MRS. P. EDWARDS.

I.O.S.

RRS DISCOVERY

CRUISE 156

18 JUNE – 29 JULY 1985

BIOLOGICAL STUDIES IN THE EASTERN NORTH ATLANTIC (47° – 31°N) CENTRED AROUND GREAT METEOR EAST (31° 17'N, 25° 24'W)

CRUISE REPORT NO. 176
1985

NATURAL ENVIRONMENT RESEARCH COUNCIL
INSTITUTE OF OCEANOGRAPHIC SCIENCES

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INSTITUTE OF OCEANOGRAPHIC SCIENCES

WORMLEY

RRS Discovery
Cruise 156
18 June - 29 July 1985

Biological studies in the eastern North Atlantic (47°-31°N) centred around Great Meteor East (31°17'N, 25°24'W)

Principal Scientist

H.S.J. Roe

CRUISE REPORT NO. 176

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ITINERARY

First leg. Depart Falmouth 1611h 18 June 1985
Arrive Falmouth (Madeira) 1648h 9 July
Second leg. Depart Funchal 0618h 11 July
Arrive Barry 2015h 29 July 1985

SCIENTIFIC PERSONNEL

R.G. Aldred	IOS Wormley	Legs 1 & 2
M.V. Angel	" "	Legs 1 & 2
D.S.M. Billett	" "	Leg 2
G.A. Boxshall	British Museum (Nat. Hist)	Leg 1
E.P. Collins	IOS Wormley	Leg 2
P.A. Domanski	" "	Legs 1 & 2
R. Dyer	" "	Leg 2
D. Edge	" "	Legs 1 & 2
E.R. Goldie	Imperial College, London	Leg 2
P.J. Herring	IOS Wormley	Legs 1 &2
R. Hull	" "	Leg 1
D.A. Jones	RVS Barry	Leg 1
R. Jordan	University of Surrey	Leg 1
G.C. Knight	RVS Barry	Leg 2
R.S. Lampitt	IOS Wormley	Leg 2
P.J. Mason	RVS Barry	Leg 1
N.R. Merrett	IOS Wormley	Leg 1
A. Muirhead	University College of Swansea	Leg 2
J. Nielsen	Zoologisk Museum, Copenhagen	Leg 1
R.D. Peters	IOS Wormley	Legs 1 & 2
P.R. Pugh	IOS Wormley	Leg 1
P.S. Rainbow	Queen Mary College, London	Leg 2
A.L. Rice	IOS Wormley	Leg 2
H.S.J. Roe	" "	Legs 1 & 2 (Principal Scientist)
J. Smithers	" "	Leg 1
M.A. Squires	" "	Leg 1
J. Taylor	" "	Leg 2
N.T. Timmins	" "	Legs 1 & 2

S.J. White	NERC Swindon	Leg 2
R.A. Wild	IOS Wormley	Leg 1 & 2

SHIP'S OFFICERS AND CREW

M.A. Harding	Master
J.J. Moran	Chief Officer
J.T. Morse	2nd Officer
P.G. Pepler	3rd Officer
I.R. Bennett	Chief Engineer
T.A. Rees	2nd Engineer
A. Greenhorn	3rd Engineer
T.J. Comley	4th Engineer
K.T. Sullivan	5th Engineer
B.A. Smith	Electrical Engineer
R.M. Morris	Purser
E.A. Rodgers	Radio Officer
M.A. Harrison	CPO deck
T. Corrall	PO
M.J. Drayton	PO
G. Aplin	Seaman
E.G. Hockin	"
N.J. Priddle	"
S.C. Cook	"
S.J. Rowe	"
A. McLean	"
N.J. McIntyre	"
D. Mawdsley	Motorman
R.D. Pestell	"
J. McHugh	"
A.D. McQueen	Chief Cook
C. Brooks	2nd Cook
J.A. Ayres	Cook
A. Harris	2nd Steward
M.C. Butler	Steward
N.D. Good	Steward
S.T. Coates	Steward
G. Fisher	Steward

OBJECTIVES

1. To provide a qualitative and quantitative description of the midwater and benthic ecosystems at a site on the Madeira Abyssal Plain (Great Meteor East).

2. To study the relationships between the midwater and benthic communities at GME.

3. To study the physical characteristics of the water column at GME.

4. To study the primary production of phytoplankton and its associated physico/chemical parameters both at GME and en route to the site.

5. To make experimental observations on a range of oceanic animals both at GME and in transit.

NARRATIVE (Fig. 1)

Discovery sailed from Falmouth at 1611h on the 18 June, a short meeting was held to outline the proposed programme. The precision echo sounder (PES) fish was deployed at 1845h. On the following morning (0400h) PES watches started and a diversion was made to pick up a HERMES buoy deployed some 9 months earlier. Despite making a box search around 46°53.2'N, 7°25.8'W the buoy was not found and a course was set for GME at 1330h on the 19th June.

Expendable Bathythermograph (XBT) launches started at 2100h on the 19 June and these continued throughout the cruise; data was telexed back to the Hydrographic Office in London. Continuous surface fluorescence profiling using the non-toxic sea water supply was also started and this too continued throughout the cruise.

A shallow (0-300m) CTD transect started at 2209h on the 19 June. A CTD fitted with rosette multisampler (MS), transmissometer and fluorometer was deployed and samples taken for nutrients, salinity, chlorophyll and particulate concentration. Cultures for coccolithophores were started from the water samples. Similar dips, with the addition of a light meter and a 7.4 litre water bottle sample made at the depth of the chlorophyll maximum, were done twice daily for the next five days.

During the afternoon and evening of 24 June a series of trial deployments of the multiple midwater trawl (RMT 1&8M) were made to adjust bridle lengths, to check a new mouth sealing system, and to acquaint newcomers with the gear. At 1910h, whilst recovering the RMT 1+8M, Mr. R. Jordan trapped his thumb between the net bars. It was decided to seek medical attention and Discovery made for Madeira at full speed.

En route to Madeira the PES fish was recovered and a damaged faring replaced. Discovery reached Funchal at 0220h on 26 June, Mr. Jordan was taken ashore to the hospital and returned about an hour later. No serious damage had occurred to his thumb and Discovery sailed for GME at 0336h.

At 0900h on 27 June the PES fish was redeployed and at 1111h midwater sampling with the RMT 1+8M started at GME. Most subsequent work at GME concentrated around a 10km square centred on 31°17'N, 25°24'W. For the next three days and nights 100m depth layers were sampled between the surface and 1500m - repeating each layer by day and night. The sampling was generally successful but a few failures occurred during the night tows. Shallow (0-300m) CTD/MS dips were done over the sunset and sunrise periods. Primary production measurements were made in association with some of these shallow CTDs; 4 water samples were taken at the depth of the chlorophyll maximum and incubated with C^{14} between the 29 June and 2 July. The first deep CTD was done on the 28 June to within 20m of the bottom (5296m); a Bathysnap release was unsuccessfully tested on this.

At 0835h on 30 June the first Semi-Balloon Otter Trawl (OTSB14) was shot and during the next six days and nights a further 5 OTSB hauls were made. For each haul 14000m of wire was paid out and the trawl allowed to settle on to the sea bed (depth 5440m). Three of the hauls were totally successful, two probably only fished on the bottom for a short while and the last haul fouled the bottom and held the ship fast for ca. 30 minutes. The net was eventually recovered, split open. The catches were small, containing fish, decapods, ophiuroids, and manganese nodules and boulders. Interspersed with the OTSB hauls were 0-300m CTD/MS dips as before and deep near bottom

RMT 1+8M tows.

The near bottom echosounder (NBES) failed on the first deep RMT 1+8M tow - due to a faulty monitor component, and the trawl hit the bottom. Nevertheless the nets were operated successfully and the bottom 300m of the water column was sampled. Two successful NBES tows were made on the 4 and 6 July when the bottom 90m of the water column was sampled. The catches were very small, the greatest micronektonic biomass - mainly pelagic holothurians, seemed to be within 10-25m of the bottom whereas the maximum planktonic concentrations were between 25-50m of the bottom.

The first leg of the cruise concluded with a deep oblique RMT 1+8M tow made between 3900-5100m and some repeated night tows in the upper 1500m. Discovery sailed for Madeira on the 8 July, a summary scientific meeting was held, and we docked in Funchal at 1648h on the 9 July.

During the port call nine scientists disembarked and ten scientists joined the ship. Discovery sailed for GME at 0618h on the 11 July; a short meeting was held to outline the remaining programme. XBT deployments and PES watches resumed at 1500h on the 12 July and the RMT 1+8M series started again at 2020h with an oblique haul between 1500-2700m. Subsequent oblique hauls were successfully made down to 5110m (on the 14 July) - thereby completing the water column sampling.

A deep CTD dip was made to within 5m of the bottom (5424m) on 13 July and a Bathysnap release successfully tested. Throughout the night of the 14/15 July a series of neuston net hauls was made at half-hourly intervals. Whilst these were proceeding a NBES haul was deployed, but at ca. 0100h on the 15 July all pressure was lost on one of the winch pumps - followed by brake failure. The warp was stopped off at 0400h and slowly recovered later in the morning. The fault was eventually traced to a defective fuse and repairs and testing were complete by 2030h. A further deep CTD (to 5375m) followed - accompanied by another unsuccessful test of a Bathysnap release.

It was decided to temporarily abandon the midwater programme in favour of the benthic sledge (BN1.5) tows, and the first of these was shot at 0226h on the 16 July The Mufax record for this tow was rather ambiguous and it was subseqently found that the net had been incorrectly rigged and that consequently it may have been wrongly orientated on the bottom. Three BN1.5 hauls followed, sampling ca. 2, 4 and 8km respectively. The catches were small but similar to each other, containing mainly bialves, ophiuroids, Bathymicrops and, in the supra-benthic net, Komokiacea. The sledge camera showed that the fauna was indeed very sparse and that the catches were representative.

A CTD dip was made to 2000m on the 17 July and a second Bathysnap release successfully tested. As sufficient benthic material had been collected on the four sledge tows a photographic sledge (BN1.5P) run was made on the 18 July. This was made over a hill to the north of the main sampling area, at a site which had been found to be rich in manganese nodules on a previous geophysical cruise. A run of ca. 6km was made and the resulting film developed back in the U.K.

Bathysnap was deployed in the centre of the 10km square box on the 19 July and three shallow RMT 1+8 Closing Cod End (CCE) hauls made during the night of the 19/20 July. During the third of these hauls - made to catch experimental animals, the Schatt davit began making heavy banging noises. Fishing was postponed until the causes could be investigated in daylight. It was found that the bolts holding the platform drive were loose and trawling was resumed at 1020h on the 20 July. A final, successful, NBES tow with the RMT 1+8M was made, the catches of which were encouragingly similar to those taken on the first leg.

A sledge tow was made on the 21 July over the manganese nodule area photographed three days earlier. A one kilometre run over the bottom produced a spectacular assortment of ca. 18000 nodules - many of them forming around large shark's teeth. A second Bathysnap was deployed at 2000h on the 21 July, midway between the existing IOS currrent mooring and the main work area. The moorings and an associated tide gauge were successfully interrogated and Discovery left GME at ca. 2230h on the 21 July.

PES and XBT surveys were resumed for the northerly passage and between the 22-26 July a series of RMT 1+8/CCE hauls were made for experimental animals. Two hauls were made each morning and two each evening, the CCE worked very successfully and the final haul of the cruise finished at 0105h on the 26 July. A detour was made to search for the HERMES buoy and during this detour sea water was collected for the Standard Sea Water Service. A concluding scientific meeting was held; the HERMES Buoy located and picked up on the 28 July, and Discovery berthed at Barry at 2015h on 29 July.

It is a pleasure to thank the Master, officers and crew for their expert help during this cruise. All the objectives were accomplished and scientifically and domestically the cruise was very successful. I would particularly like to thank, on behalf of all the scientists of this and previous cruises, the six officers for whom Discovery 156 was their last cruise.

SAMPLING EQUIPMENT AND INSTRUMENTATION

RMT Nets

The RMT 1+8 multinet was fished on 25 occasions taking 67 successful RMT 1 and RMT 8 samples from discrete depths. There were only two failures, one due to a minor electronics problem and the other probably due to an unexplained rigging fault that dropped two nets together.

The near bottom echo sounder was used on four hauls at depths of around 5400m. Some problems were experienced with keeping the net and the ship sufficiently in line to maintain acoustic links between them. This was overcome by ensuring that the hauls were made with the ship close to the wind, to prevent drift, and experimenting with the ship's heading to bring the net and the ship into line. Once this technique had been adopted no problems were experienced receiving signals from, or transmitting signals to, the net.

The rigging of the RMT 8's was changed on this cruise and the nets were not joined together. This was to prevent the possibility of the previous net being held open. The sponge rubber used on previous cruises, to help seal the mouth of the nets, was changed for a thicker and lighter rubberised horse hair. Sealing was extended to all three of the RMT 8 nets which, in combination with the rigging changes, greatly reduced leakage when the nets were closed. This was especially valuable on the deep hauls when the catches were very small and the haul and payout times were very long.

Side-wire rollers were used throughout the cruise on the sliding RMT 8 bars. These worked well, showed very little wear and made pulling the side-wires through when re-rigging very much easier. Problems were experienced with the RMT 1's twisting together on some deep hauls. The reason for this is not clear, but it did not occur when the more cumbersome sieving cod-ends were not used.

