I.O.S.

RRS CHALLENGER
CRUISE 5/84

11 – 28 AUGUST 1984

BENTHIC BIOLOGY OF THE PORCUPINE SEABIGHT

CRUISE REPORT NO. 175

1985

NATURAL ENVIRONMENT RESEARCH COUNCIL
INSTITUTE OF OCEANOGRAPHIC SCIENCES

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INSTITUTE OF OCEANOGRAPHIC SCIENCES

WORMLEY

RRS CHALLENGER

Cruise 5/84

(IOS Cruise 520)

11 - 28 August 1984

Benthic biology of the Porcupine Seabight

Principal Scientist

A.L. Rice

CRUISE REPORT NO. 175

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ITINERARY

Depart Falmouth 1100GMT 11 August 1984

Arrive Dunstaffnage 0820GMT 28 August 1984

SCIENTIFIC PERSONNEL

D.S.M. Billett	IOS Wormley
E.P. Collins	" "
A.J. Gooday	" "
R.S. Lampitt	" "
G.R.J. Phillips	" "
R. Raine	University College, Galway (Irish Observer)
A.L. Rice	IOS Wormley (Principal Scientist)
J.J. Taylor	" "
M.H. Thurston	" "

SHIP'S OFFICERS

J. Moran	Master
G. Price	Chief Officer
B. Richardson	2nd Officer
P. Pepler	3rd Officer
I. McGill	Chief Engineer
J. Barker	2nd Engineer
B. Entwhistle	3rd Engineer
S. Thomas	4th Engineer

PRE-AMBLE

Major damage to the main dredging winch barrel during Challenger cruise 3/84 necessitated the removal of the main winch leaving the ship with only the two trawl winches, each with rather less than 3000m of usable 22mm wire, and the auxillary winches. Consequently, the original programme for cruise 5/84, which had included towed benthic sampling to a depth of 4500m, had to be drastically altered, restricting such sampling to depths of no more than about 1500m and vertical wire work to less than about 2700m. However, since a major objective was an attempted retrieval of a Bathysnap and a sediment trap array deployed at about 2000m the ship had to accommodate the necessary dragging wire. Since the spooling gear on the trawl winches would not allow the passage of shackles, 1000m of 13mm wire was connected to the 22mm wire on the starboard trawl winch with soft eyes and wound on without a break apart from two soft eyes 50m out. The outboard end of the dragging wire was a further 1000m of 13mm wire wound onto the port auxillary winch. This wire was to have chains for the attachment of grapnels inserted into it at sea. In addition, a 50m pennant of 13mm wire was added to the starboard auxillary winch to allow gear to be launched over the mid-ships sheave on the A-frame and transferred to the trawl winch sheaves. Although the resulting system necessitated a great deal of wire changing not normally experienced on our Challenger cruises, the only potentially major problems experienced were the tendency of the 13mm wire to fall out of the spooling sheave on the starboard winch when tension was removed, and for the large eye splice on the 22mm wire to jam when passing around the same sheave.

OBJECTIVES

1. To recover a Bathysnap at 2000m deployed on cruise 519.
2. To grapple for a Bathysnap deployed on Cruise 517 (Challenger 6/83) and a sediment trap array deployed on cruise 519 (Frederick Russell 6/84), both of which subsequently failed to release.
3. To attempt to locate, and possibly grapple for, a Bidston pressure recorder which had also failed to release.
4. To obtain a series of samples with the SMBA multiple corer at depths ranging from 500m to 2700m.
5. To make two measurements of sediment community oxygen consumption using the suspended corer technique (see Cruise 519 report).

5. To obtain a small number of epibenthic sledge samples and particularly one at c 1200m to sample the Pheronema community and to collect living Dorhynchus.
6. To sample the upper part of the water column to collect post-larval Dorhynchus.
7. To investigate the necrophage community at the proposed CYAPORC working sites at approximately 50°22'N: 12°43'W and 50°45'N: 11°20'W using a baited Bathysnap, amphipod trap and camera system.
8. To carry out preliminary experiments on the use of homing pigeons to transport sediment samples rapidly to Cardiff for bacteriological studies.
9. To obtain a series of long photosledge transects from about 700m to 1500m to investigate the detailed distribution of the megafauna.

NARRATIVE

Challenger bunkered on the morning of 11/VIII and finally sailed at 1100GMT. Because the correct grade of fuel for the ship had not been ordered in time, the ship's speed had to be reduced in the early hours of 12/VIII due to loss of boiler pressure. This was the first intimation of a problem which the engineers had throughout the scientific part of the cruise and which inevitably resulted in some loss of time between stations.

The PES fish was streamed at 0800/12 and echosounding was commenced at 1800 as the ship approached the eastern side of the Porcupine Seabight.

The first station (52001), at a depth of 379m, was reached at 1630 and a successful cast with the SMBA multiple corer was completed by 1820.

Challenger continued to the 2000m station at approximately 51°N: 13°W, streaming the dragging wire on the port auxillary winch during the passage.

The second station was reached at 0440/13 and a multicore cast (52002#1) was completed at 0635. During this cast an unsuccessful attempt was made to release the sediment trap array (51901#6) acoustically. From the strength of the signal received the pinger appeared to be lying flat on the sea bed, indicating the loss of the rig's buoyancy and therefore making successful recovery by dragging much less likely.

At 0808/13 the Bathysnap deployed during a Frederick Russell cruise in April (51901#8) was released and successfully recovered by 0940.

During the ascent of Bathysnap 9 pigeons were released with samples from 52002#1. The light northerly winds were not favourable, but with easterlies forecast this was felt to be the best release opportunity which was likely to occur for the next few days. The birds disappeared on a roughly easterly heading which seemed to augur well, but we heard the following day that none had arrived back in Cardiff on the 13th so that the experiment had failed. (One bird did land at a loft in Northern Ireland, but much too late to be useful scientifically).

Having recovered the Bathysnap, Challenger moved the short distance to the Bidston pressure recorder station and an extensive box search was undertaken until 1650 in an unsuccessful attempt to locate the instrument.

The vessel now moved north to a proposed 1750m station at 51°15'N: 13°00'W and a multicore sample was obtained by 2009/13. During this haul the m.w.o. reading on the plot repeater differed from that at the winch control by up to an additional 150m, the control read-out appearing to agree more closely with the soundings. From this point to the end of the cruise the repeater was unreliable for both winches and during one haul (52007#1) recorded 2m throughout!

During the Bathysnap recovery and the subsequent search for the tide gauge the dragging wire had been prepared by inserting 6 lengths of chain at more or less equal intervals in the 1000m of wire on the port auxillary winch. The ship now moved to the 2000m station in the neighbourhood of the lost Bathysnap to heave to until 0300/14 so that dragging could begin at first light. An acoustic survey was conducted from 0300 to 0415 and dragging began at 0430 from a position estimated to be about 1km to the south-west of the instrument.

