	56°28'N 09°26'W	1185-1200	1192	11.50 28.10.87	60	3200	
20/87/22		OTSB(S)	56°20'N 09°11'W	735-810	772	18.03 28.10.87	60	2000	
20/87/23		OTSB(S)	56°27'N 09°19'W	975-1015	995	23.27 28.10.87	51	2500	Not on bottom
20/87/24	AT 358	Agassiz trawl	56°35'N 13°29'W	1850	1850	21.00 29.10.87	20	5800	Trawl fast, recovered on safety stop, small catch.
20/87/25	AT 359	Agassiz trawl	56°33'N 13°37'W	1684	1684	02.50 30.10.87	60	5407	Trawl fast, recovered on safety stop, no catch.
20/87/26	AT 360	Agassiz trawl	57°21'N 12°41'W	1708	1708	17.30 30.10.87	70	5005	Net badly torn, small catch
20/87/27	SBC 361	Spade box corer	57°21'N 10°21'W	2170	2170	07.45 31.10.87	-	2225	Good core
	SBC 362	Spade box corer	57°22'N 10°26'W	2175	2175	10.33 31.10.87	-	2220	Subdivided box, good core
	SBC 363	Spade box corer	57°22'N 10°27'W	2180	2180	12.45 31.10.87	-	2230	Good core
20/87/28		OTSB(S)	56°26'N 09°14'W	855-905	880	06.28 01.11.87	60	3000	
20/87/29		OTSB(S)	56°23'N 09°09'W	555-610	582	11.44 01.11.87	64	1500	
20/87/30		OTSB(P)	56°23'N 09°08'W	545-590	517	15.15 01.11.87	c. 23	1500	Trawl fast - no damage.
20/87/31		SWT(P)	56°39'N 09°00'W	210-435	353	18.31 01.11.87	59	750	



CHALLENGER
CRUISE
20/87

Bathymetry
 200 m
 ----- 1000 m
 ----- 2000 m
 ----- 3000 m
 ----- 4000 m