R.G. Aldred

Electronics and acoustics

The RMT Monitor was used on 48 trawls. An initial inter-comparison was made between the monitor and the CTD to a depth of 5415m. The results were very close, with a pressure correlation of ±5dBar and a temperature correlation of ± 0.1°C.

The NBES was used four times but was left attached to the monitor so that a continuous check on its operation was obtained from surface reflection. The system failed on the first near bottom trawl due to a 'floating gate' in the monitor's electronics; thereafter its operation was faultless. There were some difficulties in obtaining clear telemetered signals and in commanding the monitors when trawling close to the bottom with ca. 14000m of wire out. These problems were overcome by altering the ship's heading so that the PES and monitor transducers effectively lined up.

The closing cod end monitor was used on 23 occasions, and the benthic sledge monitor and its peripheral equipment on 6; all tows were successful. The OTSB 14 monitor was used on 7 trawls; a problem occurred with the pressure reading and the unit was replaced.

A Mufax and PES fish No. 10 were used throughout the cruise for echo-sounding and monitoring acoustic telemeters. A 45° backward looking towed transducer was available but this could not improve upon the results obtained from the beam steered PES fish.

Four releases were tested for the 2 Bathysnap deployments: CR 2387 to >5000m failed due to a leak; CR 2307 to >5000m was satisfactory; CR 2384 to >5000m failed due to incorrect beacon operation; CR 2553 to 2000m was satisfactory.

CR 2553 (Period 1.02, rel. freq. 460Hz) was attached with a pyro release and deployed in 5376m on the first Bathysnap. Fix 14.39Z, Posn 31°15.2'N, 25°25.4'W.

CR 2307 (Period 1.06, rel. freq. 420Hz) was attached with a pyro release and deployed in 5433m on the second Bathysnap. Fix 20.30Z, Posn. 31°19.9'N, 24°53.9'W.

Four moorings deployed on previous cruises were successfully interrogated. A Hewlett Packard microcomputer based XBT system operated successfully throughout the cruise. The development of signal digitization from telemeters and echo-sounder returns was started using a BBC microcomputer for data storage, processing and display.

D. Edge

Conductivity Temperature Depth Probe

A total of 22 successful CTD stations were occupied during the first leg of cruise 156; twenty of these were shallow casts to 300 metres and two were deep to ca. 5400 metres.

Generally the basic CTD functioned perfectly but some problems did arise with peripheral instruments. The transmissometer functioned well on all of the shallow casts but did not work on the first of the deep casts due to a leaking plug. On the second deep cast there was a dramatic decline in the signal output below 300 metres due to a signal path to seawater via a supposedly unused plug. After correcting the fault a test cast to 500 metres was performed and showed the transmissometer to be working properly.

The multisampler worked well throughout; there were a number of misfires but the bottles were generally fired at the correct depths. The underwater irradiance meter and near bottom echo sounder functioned well throughout the cruise. The oxygen probes on both the shallow and deep instruments failed to work although they would work on the bench when immersed in saturated seawater. The cause of this problem has not been found to date.

The Digidata logging system functioned successfully on all but the first cast, and the BBC microcomputer system provided on-line plots of temperature, salinity, irradiance and fluorescence versus pressure throughout the casts.

The CTD frame, whilst being difficult to handle on the winch platform, provided quick transfer of instruments between deep and shallow casts as well as good protection.

J. Smithers

Bathysnap

Two Mk V modules were deployed during the cruise for recovery in the early part of 1986. The first was in the 10km square (31°15.2'N, 25°25.4'W) using the standard Mk IV camera and a frame interval of 512 minutes. The second was to the east of the square (31°19.9'N, 24°53.9'W) using the half frame camera (Mk IV b) and an interval of 256 minutes. Both should continue photographing the seabed until April 1986. The photographs will be used to measure megafaunal activity and to monitor long term changes both in the appearance of the seabed and in the suspended sediment load. In addition, the current meters are an integral part of an array of current meters at GME being used to study the physics of the near bottom water. The rest of the moorings have already been deployed by the Marine Physics Department of I.O.S.

R.S. Lampitt

Underwater cameras

IOS deep sea cameras obtained over 2000 photographs during the four epibenthic sledge hauls and one short photosledge station carried out during the cruise.

The Mk 4A half frame which first became fully operational in 1984 was originally subject to a depth limitation of 1500 metres because of problems associated with the pressure housing optical window. New techniques have recently increased its depth range to 6000 metres making it possible to operate both the standard and half frame systems on the sledge at depth. The high capacity of the latter system was of particular value during the extended hauls made on this cruise.

No problems were encountered with the photographic equipment, well balanced results being gained throughout. A marginal loss of resolution from one standard photographic unit caused some concern and this will be fully investigated later under laboratory conditions.

During the latter stages of the cruise one half frame unit and a standard flash system were modified to operate in the elapsed time mode and were mounted on the second Bathysnap.

E.P. Collins

Computing

The computer system sampled navigation and meteorological instruments between 1830h on the 18 June and 1350h on the 9 July (leg 1); and between 1344h on the 11 July and 0632h on 29 July (leg 2). The fluorometer and surface irradiance meter were sampled throughout the cruise.

On day 174 (23 June) it was noticed that the EM log was becoming noisy. The cause of this noise was due to a Lemo connector on the D.T.S interface being so damaged that the electrical connections were becoming intermittent. This was rectified by soldering the wires directly into the interface. This repair caused a break in the data for a couple of hours.

During leg 2 of the cruise a major fault developed on the computing system which seriously affected the reliability of the data logging. The cause of the trouble was intermittent failure of the hard disc storage. It is impossible to repair this and the unit will need to be returned to its manufacturer. Therefore as good a service as possible had to be provided in spite of this problem. Navigation was provided for almost all of the work and two of the three CTD stations were recorded and processed. It was necessary to start a number of archive tapes due to full system crashes. This may prove as annoying during post cruise processing as it was to us at the time but there was nothing which could be done on the ship to prevent this.

During the cruise, several CTD stations were sampled and the data plotted and written onto magnetic tape. The processed data files were written onto magnetic tape in the standard format and given to the PSO at the end of the cruise.

D.A. Jones, G.C. Knight and P.J. Mason

Mechanical instrumentation and aft hydraulics

This was the most intensive deep samping programme yet undertaken with our sampling gear and its reliability was very reassuring. There were no flowmeter or release gear failures and all the closing cod end hauls were successful. The neuston net was used throughout the cruise with no problems.

A number of problems occurred with the aft hydraulic system. One of the carbon brushes on the electric motor of No. 1 pump had to be replaced and the slip ring cleaned. A defective fuse in the No. 11 position caused several elusive faults before it was traced. "Cracking" noises emitted from the Schatt davit which may or may not have come from the hydraulic rotary manifold; tightening the 6 bolts securing the slewing motor gear assembly to the davit reduced the "cracking" a great deal. A proximity switch in the wire count and speed electronics was defective and was replaced. Generally the hydraulic systems worked well for over 400 hours, hauling and paying out up to 14000m of wire and running non-stop for up to 20h at a time.

The slewing mechanism of the aft crane was adjusted; the maintenance of this crane continues to be a grey area between the ship's engineers and IOS personnel.

R.A. Wild, R.D. Peters, R. Dyer, M.A. Squires, N.T. Timmins

BIOLOGICAL INVESTIGATIONS: NET SAMPLING

Pelagic sampling and processing at GME

It was intended to a) sample the top 1500m of the water column in 100m depth intervals by both day and night; b) to sample the water column between 1500 and ca. 5400m at 200m depth intervals and c) to sample repeatedly the 100m depth layer immediately above the sea bed. In the event a and c were completely successfully accomplished but the depth intervals for b were 400m rather than 200m.

The RMT 1 samples from the top 1500m were subdivided by a multiple cod end which separates out 3 size fractions viz. >4.5mm, >1.0mm and >0.32mm. The >4.5mm fraction is more representatively sampled by the RMT 8 and the RMT 1 catches of these larger animals are only of passsing interest. The two smaller size fractions were each divided into two with a plankton splitter; one half was preserved in formalin for subsequent qualitative and quantitative analysis, the other half was deep frozen for subsequent measurements of dry weights and C/N ratios.

The deeper RMT 1 catches were so small that they were impossible to split with the plankton splitter. The multiple cod end was also abandoned for these samples and any animals larger than 4.5mm will be removed prior to laboratory processing. Biomass values for these small catches will be obtained from volumes, wet weights and extrapolations from the 0-1500m data.

The most striking feature of the pelagic ecosystem at GME was the scarcity of animals; this is commented on in several of the subsequent reports. Subjectively I cannot recall a more depauperate area - in terms of both numbers of individuals and species. It is likely that an important part of this ecosystem was not sampled by our nets. By far the greatest biomass was contained within Pyrosoma. These filter feeding tunicates were abundant between 700-800m by day and 100-200m by night; their food is too small to be sampled by our nets but it must have been relatively abundant to support such a large and active population.

The near bottom pelagic catches were particularly interesting. An increase in pelagic biomass close to the sea bed did occur at GME but it was far less striking than has been observed previously in shallower and/or more productive areas. Some of the most abundant near-bottom micronekton were pelagic holothurians, one of which was also found in a haul made ca. 4000m above the bottom. Unfortunately it is not, at present, possible to state unequivocably that the presence of Scottothuria in this latter haul was real rather than contamination from a previous tow. It seems most likely that it was real (thereby agreeing with a previous observation made at GME on Discovery cruise 140), and it may therefore represent a direct interchange between relatively shallow and benthopelagic ecosystems.

Although the deep sampling horizons were rather broader than originally intended, the total water column at GME was successfully sampled in greater detail than has hitherto been achieved anywhere. The catches were small but were consistent with one another, and they should allow a comprehensive analysis of the vertical structure of the pelagic ecosystem.

H.S.J. Roe

Biomass profiles (Figs 2AB, 3)

The biomass profiles in the top 1500m of the water column were estimated for three size classes of midwater organisms using measurements of displacement volumes : a) the micronekton (RMT 8 samples), i.e. animals retained by 4.5mm mesh; b) the larger macroplankton i.e. animals passing through 4.5mm mesh but retained by 1.0mm mesh (part of RMT 1 samples); c) the smaller macroplankton i.e. animals passing through 1.0mm mesh but retained by 0.32mm mesh (part of RMT 1 samples). These profiles have not been adjusted for variations in volumes of water filtered resulting from variations in towing speed. Consequently these raw data are subject to errors of 10-20% but such errors are small compared with other sampling variability. Plots of the day and night profiles are shown in figure 2AB, These profiles show the way in which diel vertical migration results in a

TABLE 1. Depths of quartiles for displacement volumes of the RMT 8 samples, the 1.0mm and 0.32mm fractions of the RMT 1 samples by day and by night for the surface 1500m (Values not corrected for flow).

	RMT 8 (micronekton)		RMT 1 1.0mm fraction (large macro-plankton)		RMT 1 0.32mm fraction (small macro-plankton)	
	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Q25	448	157	400	195	130	90
Q50	832	555	595	555	270	230
Q75	1070	947	960	1000	500	640

substantial redistribution of the biomass in the top 600m of the water column in the case of the two macroplankton size fractions, and in the top 1100m in the case of the micronekton. This effect can be seen in the way the depths of the quartile values changed between day and night (Table 1). The quartile depths are calculated by interpolating depths of the 25% (Q25), 50% (Q50) and 75% (Q75) levels from the percentage accumulation curves. The table of values illustrates clearly that for these size fractions larger animals tend to become relatively larger contributors to the pelagic standing crop with depth. This is further illustrated by the plot in figure 3 of the ratios between the standing crops of the 1.0mm and 0.32mm fractions, which shows how the small fraction dominates in the surface 500m but then tends to be the smaller at greater depths.

Total catches were slightly higher by day than by night: - for the micronekton the total night catch was 90.4% of day, and for the large and small macroplankton catches the night catches were 84.3% and 79.2% of the day catches restpectively. Although this could have been caused by vertical migration from >1500m, analyses of previous data have suggested that this is unlikely to have occurred to any great extent and that the differences lie in sampling bias and/or net avoidance. The set of hauls taken subdividing the surface 100m at night indicated that very high standing crops occurred in the surface 25m. At such shallow depths samplin variability is at its maximum and the 10-20% differences between the day and night estimates is probably of no significance.

The total catches in the surface 1500m of the water column indicated that the standing crops beneath each m^2 of sea surface of the three size fractions collected were about 0.4, 0.3 and 0.35g m^{-2} for micronekton, large and small macroplankton respectively. The largest individual contribution was probably by Pyrosoma whose occurrence was too irregular to estimate adequately, but was also probably about 0.25-0.5g m^{-2}. Thus the total pelagic community sampled only had a standing crop of about 1.5g m^{-2}, but this estimate does not include the standing crop of phytoplankton (which on the basis of the chlorophyll measurements is likely to be very low), microzooplankton, and very large nektonic species.