The whole of the outboard 1000m of 13mm wire with the grappels attached, together with the uninterrupted 1000m from the trawl winch were deployed on the bottom and the dragging operation was undertaken at a little more than 1kt. For some 12 hours all appeared to go reasonably well and from the acoustic survey we appeared to have successfully drawn a complete circle around the Bathysnap. However, at about 1400/14 the signal became confusing and we were unable to establish the location of the Bathysnap relative to the ship. Hauling began at 1730 and the wire was brought in without incident until the second grappling hook on the outer 1000m of 13mm wire reached the surface. A loop of wire caught on the fluke of this wire was successfully released, but when the third hook was reached a tangled mass of wire was encountered which could clearly not be unravelled and had to be jettisoned. Since we were still close to the much used 2000m station, the wire to be dumped should have been dragged to some less important area, though this would certainly have taken a great deal of time. However, at 2030/14 the wire was dumped at the dragging locality (51°01'N: 13°00'W) as a result of an over-hasty decision by the Principal Scientist and must present a hazard for future operations. In all, about 800m of 13mm wire, 4 grappling hooks and two Gifford grapnels were jettisoned.

After the unsuccessful completion of the dragging operation some difficulty was experienced in locating the Bathysnap, for some time the possibility being entertained that the instrument might have been released. However, by 0015/15 the Bathysnap had been located and turned off and Challenger moved 2 miles to the west to undertake the first long hang experiment with the multiple corer.

By 0336/15 the preliminary core sample (52004#1) had been obtained from a depth of 1990m. The corer was now re-rigged and a set of cores obtained from a depth of 1997m. This time the corer was raised some 80m above the sea-floor and held in this position for 18 hours until hauling began at 0020/16. At 0112 the corer was inboard with 10 good cores (52004#2).

The vessel now moved to the southwest for a multicore sample at about 2700m at 50°20'N: 13°23'W, this being completed by 0950 with 10 good cores and some indication of phytodetrital remains on the surface (52005).

The next station, in the proposed CYAPORC working area, was reached at 1300/16 and a wire test of the amphipod trap release was conducted to 1500m. In order to obtain a multicore sample within the canyon an echo-sounding survey was conducted between 50°19' and 50°22'N and 12°42' and 12°43'W, confirming the accuracy of the Seabeam chart of the area produced during NORESTLANTE 1 in 1983. However, although the bottom of the canyon at this point is apparently almost 0.5n.m. wide, some difficulty was experienced in placing the corer on the canyon floor because of the ship's drift during paying out and the corer consequently sampled the sea-bed at a depth of 2660m on the lower part of the southern levee of the canyon (52006).

Challenger now moved some 2.5n.m. to the north and a good sample was obtained at a depth of 2446m on the relatively flat area adjacent to the canyon edge (52007#1).

The amphipod trap (52007#2) was deployed at 0002/17 and reached the bottom at 0037. The trap was retrieved after some 10 hours on the bottom and in the intervening period an attempt was made to photograph the sea-floor on the sides and bottom of the canyon. To do this the camera was fitted with a bottom trigger and mounted on the Bathysnap frame which was attached to the 22mm wire on the port trawl winch with a short rope pennant buoyed half way along its length with a 10" sphere. A trial cast with the rig was conducted on the level sea-floor adjacent to the canyon from 0112 to 0400/17 (52007#3), but on retrieval the flash unit was found to have flooded through a leaking connector and none of the film had been exposed. A second trial with a replacement flash unit was completed by 1030/17. The camera system had worked satisfactorily, but many of the frames were obscured by mud disturbed by the frame and the gear was also too light to be used effectively on the large trawl wire. (For subsequent "pogostick" casts a different system was built based on a single vertical rod, and was operated from the hydrographic winch.)

The amphipod trap was released at 1214/17 and reached the surface at 1320. However, the main engines failed during the trap's ascent and the ship was unable to reach the trap on the bow thruster alone. Under engine room control the trap was eventually retrieved at 1732.

The engine fault was repaired by 1830 and we were able to proceed towards the next station, intended to be a multicore cast at about 2200m on the way to the 2000m station at 51°N: 13°W where the second long respirometry hang was to be undertaken. However, for some hours the weather had been worsening, with a heavy swell from the south-east; when we reached the 2200m position it was too rough to work and we therefore proceeded to the 2000m station and hove to awaiting an improvement. The corer was eventually shot at 0630 and brought inboard at 0845 (52008#1).

The corer was shot for the long hang at 0948, but due to a problem with the generator its descent was interrupted and the incubation did not start until 1143/18. Hauling began at 0543/19 and the gear came inboard at 0626. As it was landed on the deck the high-tech length of broom handle, used to hold the coring head in the raised position, broke and allowed the head to crash into the deck, smashing several of the core tubes and causing minor damage to the closing gear. Only two cores remained intact, but the oxygen uptake rates obtained from these cores were so similar to those obtained from the first experiment that there did not seem to be any very good argument for a replacement long hang (see respirometry report).

Challenger consequently now left the 2000m station for a series of stations in relatively shallow water, the first of which was to be an epibenthic sledge haul at 1200-1250m near the shallow transponder site at about 51°42'N: 13°00'W.

The sledge was shot at this station at 1223/19 and brought to the surface at 1420 (52009). However, the gear was not finally brought inboard until 1500 because of particularly large quantities of mud in both the central and right hand nets. In bringing the gear aboard the canvas sleeves of all three nets were torn, but no significant damage was caused to the nets themselves. The main cause of the retention of mud at this locality is the presence of large numbers of the hexactinellid sponge Pheronema, but the situation seemed to be worse on this occasion than in our previous experience. This appeared possibly to be due to the use of the 22mm trawl winch wire rather than the much thinner tapered wire on the main winch. The presence of many sponges in the supra-benthic net seemed to support the possibility that the gear had been behaving abnormally, but the net monitor had unfortunately been left switched to the camera test position so that no photographic record, which would have provided valuable information on the orientation of the sledge, was obtained.

The presence of epi-benthic material in the supra-benthic net had its advantages. A major objective of this haul was to obtain a sample of the small spider crab Dorhynchus thomsoni, including, if possible, living specimens to be maintained ashore. Because it was relatively small, the supra-benthic sample was in much better condition than those from the other nets and 13 virtually perfect crabs were obtained from it and survived to be subsequently transferred to the Marine Biological Laboratory at Port Erin (see later).

Because of the enormous catch, and the time that would be required to deal with it, it was decided to carry out a photosledge haul rather than a second epibenthic sledge haul as was the original intention. Moreover, wherever possible, future sledge hauls would be restricted to the daylight hours and photosledges would be fished at night. (This seems to have worked out reasonably well for everyone except the P.S. who somehow found himself fishing most of these night-time photosledges!) However, the camera used on 52009 was a previously unused half-frame unit for which the haul was to have been a test. Since this had not been achieved, a short test photosledge was undertaken before embarking on the long one. This test run (52010) was conducted in 550m at about 51°53'N: 13°37'W, again using the port winch, and was completed by 2200/19. The photographs from this haul were fine, confirming not only that the camera system was working satisfactorily, but also that the use of the 22mm wire did not necessarily cause the sledge to mis-behave.

The photosledge was therefore shot at 0100/20 and fished downslope from about 51°57'N: 13°15'W at a depth of about 770m. Using thin-based surveillance film in the half-frame camera the system was expected to have a capacity of some 1600 frames which, at an inter-frame interval of 30 seconds, would allow a bottom duration of well over 10 hours. However, at 0626/20 the monitor ceased to record the flash unit discharges after the gear had been on the bottom for only 5 hours, moving from 770m to 935m, and had taken only 600 photographs (52011). The gear was brought aboard by 0739 and it was found that a micro-switch in the camera had failed and was therefore not triggering the flash unit.