M.V. Angel

Faunal composition of the pelagic samples (Fig. 4)

Time only allowed a few of the micronekton samples to be sorted, but the whole of the day series of the 1.0mm fraction of the RMT 1 samples were sorted to group. These preliminary data already provide an indication of depth zonation of the planktonic communities within the surface 1500m (Table 2). The total number of individuals sorted approximately follows the profile of standing-crop. Nineteen groups were distinguished, but only around half occurred with any regularity. The greatest diversity of groups occurred in the surface 100m where radiolarians and larval decapod crustaceans made their only significant contribution. Radiolarians were particularly abundant at the surface, where large colonies up to a centimetre in diameter were clearly visible. This is a group of organisms which may have been inadequately sampled, particularly because some species form delicate gelatinous colonies which are broken up and extruded through the meshes of nets. Only four groups of organisms were numerically abundant at one or more of the sampling depths. Siphonophores in the near surface 200m, chaetognaths between 200-500m; copepods at all depths from 500-1500m except for 1200-1300 where euphausiids were most abundant. The vertical profiles of abundance of these groups are shown in figure 4. The data have not been corrected for variations in flow, but since each tow represents the filtration of around 2700m^3 of water and only half the fraction was sorted (the other half having been frozen for dry weights and C:N analysis) a count of 100 specimens is equivalent to 1 specimen per 13.5m^3 of water filtered. Hence even the largest count of 702 large copepods at 500-600m still represents only about one copepod per 2m^3.

The paucity of certain groups is worth remarking on. Firstly many of the herbivorous filter-feeders such as salps, doliolids and pteropods occurred in extremely low numbers. Mysids were surprisingly uncommon at deep mesopelagic depths and yet there was a population of quite deep-living euphausiids, which also coincided with an increase in the abundance of siphonophore pieces. Even at this crude level of analysis there are clear signs of the classical patterns of vertical zonation which must reflect changes in the food-web structure and hence the pathways along which organic matter and chemical constituents move within the communities.

Sampling depth (m)	Siphonophore (pieces)	Decapod crustaceans	Chaetognaths	Radiolarians	Copepods	Amphipods	Lepas nauplii/ cyprids	Fish	Ostracods	Euphausiids	Mysids	Pteropods	Heteropods	Squid	Doliolids	Salps	Polychaetes	Medusae	Nemertines	Total number of individuals
0-100	250	114	109	157	119	39	22/-	16	17	2	5	3	2	4	2	1	+	+	-	862
100-200	352	18	135	+	75	193	10/-	5	30	25	-	2	15	4	2	-	+	1	-	872
200-300	30	-	159	+	12	14	-/1	-	38	12	-	2	-	-	-	-	-	-	-	268
300-400	10	-	274	-	13	20	-	3	17	52	-	3	-	-	-	+	5	-	-	397
400-500	40	-	138	-	82	3	-/22	26′	8	128	-	-	-	-	-	-	2	-	-	449
500-600	43	5	133	+	702	36	-/3	85	18	113	-	-	-	-	-	-	7	-	-	1145
600-700	+	1	33	-	376	9	-	26	8	65	-	3	-	-	-	-	1	-	-	522
700-800	96	3	39	-	669	10	-	3	12	42	8	-	-	-	-	-	-	-	-	882
800-900	28	-	38	-	414	6	12/-	48	41	59	5	-	-	-	-	-	1	-	-	658
900-1000	9	6	50	-	191	1	-	9	1	122	1	1	-	-	-	-	-	-	-	391
1000-1100	18	3	26	-	145	11	-	2	11	104	1	2	-	-	-	-	-	-	-	254
1100-1200	57	1	11	-	87	6	-	2	1	34	2	-	-	-	2	-	-	-	-	203
1200-1300	120	1	22	-	126	2	-	-	5	231	-	-	-	-	-	-	-	2	-	509
1300-1400	135	2	23	-	234	5	-	2	6	176	-	1	-	-	-	-	-	-	1	585
1400-1500	46	1	(31)	-	213	2	-	(40)	5	30	-	-	-	-	-	-	-	-	-	(329)
Total	1234	155	1190	157+	3458	362	70	228	218	1195	22	17	17	8	6	1+	16+	1+	1	8326+

TABLE 2. Numbers of the main taxonomic groups sorted from the one half portions of the 1.0mm fractions of the RMT 1 samples. + indicates where specimens were present but could not be reliably picked out. Values in parentheses indicate where contamination occurred (see text).

One advantage of sorting onboard was to identify the reasons for a suspect tow. One of the night samples collected on the first leg (500-600m) had an anomalously small content. A minor problem with using the cod-end sieving system was that it sometimes induced the cod-ends of the RMT 1's to twist together so that the catches were held up in the body of the net. This was usually simply remedied by untwisting the nets and dropping them back into the sea for a few minutes so that the catch washed down. In this case the washing down process was inadequate and a large bulk of the catch stayed hung up in the net and appeared in the daytime catch from 1400-1500m. Hence the data for this catch has parentheses for fish and chaetognaths since it includes many obvious contaminants from the shallower night catches. The night catch was repeated on the second leg to give more reliable data. Otherwise there were no signs of similar contamination either from interhaul hang-up or leakage into closed nets.

M.V. Angel

Pelagic Holothurioidea

Several specimens of the swimming sea-cucumbers Scottothuria herringi and Enypniastes diaphana were taken in midwater trawls fished close to the seabed. Their density, in comparison with previously sampled areas such as the Azores-Biscay Rise and the Cape Verde Abyssal Plain, was low. One specimen of the fragile species S. herringi was taken at a depth of 1400-1520m (St. 11261#68), some 4000m above the seabed. Although the specimen was in good condition some doubts were raised about the validity of this record since the previous set of multiple midwater nets, which had been fished close to the seabed, were found to have tangled during their deployment. It is possible therefore that the specimen had been caught up on the net of the trawl (St. 11261#65). However, it should be noted that S. herringi was taken at a similar depth in this area during Discovery cruise 140 (St. 10927#1, 1430-1750m). The tentacles of both S. herringi and E. diaphana were preserved for TEM and SEM analyses in order to determine whether these holothurians are able to feed on suspended particles.

D.S.M. Billett

Copepods

Samples of about 40 species of midwater copepods were taken for the collections of the British Museum (Natural History). Additionally two parasites were found in the OTSB hauls, an asteroid siphostome from a starfish host, and the large chondracanthid Diocus, from the gill cavity of Coryphaenoides armatus. In one series of near-bottom RMT 1M hauls the proportion of dead carcases to live copepods was examined. Carcasses comprised 62 to 73% of the total copepod fraction. Some representatives of the near-bottom fauna, members of the harpacticoid family Tisbidae, were removed for taxonomic study.

G.A. Boxshall

Bioluminescence

Bioluminescence investigations have necessarily been restricted by the limited diversity of the GME fauna and in consequence relatively few studies have been made of fish and cephalopods while attention has been directed much more upon the copepod crustaceans.

A small adult female of the octopod Japetella was obtained with the luminous oral ring characteristic of mature females. Study of the morphology of this specimen should clarify whether the luminous tissue is derived from pre-existing muscle or arises de novo on maturity. Emission spectra have been obtained from the cranchiid Bathothauma and the large subocular organs of a species of Mastigoteuthis fixed for later microscopical study.

Several juveniles of the searsiid fish Holtbyrnia have been fixed for light and electron microscopy. This will enable a detailed comparison to be made between the ventral photophores and the remarkable secretory post-cleithral organ. The escas of several ceratioid angler fishes have been fixed for study by Dr. E. Bertelsen, as has also a near-perfect specimen of Monognathus.

Attempts have been made to investigate the distribution of red fluorescent material in the suborbital photophore of Malacosteus by quick-freezing the organs in a dry ice/iso-pentane mixture for the preparation of frozen sections.

Ten specimens of the shrimp Oplophorus spinosus have been injected with ^{14}C tyrosine in an attempt to determine whether there is any isotope incorporation into the animal's luciferin, thereby indicating a de novo synthesis.

Copepod studies have concentrated on the glandular distribution and morphology of the luminous tissues of the Augaptilidae, Lucicutiidae, Metridiidae and Heterorhabdidae. Fluorescent microscopy has been used to identify the glands in several species but there are clearly both specific and familial differences in the nature of the secretion. This is indicated by differences in fluorescence and the morphology of subcellular particles in both different species and in different glands within a single individual. Fixed material has been obtained for both light and electron microscopy (SEM and TEM). Similar fluorescent microscopy in the cyclopoid Oncaea conifera has given additional information concerning its photocyte distribution and structure.

Samples of the euphausiids Nematoscelis megalops and Meganyctiphanes norvegica have been taken in order to provide information on the genetic differences both between Eastern and Western North Atlantic populations and between closely spaced populations in each area.

P.J. Herring

Polonium-210 Flux experiments

A number of specimens of the more abundant decapod species collected with the closing cod end were kept alive for periods of up to five days in order to collect faecal pellets. Certain species, particularly Gennadas spp. have been found to exhibit extremely high levels of the naturally occurring radionuclide ^{210}Po. By determining the levels in faecal pellets and depriving the animals of food for several days, it is hoped that some measure of the elimination of this material may be obtained. It has been postulated that the high levels of ^{210}Po, particularly in the hepatopancreas, result from a high degree of detritivory in the diet, thus ^{210}Po might be a useful dietary marker. Determination of the flux of materials through the pelagic biological system is difficult to measure so it is also hoped that ^{210}Po will prove useful in this respect.

P.A. Domanski

Trace metals in Crustacea

The open ocean characteristically contains heavy metals at dissolved concentrations an order of magnitude or more lower than in coastal waters and correspondingly oceanic organisms might be expected to contain such metals at minimum body concentrations. As part of a wider study into the significance of levels of essential and non-essential metals in crustaceans it was considered of interest to measure metal concentrations in a variety of deep sea crustaceans. The specific objective therefore was to collect a large number of specimens of several species of deep sea malacostracan crustaceans, particularly decapods, for subsequent analysis for heavy metals including copper, zinc, iron, manganese and cadmium.

During Cruise 156 specimens in excellent condition were taken at a variety of depths from a series of sites by means of an RMT 8 with a closing cod end. The crustaceans were identified with the much appreciated assistance of Peter Domanski and stored individually deep frozen for transport to the UK. Twelve penaeid decapod and 9 carid decapod species were taken, in addition to 5 mysid species and 2 identified euphausiid species. A further collection of unidentified euphausiids was also made. Four penaeid species (Gennadas valens 79 specimens; Sergia robustus, 58; Sergia tenuiremis, 31; Sergestes henseni, 11), 2 carid species (Acanthephyra purpurea, 98; Systellaspis debilis, 67), 1 mysid (Eucopia unguiculata, 61) and 1 euphausiid (Meganyctiphanes norvegica, 261) were taken in adequate numbers for detailed analyses. Occasionally sufficient numbers of several of these species were taken in a single haul to be of use for investigations of body size - metal concentration relationships within a single species free of suspicion of geographical variation.

The retrieval of a drift buoy in the Bay of Biscay afforded the opportunity to collect 27 specimens of a goose barnacle (Lepas sp.), similarly to allow measurement of body heavy metal concentrations for comparison against levels in coastal barnacles.

The opportunity was also taken to collect and fix specimens of a deep sea amphipod Paradania sp. as part of a study of iron-rich crystals in the gut caeca of stegocephalid amphipods.

P.S. Rainbow

Mesopelagic food webs

Recent collections of mesopelagic decapods from Discovery cruises have shown that some species have very high levels of certain metals, especially cadmium. Non-regulated metals like cadmium may provide a quantitifiable tracer in food webs and a representative collection of animals, especially of those with known predator/prey relationships, was taken for future laboratory analysis.

Numbers collected:

Medusae		Mysids	
Pelagia noctiluca	2	Eucopia unguiculata	44
Siphonophora		E. sculpticauda	21
Diphyes dispar	3	Gnathophausia ingens	3
Isopods		Decapods	
Phronima sp.	9	Acanthephyra purpurea	134
Euphausiids		A. pelagica	1
Meganyctiphanes norvegica	100s	Systellaspis debilis	90
Thysanopoda sp.	27	Parapandalus richardi	12
Thysanoessa sp.	41	Sergestes 'corniculum'	16
Nematoscelis boopis?	137	Sergia robustus	30
Euphausia krohni?	11	Funchalia villosa	1
Stylocheiron sp.	35	Gennadas valens	119
		Bentheogennema intermedia	16

H.S.J. Roe

Epibenthic sledge hauls

Four epibenthic sledge hauls using one fine and two coarse nets, were obtained in the 10km square box, the sledge being fished for successively longer distances on the bottom.

These hauls were all made with the Mk II IOS epibenthic sledge which had been used only once previously on Challenger cruise 8/81. During that cruise there was some doubt about the fishing efficiency of the sledge, possibly resulting from the use of glass spheres to improve the stability of the gear (see Cruise Report 119). On the present cruise the spheres were not used and the stability problems were successfully overcome by shooting the gear through the surface layers with the ship propelled on the bow thruster and the main propulsion stopped. Nevertheless, with this uncertainty about the performance of the sledge it was difficult to know whether the extremely small sample retrieved by the first sledge haul (11262#15), which traversed only 470m according to the odometer, was truly representative of the megabenthos in the area. Unfortunately, no photographic evidence was available since, owing to an incorrect orientation of the camera control switch in the net monitor, the camera failed to operate during this haul.

Nevertheless, in view of the small sample and the absence of mud from this catch, the second sledge haul (11262#16) was fished for about 2km over the bottom and obtained a very similar sample to the first one, but correspondingly larger. This time the camera worked correctly and the photographs confirmed that megafaunal animals are, indeed, very rare on the bottom and that the catches are therefore probably representative. Accordingly, the third and fourth hauls (1126#17 and 19) were fished for about 4 and 8km respectively and again obtained similar but larger catches than the earlier hauls.

All of these samples were dominated by the asteroids Hyphalaster inermis and Styrachaster horridus with smaller numbers of species of bivalve similar to the genus Abra and occasional specimens of the holothurians Psychropotes semperiana and Pseudostichopus alanticus and the galatheid decapod Munidopsis thiele. There were also a number of small echiurans in each of the samples.

The fine residues were very small, but the supra-benthic net on each occasion took many pelagic foraminiferan tests and considerable numbers of benthic foraminiferans including komokiaceans.

Because of the lengths of the later sledge hauls and the similarity of all of the catches, it seemed unnecessary to take further epibenthic sledge samples on the abyssal plain. Accordingly, the available time was used to survey the lower slopes of the abyssal hill to the north of the 10km square box, where manganese nodules had been located but not sampled during a recent IOS geophysics cruise (Discovey cruise 153 - report 172). A photographic transect (11262#20) was made using the epibenthic sledge without any benthic nets, but at the time of writing the results are not available since thin-based film was used. This was followed by a sledge haul (11262#28) using the original epibenthic sledge now normally used as a rock dredge by the geophysics department. The sledge travelled 1096m across the bottom according to the odometer and collected almost a tonne of roughly spherical nodules mostly 3-5cm in diameter.

A.L. Rice and D.S.M. Billett

Otter trawling and demersal fishes

Six operations of the semi-balloon otter trawl (OTSB 14) were carried out in 5400m, predominantly to sample the demersal ichthyofauna. Of these three were fully successful. On two occasions the net evidently was not on the bottom for the entire 3-hour duration of the tow due, it seemed, to substantial current shear in the near-surface waters. In the final operation no signals were received from the door-mounted acoustic monitor to indicate arrival on, or departure from, the bottom by the net. After some 10 minutes of hauling for recovery, the trawl came fast on the seabed with over 13500m of warp out, causing a momentary outboard load in excess of 11 tons. Way was immediately taken off the ship and, with the hauling speed reduced, the net came free after 30 minutes or so. Normal hauling speed was resumed but when the net was recovered it was found to be irrepairably damaged.

A total of 154 specimens representing 17 species of fish were collected from the area. The species composition was reminiscent of that found at 4100m on the Madeira Abyssal Plain on Discovery cruise 148, but substantially different from the ichthyofauna at abyssal depths farther to the north. In general the mean size of fish was smaller and the relative biomass (0.005-0.05kg/1000m^2) less than in more northerly waters. This result reflected the situation of impoverished production found in the overlying water mass.

Numerically, the Chlorophthalmidae (68%), Macrouridae (21%) and the ophidioid fishes (Ophidiidae + Aphyonidae; 12%) comprised 99% of the total collection. Bathymicrops regis, a species of small adult size (< 130mm standard length), hitherto thought to be solitary and rare in the area, dominated the catches (43%). This, together with Bathypterois longipes and Echinomacrurus mollis constituted 73% of the overall catches. Of special interest were 2 specimens of a closely related congener of B. regis and a specimen of a hitherto undescribed species with sufficiently distinct characters probably to warrant generic separation within bathymicropine chlorophthalmids. In addition, some interesting ophidiids were collected, among which were the deepest-living fish known, Abyssobrotula galatheae, 2 specimens of Barathrites iris, hitherto known only from the holotype, and those aphyonids mentioned below by J.G. Nielsen.

N.R. Merrett

Demersal fishes

The main reason for my participation in Discovery cruise 156 (leg 1) was the planned fishing of the OTSB and RMT 8 at and near the bottom at abyssal depths. Three families of fish from these depths have my special interest, and we obtained very interesting material of all three.

Monognathidae. Being halfway through a revision of this family I have found it necessary to make an electron microscopic examination of certain organs. This requires that the material has to be specially fixed immediately after capture. The four specimens caught and fixed on board should fulfill this need.

Aphyonidae. Twelve specimens of this rarely caught family were obtained, three of which represent an undescribed species. The remaining nine specimens belong to species which are known from less than 10 specimens each.

Ophiidae. Three species were caught each represented by two specimens. All three are known from so few specimens that the present material adds new information both to the distribution and to the specific variation.

J.G. Nielsen

Otter trawl catches - invertebrates

The major difference between the invertebrate samples taken with the otter trawl and epibenthic sledge was the presence of many decapods, especially Aristeomorpho? and Plesiopenaeus armatus, in the otter trawl catches. These large natant crustaceans were not taken in any of the sledge samples. Otherwise the catches of the two types of gear were qualitatively similar with the asteroid Hyphalaster inermis and Styrachaster horridus dominating samples principally notable for their paucity. Several samples contained small actiniarians and bivalves, and a few specimens of the crustacean Munidopsis thiele, the asteroids Styrachaster elongatus and Freyella sexradiata, and the holothurians Psychropotes semperiana, Peniagone ferrunginea and Molpadia blakei were also taken.

D.S.M. Billett and A.L. Rice

Echinoderm reproduction

In order to continue Dr Tyler's work into the reproductive biology of echinoderms it was hoped to dissect out various tissues from deep-sea holothurians. These would then have been freeze-dried aboard Discovery and their calorific content determined by microbomb calorimetry back in Swansea. Unfortunately holothurians were scarce and those which were taken were too scarce to have provided sufficient gonad tissue to make this exercise worthwhile. Attention was therefore diverted to two Parcellerasteroid asteroids, Hyphalaster and Styrachaster. About 50 Hyphalaster were dissected immediately after capture and the gonads deep frozen. In addition, 20 specimens of each were dissected (from fixed material) and the gonads taken for routine paraffin wax histology which may yield information on the reproductive strategies of these species.

A. Muirhead

BIOLOGICAL INVESTIGATIONS: PRIMARY PRODUCTION AND ASSOCIATED STUDIES

Chlorophyll *a* distribution

During the passage down to the GME site a series of shallow CTD casts were made, at approximately 2° intervals of latitude, in order to investigate the vertical distribution of chlorophyll *a* in relation to the physical structure of the water column and also to collect water samples from various depths. As expected, at the most northerly station the phytoplankton were evenly distributed in the top mixed layer, but as we progressed south a chlorophyll maximum appeared towards the base of the shallow pycnocline. The depth of this maximum progressively deepened and broadened, such that, at the GME site, it lay at ca. 100m, with virtually no chlorophyll being registered above 70m or below 150m. Thus the surface fluorescence values, as measured from the ship's clean sea-water supply, indicated values of chlorophyll *a* of less than 0.1μg/litre.

The fluorescence/depth profiles were compared with the readings from the transmissometer and there was a clear correlation between the two. However, the particle counts carried out on the water samples were more dificult to relate to transmittance as, although a peak in particle numbers was found at the chlorophyll maximum/transmittance minimum, the highest counts always were encountered in the samples taken closer to the surface. It is presumed that much of the phytoplankton material in the chlorophyll maximum is of very small size and, therefore, was below the 2.5μm diameter limit of detection by the particle counter. This conclusion is borne out by the results of filtering samples onto different pore size filters, as at least half the material was of a size less than 1μm. In addition, large amounts of phaeophytin, a breakdown product of chlorophyll, were found in the samples from the chlorophyll maximum which, in combination with the deep depth of this maximum, probably indicates that the rate of primary production in the GME waters is relatively low.

P.R. Pugh

Primary productivity

Estimates of primary production were made by the Steeman-Nielsen ^{14}C method using a shipboard incubation unit built by the Bedford Instititute of Oceanography. Culture bottles are filed behind a light source and arranged in such a fashion as to produce a light attenuation effect of more than three orders of magnitude.

Four experiments were performed, all within the GME sampling area. Each experiment comprised two productivity determinations. Principally there were three aims:

1) to estimate the total daily primary productivity
2) to determine the relative productivity between cells <1μm in size (picoplankton) to larger cells (>1μm).
3) to investigate the degree (if any) of photo-adaptation exhibited by algal populations at different depths.

Productivity stations		Depth(s) (m)	Filter type
11261#25	29.6.85	90 (Chl. max layer)	1)GF/F (fibreglass 0.4 μm).
			2) Nuclopore (membrane 1μm)
11261#42	30.6.85	95 (Chl. max layer)	1)GF/F
			2) Nuclopore
11261#49	2.7.85	96 (Chl. max)	1)GF/F
		71 (above Chl. max)	2)GF/F
11261#59	5.7.85	68 (above Chl. max)	1)GF/F
			2) Nuclopore

P.A. Domanski

Photosynthetic Pigments

7.4 litre Niskin bottles were used to collect water samples from the chlorophyll maximum layer during most of the shallow (0-300m) CTD stations.

These samples were filtered onto GF/F filters to be analysed for photosynthetic pigments using H.P.L.C. techniques.

P.A. Domanski

Coccolithorphorids (Prymnesiophyceae) and other micro-organisms

Seawater was collected in 1.7 litre water bottles during shallow (0-300m) and deep (0-5400m) CTD casts. One litre quantities of this seawater were filtered from each bottle and the filters (nucloplore, 47mm, 0.4μm) stored for later analysis by Scanning Electron Microscopy. By utilising this latter technique, classification, distribution and community structure of coccolithorphorids can be analysed.

Before allowing the filters to run dry, samples were removed for culturing. Cultures were suspended in sterile Erd-Schreiber media and placed in an illuminated incubator at 15°C (Periodicity: 8h dark, 16h light). Later single cell isolation and axenic cultures will be attempted in order to establish a culture collection which will hopefully provide enough material for life cycle studies and elucidation of internal morphology using Transmission Electron Microscopy.

Samples were also collected from the ship's clean water supply by filtering through a 10μm mesh, resuspending in water and transferring the material to tubes of media. Neuston net samples were also prepared for culturing, although the material was dominated by Noctiluca, a naked, unarmoured dinoflagellate, and Sphaerozoum, a colonial, spicule-bearing radiolarian. Other organisms present were typical (those bearing stiff axopodial arms) radiolarians, Ceratium (an armoured dinoflagellate), an extraordinary large species of Melosira (diatom) and numerous coccolithophorids, too small to identify.

Cultures of thraustochytrids were also set up, using pine pollen grains as bait. Finally, samples collected during deep CTD casts were preserved in 1% glutaraldehyde in an attempt to determine whether or not benthic flagellates exist. These latter samples were collected for Prof. Manton of Leeds University.

R. Jordan

XBT TRANSECT (Fig. 5)

One hundred and twenty four XBTs were deployed of which 116 were successful. Most of the probes were supplied by the Hydrographic Office and information obtained south of 41°N was routinely telexed back to the Meteorological Office.

The XBT transects clearly showed the presence of 18°C water south of 34°N and east of 21°W (Fig. 5). This 18°C water was a variable feature of the GME site throughout the cruise and the XBT and associated CTD and chlorophyll fluorecence data promise to be of considerable interest.

H.S.J. Roe

GEAR ABBREVIATIONS IN STATION LIST

CTD	Conductivity Temperature Depth Probe
MS	Multi-Sampler
Trans M	Transmissometer
UFL	Underwater Fluorometer
LMD	Light Meter Diode
W/B	Water Bottle
RMT 1+8M	Multiple Rectangular Midwater Trawl with 3 pairs of (nominally) $1m^2$ mouth area nets (RMT 1) and $8m^2$ mouth area nets (RMT 8)
RMT 1+8	As above but with a single pair of nets
CCE	Closing Cod End (used on RMT 8)
NBES	Near Bottom Echo Sounder
OTSB 14	Semi-balloon Otter Trawl
BN1.5/3M/SBN	Bottom Net with 3 nets, plus a 0.32mm mesh supra benthic net
BN1.5/P	Photosledge - no nets
BN1.5/Q	Bottom Net modified as a rock dredge
B'Snap	Bathysnap V

STN.	DATE 1985	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11252	19/ 6	46 56.8N	9 47.0W	CTD	0- 300	2207-2322	NO DIGIDATA
# 0		46 56.8N	9 47.0W	MS		NIGHT	
				TRANSM			
				UFL			
11253	20/ 6	45 41.7N	12 11.3W	CTD	0- 300	1204-1250	NO DIGIDATA
# 0		45 41.7N	12 11.3W	MS		DAY	
				TRANSM			
				UFL			
				LMD			
				WB7.4			
11254	21/ 6	43 52.9N	14 22.6W	CTD	0- 300	0911-0955	NO DIGIDATA
# 0		43 52.9N	14 22.6W	MS		DAY	
				TRANSM			
				UFL			
				LMD			
				WB7.4			
11255	21/ 6	42 18.0N	15 51.7W	CTD	0- 300	2107-2145	
# 0		42 18.0N	15 51.7W	MS		NIGHT	
				TRANSM			
				UFL			
				LMD			
				WB7.4			
11256	22/ 6	40 41.2N	17 22.6W	CTD	0- 300	0907-0945	
# 0		40 41.2N	17 22.6W	MS		DAY	
				TRANSM			
				UFL			
				LMD			
				WB7.4			

STN.	DATE 1985	POSITION LAT	POSITION LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11257	22/ 6	39 1.8N	18 58.7W	CTD	0- 300	2107-2150	
# 0		39 1.3N	18 58.7W	MS		NIGHT	
				TRANSM			
				UFL			
				LMD			
				WB7.4			
11258	23/ 6	37 25.8N	20 19.8W	CTD	0- 300	0908-0951	
# 0		37 25.8N	20 19.8W	MS		DAY	
				TRANSM			
				UFL			
				LMD			
				WB7.4			
11259	23/ 6	35 36.8N	21 51.0W	CTD	0- 300	2106-2148	
# 0		35 36.8N	21 51.0W	MS		NIGHT	
				TRANSM			
				UFL			
				LMD			
				WB7.4			
11260	24/ 6	33 53.8N	23 20.1W	CTD	0- 300	0905-0946	
# 0		33 53.8N	23 20.1W	MS		DAY	
				TRANSM			
				UFL			
				LMD			
				WB7.4			
11261	27/ 6	31 28.5N	24 54.2W	RMT1M/1	300- 400	1128-1228	
# 1		31 27.6N	24 56.3W	RMT8M/1		DAY	FLOW DIST. 3.26 KM.
11261	27/ 6	31 27.6N	24 56.3W	RMT1M/2	400- 500	1228-1329	
# 2		31 27.1N	24 58.4W	RMT8M/2		DAY	FLOW DIST. 3.35 KM.