Since we were now very close to the position of a required epibenthic sledge haul at about 1000m to sample the Parapagurus/Epizoanthus community the nets were added to the sledge and the gear was shot at 0957 and recovered at 1126 with another very large catch (52012).

Challenger now made for a proposed 500m station at 52°04'N: 13°30'W and the epibenthic sledge was shot at 1509 and recovered at 1605 with a third very large catch which took almost an hour to bring over the transom (52013).

On completion of this station the vessel moved south-east to obtain a multicore sample at about 1000m and to continue the photographic transect begun with 52011. The multicore cast was completed by 2233 (52014) and the photo-sledge was shot at 2347 from close to the endpoint of 52011 with the intention of making a course of about 140° to avoid the rather rough topography at around 51°30'N: 13°00'W. However, because of a beam wind the course actually made was almost due south. This course might eventually have caused us to abort the haul, but at 0530/21, long before this would have been necessary, all traces on the Mufax were lost and the sledge was brought inboard at 0611 after having been on the bottom for only a little over 5 hours and having obtained some 613 photographs (52015). The fault turned out to be a burned out capacitor in the net monitor.

The ship now moved the short distance to a proposed 1350m station to multicore at a locality to the south of the transponder station sampled during cruise 516. Two hauls at this station (52016#1 and #2) were successfully completed by 1220/21, both obtaining very good cores.

Challenger now moved to a station at 1500m at c. 51°31'N: 13°00'W and an epibenthic sledge was fished from 1404 to 1603h (52017), this time using the starboard winch with its 1000m of 13mm wire. The catch was good, but much cleaner than the earlier three sledge catches, seemingly confirming the suggestion that these excessive catches were due to the use of the heavy 22mm wire on the port winch.

It was now time to begin the overnight photosledge to complete the transect begun with 52011 and 52015. Accordingly, the sledge was shot at 1853/21 at about 51°43'N: 13°06'W and reached the bottom in a depth of 1095m, that is slightly shallower than the deepest depth reached during 52015. This time all seemed to proceed smoothly and the sledge was towed on the bottom for almost 11 hours, being brought aboard at 0716/22, and had covered some 17n.m. according to the ship's positions (52018). During this time 1264 frames were registered on the Mufax, the final ones being at a depth of 1620m thus amply covering the depth range originally hoped for. Consternation was caused by the discovery that all of the film had passed onto the take-up spool, suggesting that a fault in the camera might have caused it to wind on continuously, though there was no evidence of such a fault when it came aboard. This prompted a re-assessment of the camera capacity which turned out to be about 1350 frames rather than the assumed 1600. (When the film from this haul was later processed it transpired that the camera did run out of film on the bottom but not until 0607h, that is only 9 minutes before hauling began).

The vessel was now close to a proposed 1750m epibenthic sledge station so that after the nets had been fitted to the sledge the gear was shot at 0914 and recovered at 1205, having again been fished on the 13mm wire on the starboard winch (52019).

Challenger now moved to the north-west, towards the Porcupine Bank, to obtain two relatively shallow multicore samples. These casts (52020 at 493m and 52021 at 742m) were successfully completed by 2310/22.

A final photosledge haul was now made (52022), some 20 miles to the south-west of the previous transect, and intended to cover the depth range from about 950 to 1250m and thus pass through the Pheronema community. This haul was successfully completed by 0732/23.

Challenger now left the northern part of the Seabight for the last time, the remainder of the cruise to be spent mainly in the proposed CYAPORC working area at about 50°23'N: 12°43'W. However, during the passage to this station a multicore sample was obtained from a depth of 2220m (52023).

During the passage to the CYAPORC station we learnt of the impending dock strike which was ultimately to result in our docking at Dunstaffnage.

Having arrived at the CYAPORC position at 1700/23 a baited Bathysnap (52024#1) and an amphipod trap array (52024#2) were both launched on the relatively flat sea-floor adjacent to the canyon at a depth of 2456m, reaching the bottom at 1805 and 1829 respectively.

A multicore sample in the same area was obtained by 2100/23 and this was followed by a short test drop of the new 'Pogostick' camera rig which had been built during the passage from the previous station and was based on a spare epibenthic sledge net bar (52024#4).

These hauls were completed by midnight and, in the time available before the recovery of the amphipod trap and the Bathysnap at first light, two shallow RMT 1 hauls were made in an attempt to collect the pelagic first crab stages of Dorhynchus which were expected to be in the water column at this time (52024#5 and #6).

The amphipod trap and Bathysnap were both successfully recovered by 0717 and this was followed by a Pogostick camera drop from 0848-1126 (52024#7).

The station was completed by a further RMT 1 haul (52024#8) and a second Pogostick drop from 1456-1718/24, attempting to obtain a series of photographs down the steep northern side of the canyon and onto the floor.

Challenger now made for the head of the canyon to work on the sea-floor adjacent to the canyon at a depth of about 1000m at c. 50°45'N: 11°20'W.

Having arrived at the proposed station position at 0045/25 rather more than an hour was spent in locating a relatively flat area of sea-bed to deploy the baited Bathysnap (52025#1) and amphipod trap (52025#2). These reached the bottom at 0210 and 0241 respectively, in a depth of 940m.

The multiple corer was launched at 0312 for a sample in the same depth, but when the echosounder record was examined it was clear that the ship had drifted over an area of much too irregular topography for the corer. The corer was therefore held suspended in mid-water for an hour until a relatively flat sea-floor, at a depth of c.800m, was found. The multicore cast was then continued and successfully completed by 0526/25, obtaining 6 short, sandy cores (52025#3).

An echosounder survey for a suitable area of the canyon side on which to deploy the Pogostick camera was abandoned after 1½ hours, only vertical or near vertical faces having been found. The ship therefore returned to the locality of 52025#3 and a further multicore sample was obtained (52025#4), this time obtaining 3 good but very short cores.

A further RMT 1 haul, between 300 and 600m was completed by 1100 and the station was completed by the retrieval of the amphipod trap and Bathysnap by 1424/25.

Challenger now moved onto the shelf edge at about 50°48'N: 11°07'W to obtain an epibenthic sledge sample in a depth of 215m which was completed at 1743/25.

The ship now made for Dunstaffnage where we docked at 0920/28. During the homeward passage the remaining pigeons were released during the morning of the 26th and Challenger was met by the MV Silver Spray at 0600/27 to transfer the living Dorhynchus to the University of Liverpool Marine Laboratory at Port Erin, Isle of Man.

It is a pleasure to acknowledge the willing co-operation and interest shown by the ship's officers and crew.