STN.	DATE 1985	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11261 # 3	27/ 6	31 27.1N 31 26.2N	24 58.4W 25 0.3W	RMT1M/3 RMT8M/3	500- 600	1329-1429 DAY	FLOW DIST. 3.94 KM.
11261 # 4	27/ 6	31 24.5N 31 23.5N	25 4.3W 25 7.3W	RMT1M/1 RMT8M/1	600- 700	1605-1705 DAY	FLOW DIST. 3.70 KM.
11261 # 5	27/ 6	31 23.5N 31 22.4N	25 7.3W 25 9.5W	RMT1M/2 RMT8M/2	700- 800	1705-1805 DAY	FLOW DIST. 3.77 KM.
11261 # 6	27/ 6	31 22.4N 31 21.2N	25 9.5W 25 11.6W	RMT1M/3 RMT8M/3	800- 900	1805-1906 DAY	FLOW DIST. 3.71 KM.
11261 # 7	27/ 6	31 20.5N 31 20.5N	25 13.8W 25 13.8W	CTD MS TRANSM UFL LMD WB7.4	0- 300	2025-2102 DUSK	
11261 # 8	27/ 6	31 20.2N 31 19.6N	25 17.3W 25 19.9W	RMT1M/1 RMT8M/1	600- 700	2209-2309 NIGHT	NETS FAILED; NO FLOW
11261 # 9	28/ 6	31 19.6N 31 18.2N	25 19.9W 25 27.2W	RMT1M/2 RMT8M/2	700- 0	0049-0354 NIGHT	NETS FAILED; NO FLOW
11261 #10	28/ 6	31 17.5N 31 17.3N	25 31.6W 25 33.3W	RMT1M/1 RMT8M/1	320- 0	0422-0456 NIGHT	MONITOR TEST; NO FLOW
11261 #11	28/ 6	31 17.8N 31 17.8N	25 33.6W 25 33.6W	CTD MS TRANSM UFL WB7.4 LMD	0-5296	0542-1008 DAWN	UNSUCCESSFUL BSNAP RELEASE TEST

STN.	DATE 1985	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11261 #12	28/ 6	31 18.6N 31 17.8N	25 31.7W 25 29.1W	RMT1M/1 RMT8M/1	300- 200	1046-1146 DAY	FLOW DIST. 4.09 KM.
11261 #13	28/ 6	31 17.8N 31 16.9N	25 29.1W 25 26.7W	RMT1M/2 RMT8M/2	200- 100	1146-1247 DAY	FLOW DIST. 4.09 KM.
11261 #14	28/ 6	31 16.9N 31 16.0N	25 26.7W 25 24.2W	RMT1M/3 RMT8M/3	100- 0	1247-1347 DAY	FLOW DIST. 4.07 KM.
11261 #15	28/ 6	31 14.4N 31 13.1N	25 20.5W 25 18.3W	RMT1M/1 RMT8M/1	900-1000	1509-1609 DAY	FLOW DIST. 3.55 KM.
11261 #16	28/ 6	31 13.1N 31 11.8N	25 18.3W 25 16.1W	RMT1M/2 RMT8M/2	1000-1100	1609-1709 DAY	FLOW DIST. 3.82 KM.
11261 #17	28/ 6	31 11.8N 31 10.0N	25 16.1W 25 14.2W	RMT1M/3 RMT8M/3	1100-1200	1709-1809 DAY	FLOW DIST. 3.82 KM.
11261 #18	28/ 6	31 10.2N 31 10.2N	25 13.4W 25 13.4W	CTD MS TRANSM UFL LMD WB7.4	0- 300	1917-2006 DUSK	
11261 #19	28/ 6	31 12.9N 31 14.7N	25 14.6W 25 15.7W	RMT1M/1 RMT8M/1	910-1000	2146-2246 NIGHT	FLOW DIST. 2.87 KM.
11261 #20	28/ 6	31 14.7N 31 17.1N	25 15.7W 25 17.0W	RMT1M/2 RMT8M/2	1000-1110	2246-2356 NIGHT	FLOW DIST. 3.91 KM.
11261 #21	28/ 6 29/ 6	31 17.1N 31 19.0N	25 17.0W 25 18.0W	RMT1M/3 RMT8M/3	1100-1200	2356-0057 NIGHT	FLOW DIST. 3.50 KM.

STN.	DATE 1985	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11261	29/ 6	31 22.4N	25 19.5W	RMT1M/1	300- 400	0235-0335	
#22		31 24.6N	25 20.1W	RMT8M/1		NIGHT	FLOW DIST. 3.25 KM.
11261	29/ 6	31 24.6N	25 20.1W	RMT1M/2	400- 500	0335-0436	
#23		31 26.5N	25 20.8W	RMT8M/2		NIGHT	FLOW DIST. 3.64 KM.
11261	29/ 6	31 26.5N	25 20.8W	RMT1M/3	500- 600	0436-0536	
#24		31 29.0N	25 22.0W	RMT8M/3		NIGHT	FLOW DIST. 3.59 KM.
11261	29/ 6	31 29.8N	25 22.3W	CTD	0- 300	0639-0702	
#25		31 29.8N	25 22.3W	MS		DAWN	
				TRANSM			
				UFL			
				LMD			
				WB7.4			
11261	29/ 6	31 28.1N	25 23.4W	RMT1M/1	1200-1300	0840-0940	
#26		31 26.1N	25 22.4W	RMT8M/1		DAY	FLOW DIST. 2.77 KM.
11261	29/ 6	31 26.1N	25 22.4W	RMT1M/2	1300-1400	0940-1040	
#27		31 24.1N	25 22.1W	RMT8M/2		DAY	FLOW DIST. 3.07 KM.
11261	29/ 6	31 24.1N	25 22.1W	RMT1M/3	1400-1500	1040-1140	
#28		31 22.2N	25 21.7W	RMT8M/3		DAY	FLOW DIST. 3.40 KM.
11261	29/ 6	31 20.6N	25 20.5W	RMT1M/1	2- 25	1314-1414	
#29		31 18.1N	25 20.5W	RMT8M/1		DAY	FLOW DIST. 3.68 KM.
11261	29/ 6	31 18.1N	25 20.5W	RMT1M/2	25- 50	1414-1514	
#30		31 15.6N	25 20.3W	RMT8M/2		DAY	FLOW DIST. 4.52 KM.
11261	29/ 6	31 15.6N	25 20.3W	RMT1M/3	50- 100	1514-1614	
#31		31 13.3N	25 20.1W	RMT8M/3		DAY	FLOW DIST. 4.04 KM.

STN.	DATE 1985	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11261	29/ 6	31 12.3N	25 21.3W	RMT1M/1	400- 500	1708-1808	
#32		31 11.8N	25 23.4W	RMT8M/1		DAY	FLOW DIST. 3.32 KM.
11261	29/ 6	31 11.8N	25 23.4W	RMT1M/2	500- 600	1808-1908	
#33		31 11.3N	25 25.9W	RMT8M/2		DAY	FLOW DIST. 3.73 KM.
11261	29/ 6	31 11.3N	25 25.9W	RMT1M/3	600- 0	1908-2009	
#34		31 10.5N	25 27.3W	RMT8M/3		DAY	FLOW DIST. 3.98 KM.
11261	29/ 6	31 10.1N	25 27.5W	CTD	0- 300	2033-2115	
#35		31 10.1N	25 27.5W	MS		NIGHT	
				TRANSM			
				UFL			
				LMD			
				WB7.4			
11261	29/ 6	31 9.8N	25 29.1W	RMT1M/1	600- 700	2204-2304	RMT8 1 AND 2 FISHED TOGETHER
#36		31 9.8N	25 31.2W	RMT8M/1	600- 800	NIGHT	FLOW DIST. 3.23 KM.
11261	29/ 6	31 9.8N	25 31.2W	RMT1M/2	700- 800	2304-0004	
#37	30/ 6	31 10.1N	25 33.3W	RMT8M/2	600- 800	NIGHT	FLOW DIST. 3.01 KM.
11261	30/ 6	31 10.1N	25 33.3W	RMT1M/3	800- 895	0004-0104	
#38		31 10.5N	25 35.5W	RMT8M/3		NIGHT	FLOW DIST. 3.14 KM.
11261	30/ 6	31 11.6N	25 37.4W	RMT1M/1	0- 100	0208-0308	
#39		31 13.7N	25 37.4W	RMT8M/1		NIGHT	FLOW DIST. 3.73 KM.
11261	30/ 6	31 13.7N	25 37.4W	RMT1M/2	100- 200	0308-0409	
#40		31 15.9N	25 37.1W	RMT8M/2		NIGHT	FLOW DIST. 3.62 KM.
11261	30/ 6	31 15.9N	25 37.1W	RMT1M/3	200- 300	0409-0509	
#41		31 17.8N	25 37.0W	RMT8M/3		NIGHT	FLOW DIST. 3.91 KM.

STN.	DATE 1985	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11261	30/ 6	31 24.2N	25 35.5W	CTD	0- 300	0647-0707	
#42		31 24.2N	25 35.5W	MS		DAWN	
				TRANSM			
				UFL			
				LMD			
				WB7.4			
11261	30/ 6	31 6.7N	25 8.7W	OTSB14	5440-5440	1535-1600	
#43		31 5.7N	25 7.6W			DAY	LOG DIST. 17.90 KM.
11261	1/ 7	31 7.0N	25 5.2W	OTSB14	5440-5440	0541-0830	
#44		31 12.6N	25 11.1W			DAWN	LOG DIST. 13.40 KM.
11261	1/ 7	31 15.3N	25 14.3W	CTD	0- 300	1343-1434	
#45		31 15.3N	25 14.3W	MS		DAY	
				UFL			
				LMD			
				TRANSM			
				WB7.4			
11261	1/ 7	31 18.4N	25 21.0W	RMT1M/1	5427-5325	2245-0045	NBES FAILED
#46	2/ 7	31 22.3N	25 24.5W	RMT8M/1		NIGHT	FLOW DIST. 7.82 KM.
				NBES			
11261	2/ 7	31 22.3N	25 24.5W	RMT1M/2	5325-5233	0045-0245	NBES FAILED
#47		31 25.9N	25 27.9W	RMT8M/2		NIGHT	FLOW DIST. 3.49 KM.
				NBES			
11261	2/ 7	31 25.9N	25 27.9W	RMT1M/3	5233-5132	0245-0445	NBES FAILED
#48		31 35.0N	25 35.7W	RMT8M/3		NIGHT	FLOW DIST. 3.45 KM.
				NBES			

STN.	DATE 1985	POSITION LAT	POSITION LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11261	2/ 7	31 35.0N	25 35.7W	CTD	0- 300	0836-0932	
#49		31 35.0N	25 35.7W	MS		DAY	
				LMD			
				UFL			
				TRANSM			
				WB7.4			
11261	2/ 7	31 12.8N	25 18.3W	OTSB14	5440-5440	1900-2200	
#50		31 18.5N	25 25.5W			DUSK	LOG DIST. 17.10 KM.
11261	3/ 7	31 25.1N	25 33.0W	CTD	0-5461	0336-0835	MONITOR/CTD CALIBRATION
#51		31 25.1N	25 33.0W	MS		NIGHT	
				TRANSM			
11261	3/ 7	31 12.6N	25 12.5W	OTSB14	5440-5440	1454-1805	
#52		31 6.6N	25 5.4W			DAY	LOG DIST. 15.80 KM.
11261	3/ 7	30 59.7N	24 56.9W	CTD	0- 300	2316-2350	
#53		30 59.7N	24 56.9W	MS		NIGHT	
				UFL			
				TRANSM			
				LMD			
				WB7.4			
11261	4/ 7	31 8.9N	25 7.1W	RMT1M/1	5368-5347	0607-0808	49-90M OFF BOTTOM
#54		31 11.7N	25 11.3W	RMT8M/1		DAWN	FLOW DIST. 6.09 KM.
				NBES			
11261	4/ 7	31 11.7N	25 11.3W	RMT1M/2	5383-5415	0806-1009	24-55M OFF BOTTOM
#55		31 14.7N	25 14.6W	RMT8M/2		DAY	FLOW DIST. 7.01 KM.
				NBES			