MULTIPLE CORER

The multiple corer was as reliable as ever, generally yielding at least 9 or 10 good cores, 18-25cm long. Difficulty in obtaining samples was experienced only at Station 52025 (795m), on the eastern side of the Seabight, where the cores which were recovered were very short (50-10cm), presumably because of the compacted nature of the sandy sediment. Surprisingly, the longest cores of the cruise (30-37cm) were also taken in a sandy, although much softer sediment at station 52020 (493m). The one major coring failure occurred just after the gear had landed on deck after the second 18h incubation experiment. The wooden stick, which prevents the lowering of the coring head, was incorrectly positioned, being partly wedged against the upper collar of the hydraulic damper. This caused the stick to bend and snap and, as a result, the coring head plummeted downwards smashing all but one of the tubes and damaging some of the core catchers. The damage, however, was less than first feared and coring operations were able to continue normally.

The coring programme was basically designed to provide samples for foraminiferal studies, augmenting those obtained during Challenger cruise 6/82, 10/82, Frederick Russell cruise 6/84 and Discovery cruise 147. As a result of this cruise, the amount of available material has been more than doubled. At most stations the cores were, as previously, subsampled using 20mℓ syringes, the subcores being cut into 1cm thick slices down to 5cm in order to study standing crops, species diversity, vertical distribution and other aspects of the foraminiferal communities along a bathymetric gradient. A few subcores were cut into 2mm thick layers which will yield detailed information on the vertical distribution patterns of foraminiferans in the upper 2cm. These thin slices were obtained using a specially designed syringe attachment incorporating a micrometer which allows precise control over the extrusion of the sediment.

MULTIPLE CORER DROPS

Station and haul	Tubes fitted	Cores obtained	
52001#1	11	10	
52002#1	11	9	
52003#1	11	11	
52004#1	11	11	
52004#2	12	10	1 tube lost
52005#1	10	10	
52006#1	11	9	
52007#1	11	11	
52008#1	10	8	
52008#2	10	10	8 cores lost when coring head crashed on deck
52014#1	11	11	
52016#1	12	11	
52016#2	12	11	
52020#1	10	10	
52021#1	10	9	
52023#1	11	10	
52024#3	10	10	
52025#3	10	6	
52025#4	10	3	

At station 52016 (1370m) the upper 1cm of sediment, together with the overlying few centimetres of water, was taken from all 11 cores. These samples will be used to study relationships between harpacticoid copepods and Foraminifera. Some surface sediment was specially fixed in glutaraldehyde and osmium tetroxide for electron microscopy. Surface material was also taken for microbiological analysis as part of the fluff programme.

Two 18h incubation experiments using the multiple corer were performed to study benthic respiration (stations 52004 and 52008). Unfortunately, all but 2 of the samples from the second experiment were lost when the coring head crashed. The top 10cm of sediment from the incubated cores was preserved for meiofaunal analysis at IMER.

A.J. Gooday

FORAMINIFERANS AND XENOPHYOPHORES

Macroscopic rhizopods lying on, or protruding from the surface of cores were documented and preserved as on previous cruises. Most obvious was a large species of *Pelosina* (possibly *P. arborescens*) in which the test projected well above the sediment surface and broke up distally into a more or less well developed system of branching arms. This kind of tree-like morphology indicates suspension feeding. *Pelosina* occurred between 741m and 2660m but was most abundant at 1370m (Station 52016) and particularly at 798m (Station 52025) where 12 cores yielded 16 specimens, 8 of them in a single core. Delicate flexible, thread-like foraminiferans (*Rhizammina* sp., aff. *algaeformis*), often several centimetres long, were frequently observed lying on, or just below the sediment surface in cores obtained deeper than 1370m. Needle-like tubes (*Rhabdammina* aff. *linearis*), buried in the top few millimetres of sediment, were also fairly common at some stations. Only a few xenophyophores were seen in the cores, but among them was one fascinating specimen. Initially, three short tubes were visible protruding in a line from the core surface. When excavated, the tubes proved to originate from an extensive, thin and very fragile, plate-like test located a few millimetres below the surface. The observation is significant because so little is know about infaunal xenophyophores.

One of the epibenthic sledge catches (Station 52009, 1220-1250m) contained numerous *Bathysiphon* tubes belonging to three species: *B. rufus*, *B.* aff. *filiformis* and a delicate, white form which is probably a new species. All three have been observed previously in the N E Atlantic but never so abundantly. Also notable was the abundant occurrence of Rhabdammina irregularis and Pelosina sp. (? same species as in cores) in sledge residues from Station 52019 (1710-1725m).

A.J. Gooday

RESPIROMETRY

As part of an investigation into the seasonal variation of rates of respiration by the sediment community in the deep sea, the rate of sediment community oxygen uptake at the IOS 2000m station (52004 and 52008) was measured twice using the SMBA multiple corer and the suspended core technique. The method is outlined in Frederick Russell Cruise Report 5/84 (Cruise 519) and experiments earlier this year are described there and in Discovery Cruise 147 Report. The first determination (Station 52004) gave an average result of 112 mg O_2 consumed m^{-2} day^{-1} from 10 cores (range 56-162 mg O_2 consumed m^{-2} day^{-1}) after an 18 hour incubation. To test whether this measurement is significantly different from the April (pre-phytodetritus) measurement of 70 mg m^{-2} day^{-1}, however, these results will first have to be converted into a biomass-specific respiration rate, and to this end the sediment samples from the cores were preserved and will be sent to Richard Warwick (IMER) for meiofaunal analysis. Samples of overlying water were also taken to measure the flux of nutrients across the sediment water interface.

The second measurement (Station 52008) met with an accident when, as the corer was being lowered inboard after the 18-hour incubation, a support holding the coring head snapped and the cores crashed into the deck with the resultant loss of all but two cores. These two salvaged cores gave results of 69 and 65 mg O_2 consumed m^{-2} day^{-1}. An overall assessment of the results obtained at this 2000m station showed that, biomass considerations aside, rates of SCOC were not significantly different from values obtained in April.

R. Raine, R.S. Lampitt, D.S.M. Billett

AMPHIPOD TRAPS

Three deployments were made with rigs consisting of two rosettes, each holding six 2 litre traps, suspended in a framework attached to the bar of the IOS command release system. The rig, which incorporated 15kg of retained weight, was ballasted with 120kg of chain and supported by four 17" glass buoyancy spheres. The traps were baited with scrap fish, mainly plaice heads and defilleted bodies.

Two deployments were made close to the proposed Cyana dive site at 50°20'N 12°40'W, and another near the 1000m isobath just north of the Gollum Canyon system. Catches were small, with Orchomene sp. and Eurythenes gryllus at 2450m, and Hippomedon sp. and Euonyx sp. at 950m.

M.H. Thurston

UNDERWATER CAMERAS

Eighteen stations involved the use of IOS Mk 4 deep-sea cameras during the cruise. These covered trials associated with Bathysnap, a suspended frame system and the epibenthic sledge. A total of 5216 negatives were gained during this period, a high proportion of these yielding useful data.

Following the recovery of a Bathysnap, originally deployed in April 1984, two further short term stations were successfully completed with this system. On both occasions, standard Mk 4 cameras were employed yielding 334 quality negatives, this being consistent with operational periods and intervals selected. One flash unit sustained minor damage during recovery operations, but effective repairs were subsequently carried out during the cruise. Satisfactory results were also obtained by the lithium powered camera during the initial long term station.