STN.	DATE 1985	POSITION LAT	POSITION LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11261 #56	4/ 7	31 14.7N 31 17.6N	25 14.6W 25 18.3W	RMT1M/3 RMT8M/3 NBES	5415-5425	1009-1206 DAY	11-25M OFF BOTTOM FLOW DIST. 7.37 KM.
11261 #57	4/ 7	31 22.2N 31 22.2N	25 25.3W 25 25.3W	CTD MS UFL LMD TRANSM WB7.4	0- 300	1601-1637 DAY	
11261 #58	4/ 7 5/ 7	31 6.0N 30 58.5N	25 3.7W 24 57.6W	OTSB14	5440-5400	2345-0309 NIGHT	LOG DIST. 17.80 KM.
11261 #59	5/ 7	30 49.5N 30 49.5N	24 50.6W 24 50.6W	CTD MS UFL LMD TRANSM WB7.4	0- 300	0900-0943 DAY	
11261 #60	5/ 7	31 4.0N 31 8.1N	25 9.7W 25 14.6W	OTSB14	5440-5400	1620-1920 DAY	NO DISTANCE RUN; NET FAST
11261 #61	6/ 7	31 13.2N 31 14.8N	25 16.9W 25 19.1W	RMT1M/1 RMT8M/1	600- 700	0152-0252 NIGHT	FLOW DIST. 3.28 KM.
11261 #62	6/ 7	31 14.8N 31 16.4N	25 19.1W 25 21.4W	RMT1M/2 RMT8M/2	700- 800	0252-0352 NIGHT	FLOW DIST. 3.91 KM.
11261 #63	6/ 7	31 14.4N 31 19.2N	25 21.7W 25 21.4W	RMT1M/1 RMT8M/1 NBES	5345-5385	1325-1524 DAY	48-90M OFF BOTTOM FLOW DIST. 7.24 KM.

STN.	DATE 1985	POSITION LAT	POSITION LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11261 #64	6/ 7	31 19.2N 31 24.3N	25 21.4W 25 21.3W	RMT1M/2 RMT8M/2 NBES	5385-5410	1524-1735 DAY	25-48M OFF BOTTOM FLOW DIST. 8.71 KM.
11261 #65	6/ 7	31 24.3N 31 28.9N	25 21.3W 25 21.9W	RMT1M/3 RMT8M/3 NBES	5410-5430	1735-1929 DAY	11-31M OFF BOTTOM FLOW DIST. 7.64 KM.
11261 #66	7/ 7	31 33.0N 31 30.5N	25 25.8W 25 26.1W	RMT1M/1 RMT8M/1	1200-1300	0112-0212 NIGHT	FLOW DIST. 3.59 KM.
11261 #67	7/ 7	31 30.5N 31 28.4N	25 26.1W 25 25.5W	RMT1M/2 RMT8M/2	1300-1400	0212-0312 NIGHT	FLOW DIST. 4.18 KM.
11261 #68	7/ 7	31 28.4N 31 26.3N	25 25.5W 25 25.2W	RMT1M/3 RMT8M/3	1400-1520	0312-0412 NIGHT	FLOW DIST. 3.82 KM.
11261 #69	7/ 7	31 11.2N 31 7.9N	25 25.3W 25 25.2W	RMT1M/1 RMT8M/1	3900-4300	1153-1311 DAY	FLOW DIST. 4.22 KM.
11261 #70	7/ 7	31 7.9N 31 4.7N	25 25.2W 25 25.2W	RMT1M/2 RMT8M/2	4300-4700	1311-1423 DAY	FLOW DIST. 4.35 KM.
11261 #71	7/ 7	31 4.7N 31 2.3N	25 25.2W 25 25.2W	RMT1M/3 RMT8M/3	4700-5100	1423-1516 DAY	FLOW DIST. 3.15 KM.
11261 #72	7/ 7	30 53.7N 30 53.7N	25 22.7W 25 22.7W	CTD MS LMD UFL TRANSM	0- 300	1923-2004 NIGHT	

STN.	DATE 1985	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11261	7/ 7	30 59.7N	25 21.2W	RMT1M/1	0- 25	2147-2247	
#73		31 1.3N	25 19.2W	RMT8M/1		NIGHT	FLOW DIST. 4.04 KM.
11261	7/ 7	31 1.3N	25 19.2W	RMT1M/2	25- 50	2247-2347	
#74		31 2.8N	25 17.1W	RMT8M/2		NIGHT	FLOW DIST. 3.68 KM.
11261	7/ 7	31 2.8N	25 17.1W	RMT1M/3	50- 100	2347-0047	
#75	8/ 7	31 4.4N	25 15.1W	RMT8M/3		NIGHT	FLOW DIST. 3.46 KM.
11262	12/ 7	31 23.5N	25 6.7W	RMT1M/1	1500-1910	2225-0025	
# 1	13/ 7	31 23.2N	25 13.3W	RMT8M/1		NIGHT	FLOW DIST. 8.18 KM.
11262	13/ 7	31 23.2N	25 13.3W	RMT1M/2	1910-2315	0025-0227	
# 2		31 22.8N	25 19.3W	RMT8M/2		NIGHT	FLOW DIST. 8.94 KM.
11262	13/ 7	31 22.8N	25 19.3W	RMT1M/3	2310-2700	0227-0429	
# 3		31 21.8N	25 25.3W	RMT8M/3		NIGHT	FLOW DIST. 8.22 KM.
11262	13/ 7	31 19.7N	25 17.0W	RMT1M/1	2700-3110	1030-1230	
# 4		31 19.4N	25 10.8W	RMT8M/1		DAY	FLOW DIST. 7.91 KM.
11262	13/ 7	31 19.4N	25 10.8W	RMT1M/2	3110-3500	1230-1518	
# 5		31 18.6N	25 2.4W	RMT8M/2		DAY	FLOW DIST. 11.38 KM.
11262	13/ 7	31 18.6N	25 2.4W	RMT1M/3	3330-3910	1518-1737	
# 6		31 23.0N	24 58.1W	RMT8M/3		DAY	FLOW DIST. 9.60 KM.
11262	13/ 7	31 28.4N	24 56.3W	CTD	0-5424	2042-0135	SUCCESSFUL BSNAP RELEASE TEST
# 7	14/ 7	31 28.4N	25 56.3W	MS		NIGHT	
				TRANSM			
11262	14/ 7	31 27.4N	24 56.3W	RMT1M/1	500- 600	0227-0329	
# 8		31 25.0N	24 56.5W	RMT8M/1		NIGHT	FLOW DIST. 3.91 KM.

STN.	DATE 1985	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11262	14/ 7	31 25.0N	24 56.5W	RMT1M/2	600- 495	0329-0432	
# 9		31 22.5N	24 56.5W	RMT8M/2		NIGHT	FLOW DIST. 4.67 KM.
11262	14/ 7	31 14.2N	25 10.8W	RMT1M/1	3900-4295	1050-1253	
#10		31 13.5N	25 16.7W	RMT8M/1		DAY	FLOW DIST. 6.47 KM.
11262	14/ 7	31 13.5N	25 16.7W	RMT1M/2	4295-4720	1253-1453	
#11		31 12.7N	25 22.4W	RMT8M/2		DAY	FLOW DIST. 7.28 KM.
11262	14/ 7	31 12.7N	25 22.4W	RMT1M/3	4720-5110	1453-1653	
#12		31 12.4N	25 27.9W	RMT8M/3		DAY	FLOW DIST. 8.09 KM.
11262	14/ 7	31 12.1N	25 34.0W	NN	0- 0	2030-0630	SERIES of 12 TOWS
#13	15/ 7	31 16.0N	25 4.6W			NIGHT	
11262	15/ 7	31 14.6N	25 27.9W	CTD	0-5349	2115-0130	UNSUCCESSFUL BSNAP RELEASE TEST
#14	16/ 7	31 14.6N	25 27.9W	MS		NIGHT	
				TRANSM			
11262	16/ 7	31 14.7N	25 8.6W	BN1.5/3M	5432-5432	0839-1109	
#15		31 13.2N	25 3.9W	SBN 0.5		DAY	LOG DIST. 0.47 KM.
11262	16/ 7	31 9.1N	25 12.6W	BN1.5/3M	5432-5432	2320-0051	
#16	17/ 7	31 8.7N	25 9.6W	SBN 0.5		NIGHT	LOG DIST. 2.16 KM.
11262	17/ 7	31 13.3N	25 14.4W	BN1.5/3M	5432-5432	1214-1417	
#17		31 11.5N	25 9.5W	SBN 0.5		DAY	LOG DIST. 4.08 KM.
11262	17/ 7	31 6.4N	25 31.9W	CTD	0-2000	2157-2354	SUCCESSFUL BSNAP RELEASE TEST
#18		31 6.4N	25 31.9W	TRANSM		NIGHT	
11262	18/ 7	31 19.8N	25 29.0W	BN1.5/3M	5432-5432	0539-1224	
#19		31 34.0N	25 26.9W	SBN 0.5		DAY	LOG DIST. 7.95 KM.

STN.	DATE 1985	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11262	19/ 7	31 28.0N	25 12.3W	BN1.5/P	5110-5220	0444-0742	
#20		31 31.7N	25 8.7W			DAWN	
11262	19/ 7	31 15.2N	25 25.4W	B.SNAP	5376-5376	1447-1651	
#21		31 15.2N	25 25.4W			DAY	
11262	19/ 7	31 15.3N	25 22.1W	RMT1	800- 680	1812-1912	
#22		31 14.6N	25 19.0W	RMT8		DAY	FLOW DIST. 4.40 KM.
				CCE			
11262	19/ 7	31 11.2N	25 18.3W	RMT1	800- 665	2157-2257	
#23		31 9.7N	25 20.3W	RMT8		NIGHT	FLOW DIST. 3.77 KM.
				CCE			
11262	20/ 7	31 10.0N	25 19.4W	RMT1	800- 585	0146-0316	
#24		31 12.5N	25 16.4W	RMT8		NIGHT	FLOW DIST. 5.48 KM.
				CCE			
11262	20/ 7	31 15.3N	25 10.5W	RMT1M/1	5340-5375	1647-1847	51-90M OFF BOTTOM
#25		31 16.7N	25 5.7W	RMT8M/1		DAY	FLOW DIST. 7.10 KM.
				NBES			
11262	20/ 7	31 16.7N	25 5.7W	RMT1M/2	5375-5415	1847-2047	25-51M OFF BOTTOM
#26		31 18.0N	25 1.9W	RMT8M/2		DAY	FLOW DIST. 7.19 KM.
				NBES			
11262	20/ 7	31 18.0N	25 1.9W	RMT1M/3	5415-5430	2047-2247	10-25M OFF BOTTOM
#27		31 19.4N	24 58.8W	RMT8M/3		DUSK	FLOW DIST. 7.73 KM.
				NBES			
11262	21/ 7	31 28.4N	25 13.7W	BN1.5/Q	5400-5200	1156-1310	
#28		31 29.3N	25 10.7W			DAY	LOG DIST. 1.10 KM.

STN.	DATE 1985	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11262 #29	21/ 7	31 19.9N 31 19.9N	24 53.9W 24 53.9W	B.SNAP	5433-5433	2026-2216 DUSK	
11263 # 1	22/ 7	32 41.9N 32 43.6N	23 45.8W 23 43.9W	RMT1 RMT8 CCE	1000- 370	0952-1052 DAY	FLOW DIST. 3.91 KM.
11263 # 2	22/ 7	32 47.3N 32 48.9N	23 40.5W 23 39.2W	RMT1 RMT8 CCE	900- 740	1312-1412 DAY	FLOW DIST. 3.39 KM.
11264 # 1	22/ 7	33 27.4N 33 28.7N	22 57.5W 22 55.7W	RMT1 RMT8 CCE	800- 590	2054-2154 NIGHT	FLOW DIST. 3.64 KM.
11264 # 2	22/ 7 23/ 7	33 30.8N 33 32.5N	22 53.2W 22 51.3W	RMT1 RMT8 CCE	500- 315	2341-0041 NIGHT	FLOW DIST. 4.00 KM.
11265 # 1	23/ 7	34 27.6N 34 29.2N	21 41.9W 21 47.4W	RMT1 RMT8 CCE	1100- 870	0920-1020 DAY	FLOW DIST. 3.82 KM.
11265 # 2	23/ 7	34 32.9N 34 34.7N	21 43.9W 21 42.7W	RMT1 RMT8 CCE	1300-1040	1249-1349 DAY	FLOW DIST. 3.37 KM.
11266 # 1	23/ 7	0 0. 0 0.	0 0. 0 0.	RMT1 RMT8 CCE	800- 590	2048-2143 NIGHT	FLOW DIST. 3.55 KM.
11266 # 2	23/ 7 24/ 7	35 22.3N 35 24.7N	21 2.9W 21 0.4W	RMT1 RMT8 CCE	300- 190	2316-0046 NIGHT	FLOW DIST. 5.82 KM.

STN.	DATE 1985	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11267	24/ 7	36 20.3N	20 21.6W	RMT1	1500-1270	0940-1130	
# 1		36 24.0N	20 19.3W	RMT8		DAY	FLOW DIST. 6.75 KM.
				CCE			
11268	24/ 7	37 31.2N	19 26.3W	RMT1	600- 405	2039-2209	
# 1		37 33.7N	19 23.7W	RMT8		NIGHT	FLOW DIST. 5.77 KM.
				CCE			
11268	24/ 7	37 35.6N	19 21.1W	RMT1	215- 120	2326-0026	
# 2	25/ 7	37 37.3N	19 19.0W	RMT8		NIGHT	FLOW DIST. 4.00 KM.
				CCE			
11269	25/ 7	38 43.3N	18 17.7W	RMT1	810- 615	0858-0958	
# 1		38 44.9N	18 15.4W	RMT8		DAY	FLOW DIST. 3.64 KM.
				CCE			
11269	25/ 7	38 46.9N	18 12.1W	RMT1	600- 400	1133-1304	
# 2		38 49.0N	18 9.5W	RMT8		DAY	FLOW DIST. 5.23 KM.
				CCE			
11270	25/ 7	39 39.7N	17 5.0W	RMT1	1000- 690	2109-2221	
# 1		39 41.1N	17 2.8W	RMT8		NIGHT	FLOW DIST. 4.30 KM.
				CCE			
11270	25/ 7	39 42.4N	17 0.1W	RMT1	300- 90	2351-0100	
# 2		39 43.6N	16 57.3W	RMT8		NIGHT	FLOW DIST. 4.71 KM.
				CCE			
11271	26/ 7	40 31.8N	15 36.2W	RMT1	805- 675	0849-1019	
# 1		40 33.2N	15 32.4W	RMT8		DAY	FLOW DIST. 5.68 KM.
				CCE			

STN.	DATE 1965	POSITION LAT	POSITION LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
11271 # 2	26/ 7	40 34.9N 40 36.2N	15 29.0W 15 26.7W	RMT1 RMT8 CCE	510- 355	1154-1254 DAY	FLOW DIST. 4.04 KM.
11272 # 1	26/ 7	41 26.5N 41 27.8N	14 6.5W 14 2.5W	RMT1 RMT8 CCE	800- 620	2057-2227 NIGHT	FLOW DIST. 5.95 KM.
11272 # 2	26/ 7 27/ 7	41 28.9N 41 30.1N	13 59.0W 13 56.5W	RMT1 RMT8 CCE	300- 100	2357-0057 NIGHT	FLOW DIST. 4.00 KM.

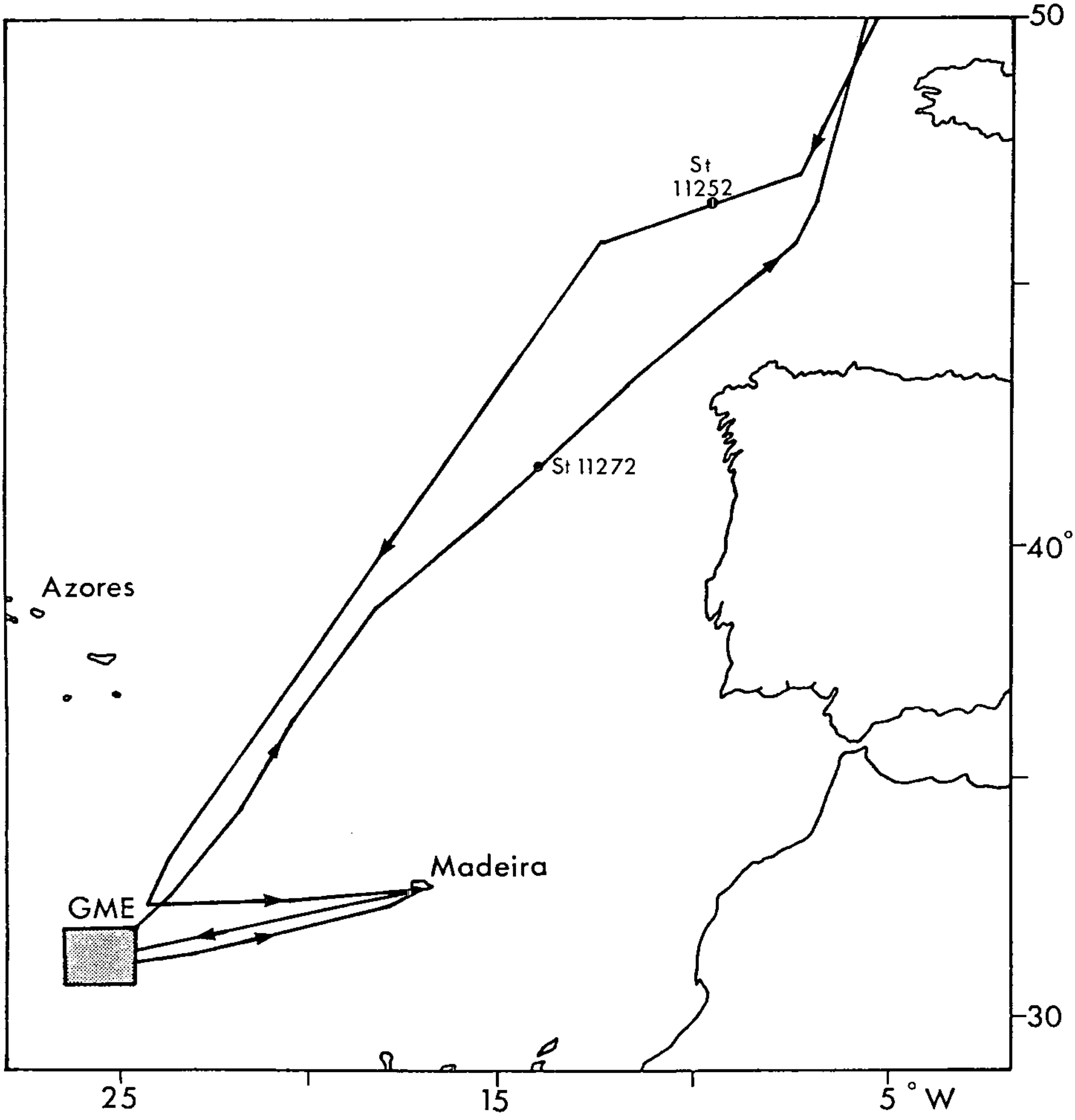

FIGURE 1. Track chart RRS Discovery Cruise 156. Stns 11252 and 11272 are the first and last stations respectively; GME is the main work area.

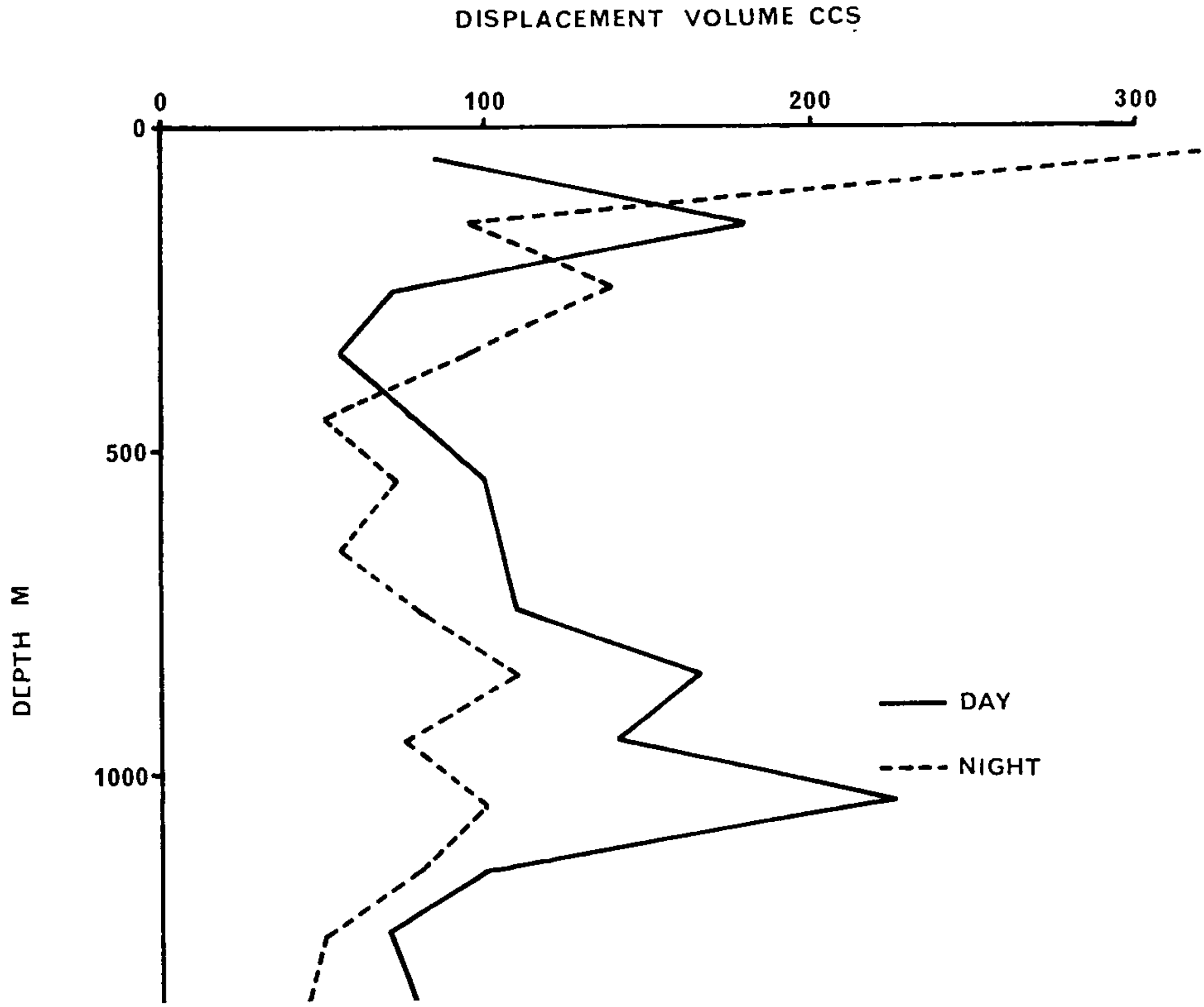

FIGURE 2A. Profiles of displacement volumes of complete RMT 8 micronekton samples (unstandardised) by both day and night.

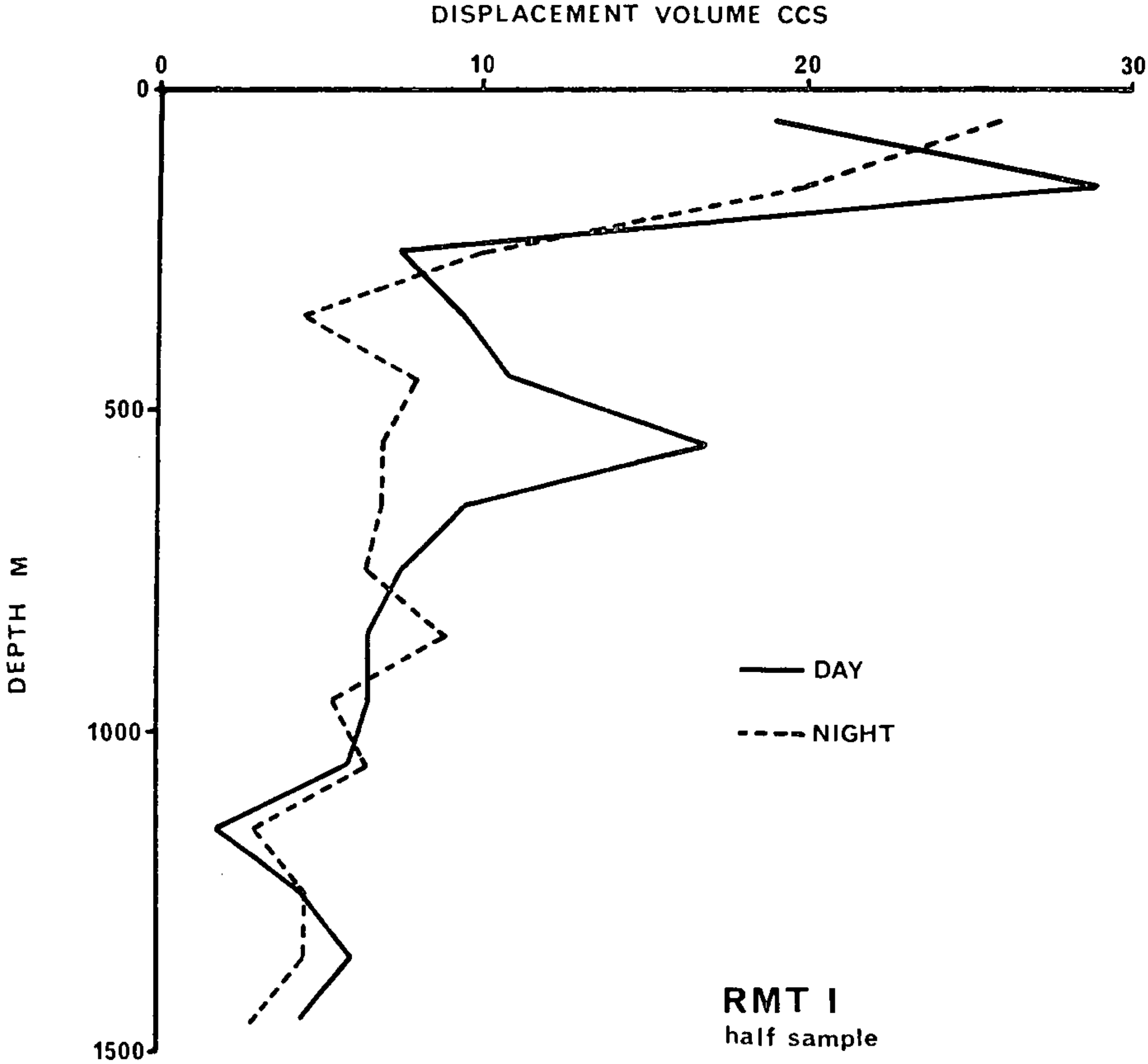

FIGURE 2B. Profiles of displacement volumes of half samples of RMT 1 macroplankton samples (unstandardised) by both day and night.