Trials were undertaken with a suspended frame assembled during the cruise to gain random photographs in areas considered unsuitable for sledge operation. This unit embodies a standard Mk 4 camera and a new IOS trigger switch designed to initiate the photographic system on contact with the sea-bed. Water penetration, through a faulty flash unit pressure housing seal, resulted in a loss of records during the initial station but the three subsequent trials gained 179 negatives. On board processing assisted in developing a satisfactory technique for operating the frame.

Summarising results achieved during the six short duration epibenthic sledge hauls completed, again the first station proved abortive due in this instant to problems with the acoustic command trigger circuit. The following hauls produced 350 acceptable quality negatives, although some inconsistency was apparent in record density between hauls due to a slight variation in power output from the various flash units employed. Efforts will therefore be made to gain a standard discharge level from all operational units.

Five photo sledge surveys were also accomplished during the cruise using a new Mk 4 cine format photographic unit having a potential 1400 frame capability when using thin base film. The initial station took the form of a short trial to check the integrity of the system under operational conditions and following examination of records to gain an impression of the unit's potential value.

Results gained were encouraging and attempts were therefore made to achieve a series of long duration hauls. The two initial stations were terminated after five hours, following minor problems with the photographic unit and the acoustic command system, but subsequent hauls were extended to eleven hours without further incident, the whole series producing over 4000 photographs.

A new IOS remote detector unit formed part of the sledge camera system for the first time during trials on the Challenger. This unit is designed to generate a pulse, following flash operation, and transmit it to the acoustic system for ultimate display on the Mufax record. This provided the operator with an instant indication of camera function and, to a certain degree, sledge performance during the progress of each station and finally gained a total integration of accumulated data.

The unit performed without incident and proved of value during the cruise.

E.P. Collins

ORNITHOLOGY

Ornithological observations were made on an opportunistic but fairly regular basis. Over 120 ten minute watches were carried out during the period 12-26 August, and these were supplemented by eighty casual observations.

Eighteen species of seabird were recorded, together with several waders and landbirds. Five species were seen at 30-50% of all regular watches. These common species were fulmar (Fulmarus glacialis), British storm petrel (Hydrobates pelagicus), gannet (Sula bassana), kittiwake (Rissa tridactyla) and lesser black-backed gull. With the exception of the great skua (Catharacta skua) (13%), all other species were seen at less than 10% of watches.

Passage migrants, including pomarine skua (Stercorius pomarinus), Arctic skua (S. parasitica), long-tailed skua (S. longicaudus), Sabine's gull (Xema sabini) and Arctic tern (Sterna paradisaea), were seen in small numbers, and showed the expected southerly trend in movement. Almost all of the individuals seen were adult. Also moving south were parties of waders including turnstone (Arenaria interpres) and phalaropes (Phalaropus sp.). Curlew (Numenius arquata) were attracted to the ship's aft working lights during one dark night with poor visibility.

Strong directional tendencies were noted among the (mainly) adult gannets seen on 26 August, when the ship was off south eastern Ireland. The flight paths suggest strongly that most of the birds seen were coming from the large gannetry on Great Saltee, and that many of the remainder were returning there.

Southern hemisphere breeders, greater shearwater (Puffinus gravis), sooty shearwater (P. griseus) and Wilson's storm petrel (Oceanites oceanicus), were present in small numbers as were the lower latitude northern hemisphere species Cory's shearwater (Calonectris diomedea) and, more surprisingly, by soft-plummaged petrel (Pterodroma mollis).

A paucity of birds during the period 16-18 August coincided with southerly winds and with the most south westerly station occupied during the cruise. A return to this position later in the cruise, when light westerly winds prevailed, showed that bird densities were not significantly different from those found in other areas. It is probable, therefore, that the low numbers seen during the earlier period was caused by meteorological factors rather than the increased distance from land.

M.H. Thurston

PHYTODETRITUS PROGRAMME

The was the third and last cruise to the Porcupine Seabight in the 1984 Phytodetritus Programme, the others being Frederick Russell 6/84 (7-13 April) and Discovery 147 (in the Seabight 10-16 May). Six aspects of the programme were examined on this cruise.

1. To sample superficial sediment and benthic phytodetritus using the multicorer for microbiology, chemical analysis and phytoplankton species composition. Material for chemical analysis was collected on pre-combusted, fine glass-fibre filters and frozen. Other material was preserved in 5% formalin. In order to examine the speed and degree of shrinkage of bacterial cells due to preservation, an attempt was made to transport subsamples very rapidly to the laboratory in Cardiff (John Fry UWIST). Carrier pigeons were trained for this purpose but due to adverse weather conditions this was not achieved (see NARRATIVE).

2. To examine the spatial and temporal distribution using the multicorer throughout the Seabight and Bathysnap at ~ 2000m and ~ 4500m. A summary of the spatial distribution on this and previous cruises is given below.

Bathysnap V was successfully recovered after a 4 month deployment period at 2025m (Frame interval 512 mins). (Bathysnap V is a modified VACM tripod with braidline above it to the current meter 2.5m off sea-bed and the 4 buoyancy spheres 13m off sea-bed. Camera and flash positions as standard). Phytodetritus started to accumulate on the sea-bed on 10 May, reached a peak concentration on about 25 May and then decreased until very little was evident by 6 June. This is in broad agreement with observations using the corer. Large numbers of the echinoid *Echinus affinis* caused disturbance of the sediment surface and may well have been responsible for the disappearance of the detrital layer. A further slight deposition of detritus occurred at the end of June.

Summary of spatial distribution of phytodetritus

7-13 April	10-16 May	12-23 August
		379m None
		493m None
	1008m Small quantity	1000m None
	1336m Small quantity	
	1360m Small quantity	
	1600m Small quantity	1660m Possibly some
		1990m None
2000m None	2000m None on 12th Present on 15th	2010m None
		2446m Small quantity
		2660m Present up to 2mm
	2723m None	2725m Present up to 3mm
	4000m Very small quantity on 10th	
	4535m Present up to 1mm on 10th	

One particularly interesting observation was that two herds of over 100 specimens of the holothurian Kolga hyalina moved through the field of view leaving a trail of faeces on the sea-bed.

Bathysnap III deployed at 4522m also in April was not recoverable in September (Challenger Cruise 6/84) due to a lack of acoustic contact. The instrument is presumed lost with serious loss of data.

3. To examine the effect of recently deposited detritus on chemical fluxes (in particular O_2) across the sediment water interface by an in situ incubation technique (see section on RESPIROMETRY).

4. To examine the effects of a seasonal food supply on the meiofauna. Sediment samples were taken for this purpose and analysis is in progress.

5. To examine the effect of the accumulation of detritus on the apparent bioturbation rate as measured by different radioisotopes (viz. ^{210}Pb and ^{234}Th). For comparison with previously obtained cores, samples were taken at 2500m, frozen immediately and sent to Claude Lambert (CNRS) for analysis.

6. To obtain quantitative and qualitative data on the vertical flux of detritus throughout the water column using a sediment trap mooring. Due to the failure to retrieve this mooring (see section on INSTRUMENTATION), this important aspect of the programme yielded no results.

R.S. Lampitt
D.S.M. Billett

INSTRUMENTATION

P.E.S. Mufax

The time mark circuit had been bypassed internally and nowhere had a note been left indicating how or why. On restoring the time marks it was discovered that the clock was of the unmodified 'new' type which I have criticised heavily before - totally unsuitable for scientific work. The handbook did not describe the 'new' clock.

The receiver circuit had a fault resulting in at least 24dB loss in signal; the fault was between the transformer receiver winding and the marking amplifier; time did not permit repair before the Mufax became totally unusable; the fault was bypassed using the receiver in the command system deck unit and the single element.

During the attempt to relocate the 'old' Bathysnap after the dragging the Mufax paper drive stopped working; this was due to a failure of the spring clutch arrangement and was found to be totally irreparable with the facilities available. Fortunately, for the first time in this series of cruises I had brought a Mufax normally used for laboratory work; this unit was far from fully operational and so the command system deck unit took over the transmit and receive functions, the Mufax being used purely as a display unit.

Simrad doppler speed log

Would produce erratic and wrong results after being on for several hours; the E.M. log was being used for navigation and so the fault was reported for repair in port.

Sediment trap mooring

Attempted location of sediment trap release after coring station between its position and the 'new' style Bathysnap which had been easily located. Took 30 x ten second bursts of 320 to switch on, then homed in and started release sequence; at first slow 26 bursts of 280 to first relay operation - but did not start to rise. Took through firing position again; this time only ten bursts. The beacon signal was strong but no separation from bottom. Came abeam just after second relay operation and signal strength fell abruptly by more than 18dB. Carried on the same track and the signal became intermittently reasonable then bad. Reversed the course and the reverse occurred - the signal abruptly increased as we passed beam on. This behaviour is typical of the acoustic directivity of a release lying on its side on the sea-bed - the recovery attempt was abandoned.

'New style' Bathysnap

Initial recovery: the acoustic beacon was quickly located and, after a limited homing in period (we were already close), the release sequence was started. The relay was operated twice and on the first occasion nothing appeared to happen. After the second operation there appeared to be a slight change in beacon slope indicating a very slow ascent - although there was no bottom echo. After studying this for ten minutes there was a sudden change of slope and clear bottom echo - the release had obviously been mechanically fouled in some way and had just managed to break clear. The recovery was normal. The frame was heavily coated with corrosion growths (as high as one inch above the surface) which may well have jammed the frame in the guides used on this type of disposable base plate. The stainless steel release assembly was relatively clean and the moving parts were completely free. It was, however, replaced for the subsequent deployments. Both retractor units were clean and fully operational.

Subsequent deployments: the Bathysnap acoustic package and 'new' mechanical release fitted with retractor units were used on two short term 'baited' deployments without problem.

Amphipod trap moorings

The amphipod trap rigs were mounted on the command release bar to position the rigs as near bottom as practicable without using a specially designed frame. As a mooring it was easy to handle and performed well on three occasions; as an amphipod trap it is described elsewhere.

Monitors

A series of problems were encountered with the sledge monitors but they affected only two hauls. One problem was operation 'finger trouble' (mine) - the monitor was deployed (on yet another cruise) with the switch in the camera test position; this results in many midwater pictures of nothing and no film left for the actual sea-bed! All the other problems were primarily due to the age of the monitors: an acoustic transducer and several battery cells had to be discarded; an output transformer winding broke down causing catastrophic failure of a series of components, this required major component replacement and rewiring; the disturbance caused by the rewiring caused a variety of further problems with 'update modifications'; a voltage regulator was also found to be unstable which caused the pressure calibration to wander. All these faults were rectified but only as a short term solution.

The RMT monitor and release gear performed well.

Dragging for the 'old' Bathysnap

The lost Bathysnap is in 2000 metres of water with a well behaved acoustic package, but refuses to release from the sea-bed. The dragging philosophy was: first to lay about 2000 metres of drag line in a straight line on the sea-bed with the Bathysnap near the centre; the ship would then slowly pull the drag line in a sweep across the sea-bed through the Bathysnap position with the drag line effectively pivoting on a heavy anchor at its far end. The two major problems were navigating with respect to Bathysnap and ensuring the drag line behaved as was required.

Navigation: There was only the acoustic beacon on the Bathysnap available as a real time navigation aid on the required scale; the Doppler shift principle was used to infer the position of the ship relative to Bathysnap, but the repetition rate was not known accurately enough to prevent the build up of considerable uncertainties by the end of the exercise. Any future exercises of a similar nature should plan from the outset to utilise a second reference transponder mooring.

Manoeuvring: The drag line itself was long, and complex, the main towing warp was very heavy, and the beacon included to monitor the leading end of the drag line failed after deployment; the first factor resulted in a very slow deployment during which time we moved away from our intended launch point and subsequently away from the second planned launch point; the first and second factors resulted in the drag line pivotting at several intermediate points; the third factor prevented us observing the behaviour of the drag line. All these factors combined with the ever increasing navigational uncertainties to render the attempt ineffective and tangle the drag line.

I think that an instrument package such as Bathysnap is recoverable in this depth of water by dragging BUT a second navigation reference is essential and the interaction of the drag line, towing warp and ship manoevres needs to be properly investigated before an attempt is practical. This second point was also well illustrated by the early stages of the unsuccessful attempt to recover BENCAT on Discovery Cruise 118.

General comments on instrumentation

1. P.E.S. Mufax failure: the majority of Challenger cruises now rely on the P.E.S. system for monitoring instrument systems in addition to echosounding. We were very fortunate to have a back up unit of our own on board (for the first time in this series), although it was not itself fully operational; if this had not been available the failure would have cost at least three days (out of a cruise of thirteen working days) to obtain a replacement. I feel the time has come for RVS and IOS to pool their P.E.S. resources fully and equip Challenger, Discovery and Darwin with two P.E.S. Mufax and at least two P.E.S.

fish each for all our benefits.

2. Use of a bottom echo to relocate a released mooring after failure of the ship's main propulsion: during the final recovery phase (visually sighted on the surface) of an amphipod trap mooring we lost control of the main propulsion; the bow thruster failed to hold us against the steady force 6 wind and, by the time we had regained limited use of the main propulsion, we were two and a half nautical miles away. The acoustic package was only ten metres below the surface which resulted in lost contact with the direct path signal at about one nautical mile; however, the water depth was about 2500 metres and loss of the direct signal was more than made up for by a strong bottom reflected signal which was still usable at two and a half nautical miles; the mooring was relocated without difficulty.

3. Scratched retractor pistons: the use of retractors has been well established as a reliable alternative to the pyrorelease, but after several operations the sliding piston becomes so badly scratched that it requires replacement; two ways of avoiding the scratching were successfully tested on this cruise. Two pistons with a hard plastic coating and two pistons with a hard anodised surface finish were used; one of each were paired on each mooring deployment; 5 deployments were made and no scratches or other blemishes were incurred. These tests confirmed results obtained in other tests and deployments; the cheaper of these alternatives will now be adopted as standard; that is, all retractors will now have a hard anodised surface finish.

G.R.J. Phillips

BATHYSNACK

Two short term baited deployments of Bathysnap V were successfully accomplished (at 2456 and 940m). During both of these drops, in contrast to previous baited deployments (St. 51215 4009m), the necrophages attracted were of large individuals (fish, decapods and gastropods) and a total of less than 10 amphipods were photographed.