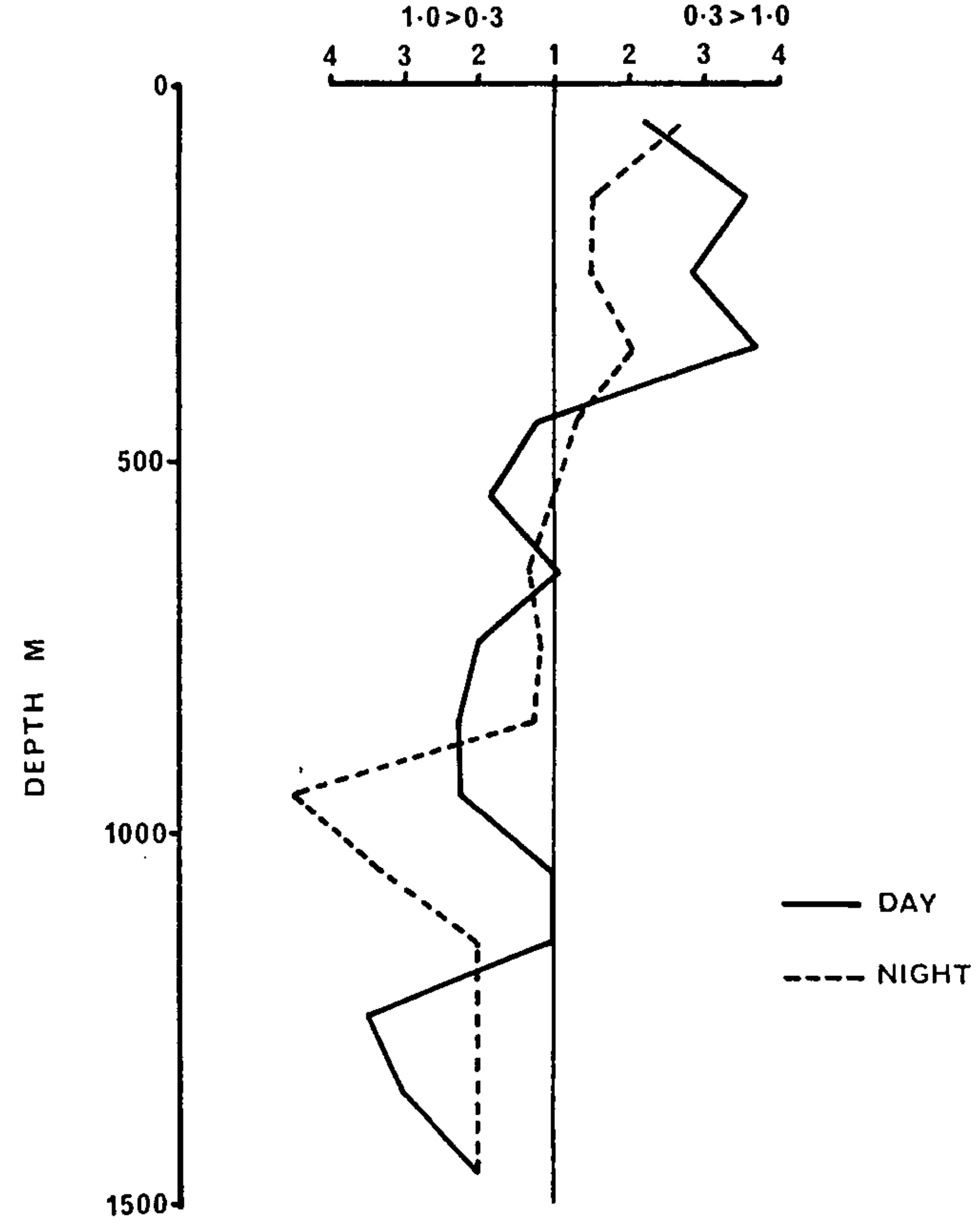

FIGURE 3. Ratio between displacement volumes of 1.0 and 0.32mm fractions of RMT 1 samples, showing the shift in ratios with depth.

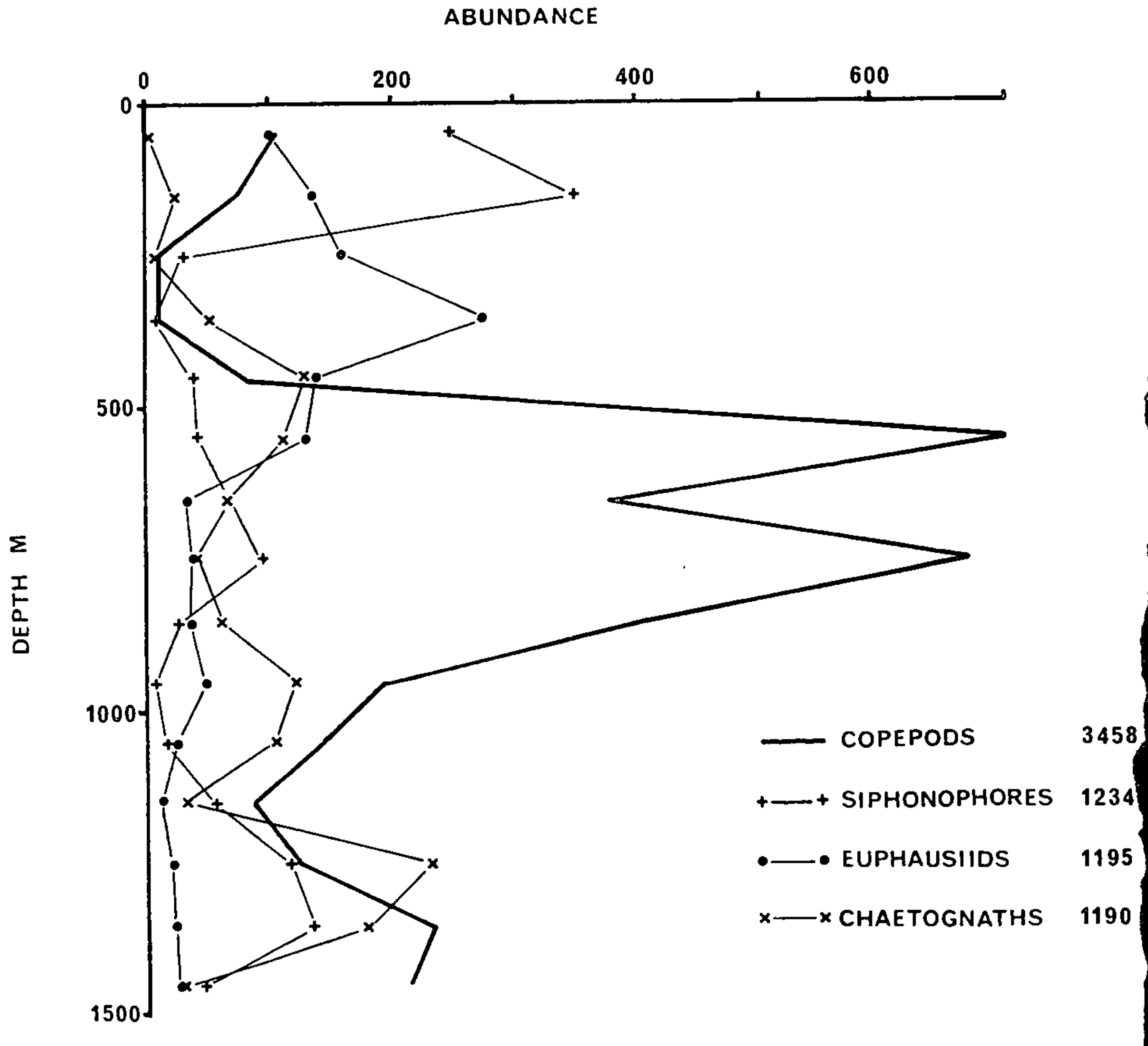

FIGURE 4. Profiles of numerical abundance of the four dominant groups of macroplankton in the 1.0mm half subsamples in the RMT 1 daytime samples. The counts per half sample for each group are shown.

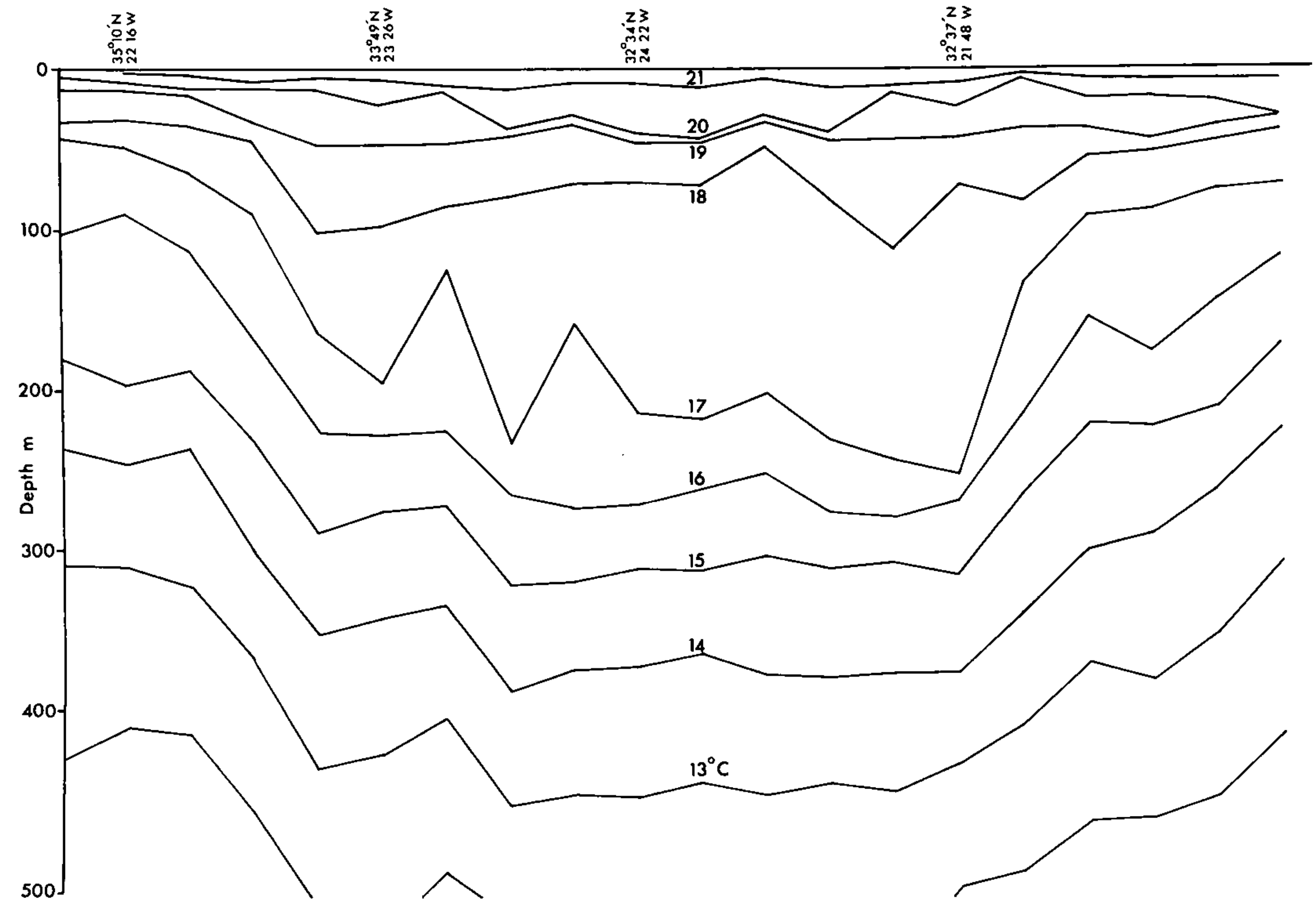

FIGURE 5. Part of the XBT profile from the first leg; the course is SW to 32°34'N and E thereafter.