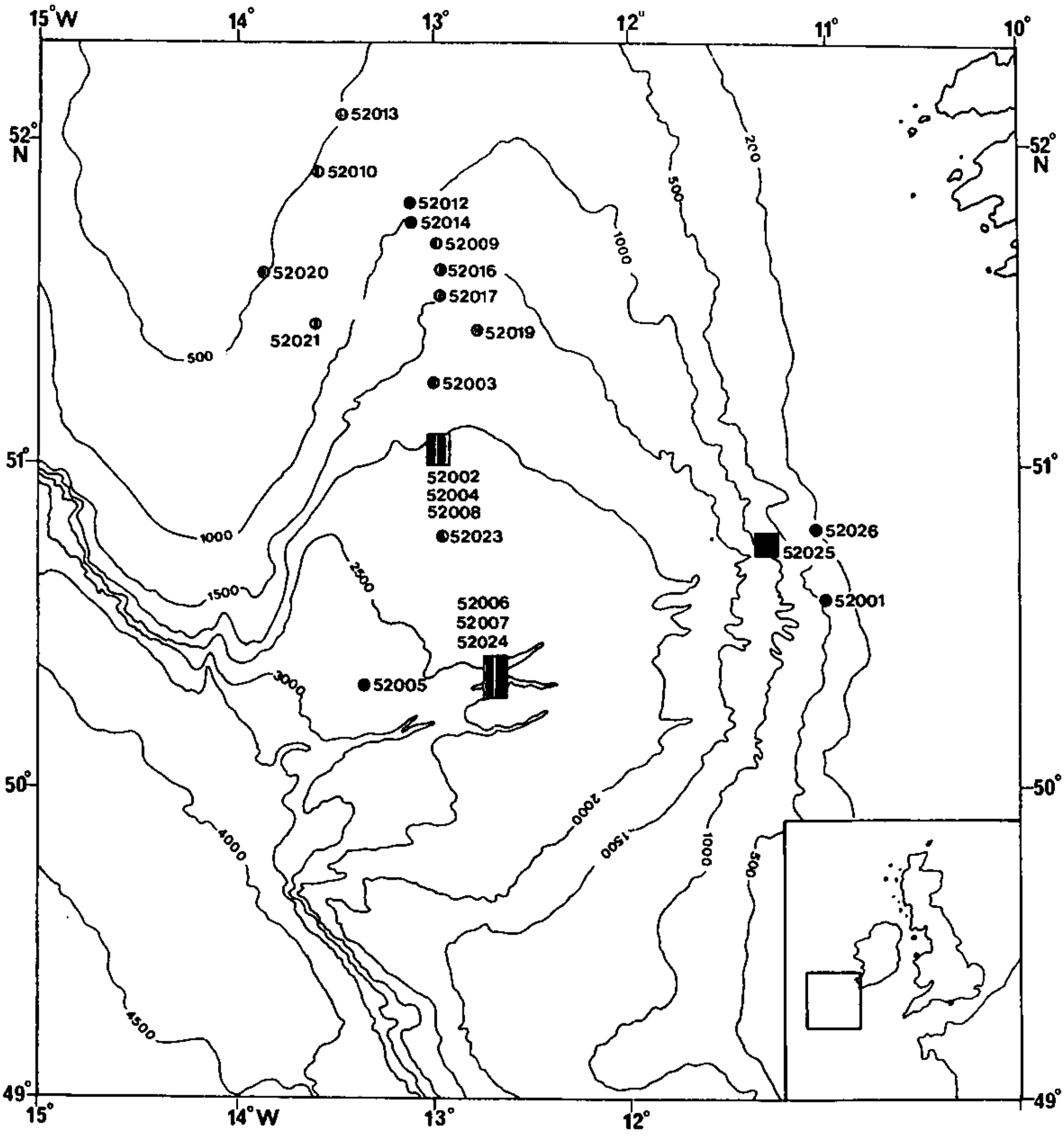
R.S. Lampitt

STATION LIST

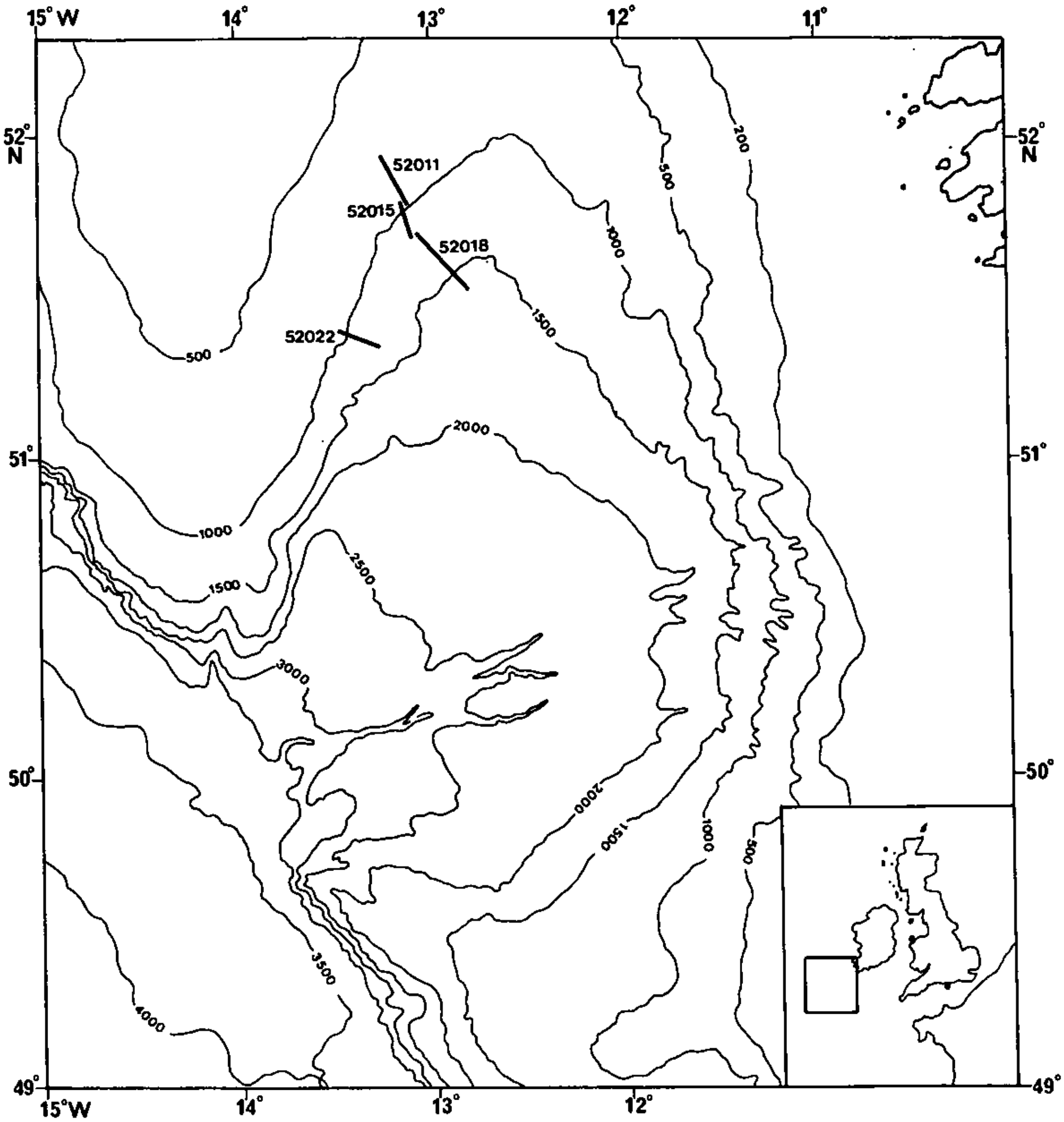
STATION	DATE 1984	GEAR POSITION START N	GEAR POSITION START W	GEAR POSITION END N	GEAR POSITION END W	GEAR	SAMPLER DEPTH (M CORRECTED)		DURATION (GMT)		DISTANCE RUN (M) ODOMETER	DISTANCE RUN (M) CALCULATED	REMARKS
52001#1	12.8	50°34.87'	11°01.02'			MC	380		1754				10 cores in 11 tubes
52002#1	13.8	51°02.76'	12°57.70'			MC	2008		0550				9 cores in 11 tubes
52003#1	13.8	51°15.44'	13°00.90'			MC	1659		1929				11 cores in 11 tubes
52004#1	15.8	51°04.01'	12°55.40'			MC	1988		0252				11 cores in 11 tubes
52004#2	15.8	51°03.04'	12°56.22'			MC	1995		0607				Respirometry hang. Haul at 0200 16.8 10 cores in 11 tubes.
52005#1	16.8	50°19.62'	13°22.64'			MC	2724		0850				10 cores in 10 tubes
52006#1	16.8	50°20.37'	12°42.33'			MC	2659		1939				9 cores in 11 tubes
52007#1	16.8	50°22.67'	12°41.69'			MC	2447		2236				11 cores in 11 tubes
52007#2	17.8	50°22.71'	12°40.72'			AMPHT	2443		0037	1241			Descent rate 1.17m/s, ascent rate 1.04m/s, recovery delayed due to failure of ships engines
52007#3	17.8	50°22.89'	12°39.07'	50°22.94'	12°38.31'	POGOSNAP	2434	2453	0218	0306		904	
52007#4	17.8	50°22.48'	12°37.92'	50°22.65'	12°37.26'	POGOSNAP	2409	2403	0844	0932		843	67 frames
52008#1	18.8	51°02.55'	12°55.59'			MC	2024		0747				8 cores in 10 tubes
52008#2	18.8	51°02.45'	12°56.31'			MC	2023		1139				Respirometry hang. Haul at 0543 19.8, 2 cores*
52009#1	19.8	51°41.13'	12°59.08'	51°40.79'	12°58.03'	BN1.5/3M	1206	1236	1310	1333	682	1360	Nets damaged at recovery due to very large catches
52010#1	19.8	51°54.18'	13°34.63'	51°54.16'	13°33.85'	BN1.5/P	545	545	2117	2137	643	911	Test run for half-frame camera
52011#1	20.8	51°56.23'	13°14.63'	51°48.80'	13°09.23'	BN1.5/P	762	925	0124	0640	10195	15090	Half-frame camera, 569 usable frames
52012#1	20.8	51°47.95'	13°07.26'	51°48.09'	13°06.84'	BN1.5/3M	984	984	1032	1046	331	522	Standard camera
52013#1	20.8	52°04.92'	13°28.74'	52°05.08'	13°28.34'	BN1.5/3M	515	525	1528	1541	295	536	Standard camera
52014#1	20.8	51°45.72'	13°07.83'			MC	1006		2158				11 cores in 11 tubes
52015#1	21.8	51°48.50'	13°09.90'	51°41.46'	13°07.19'	BN1.5/P	920	1028	0014	0530	9300	13420	Half-frame camera, 521 usable frames
52016#1	21.8	51°36.85'	12°57.30'			MC	1369		0905				11 cores in 12 tubes
52016#2	21.8	51°37.75'	12°55.37'			MC	1373		1136				11 cores in 12 tubes
52017#1	21.8	51°31.74'	12°58.39'	51°31.95'	12°57.69'	BN1.5/3M	1457	1472	1456	1515	308	888	Standard camera
52018#1	21.8	51°42.36'	13°05.76'	51°31.39'	12°46.97'	BN1.5/P	1082	1600	1930	0616	15274	29700	Half-frame camera, 1285 usable frames
52019#1	22.8	51°24.81'	12°46.17'	51°25.14'	12°45.55'	BN1.5/3M	1736	1725	1024	1056	870	924	Monitor depths suspect due to falling battery voltage: echo sounder depths used here
52020#1	22.8	51°36.94'	13°51.94'			MC	493		1942				10 cores in 10 tubes
52021#1	22.8	51°26.97'	13°36.08'			MC	743		2247				9 cores in 10 tubes
52022#1	23.8	51°23.79'	13°29.50'	51°20.71'	13°17.93'	BN1.5/P	925	1265	0045	0649	11610	14570	Half-frame camera, 688 usable frames
52023#1	23.8	50°47.76'	12°56.67'			MC	2220		1255				10 cores in 11 tubes
52024#1	23.8	50°22.84'	12°43.16'			BATHYSNACK	2454		1805	0607			Standard camera, 180 frames
52024#2	23.8	50°22.65'	12°43.12'			AMPHT	2454		1829	0450			
52024#3	23.8	50°22.02'	12°43.12'			MC	2468		1957				10 cores in 10 tubes
52024#4	23.8	50°21.37'	12°44.01'	50°21.38'	12°44.22'	POGOSNAP	2428	2430	2312	2347			28 frames
52024#5	24.8	50°21.81'	12°45.30'	50°22.81'	12°47.78'	RMT 1	220	315	0046	0140			

STATION LIST CONTINUED

52024#6	24.8	50°23.21'	12°47.50'	50°23.05'	12°45.08'	RMT 1	300	415	0227	0327			
52024#7	24.8	50°20.68'	12°43.07'	50°20.17'	12°42.80'	POGOSNAP	2539	2709	0924	1059			60 frames
52024#8	24.8	50°19.80'	12°41.61'	50°19.54'	12°39.50'	RMT 1	800	610	1212	1312			
52024#9	24.8	50°21.27'	12°45.28'	50°20.51'	12°45.15'	POGOSNAP	2488	2545	1526	1650			60 frames
52025#1	25.8	50°44.87'	11°19.99'			BATHYSNACK	944		0210	1344			Standard camera, 174 frames
52025#2	25.8	50°44.95'	11°19.92'			AMPHT	942		0241	1238			
52025#3	25.8	50°46.00'	11°19.75'			MC	799		0458				6 cores in 10 tubes
52025#4	25.8	50°45.34'	11°18.56'			MC	796		0756				3 cores in 10 tubes
52025#5	25.8	50°43.45'	11°17.66'	50°41.43'	11°18.52'	RMT 1	315	610	0947	1100		3869	
52026#1	25.8	50°48.08'	11°05.07'	50°47.13'	11°03.72'	BN1.5/3M	218	208	1628	1711	857	1559	Standard camera, 120 frames



STATION POSITIONS OTHER THAN PHOTOSLEDGES



PHOTOSLEDGE POSITIONS