SCOTTISH MARINE BIOLOGICAL ASSOCIATION

Dunstaffnage Marine Research Laboratory

and

STIRLING UNIVERSITY

Department of Biology.

Cruise Report

RRS Challenger.

Cruise 2/1979

29th January - 25th February,

1979.

Duration of Cruise: 09.30 29th January until 06.00 25th February calling at Funchal, Madeira 10-12th February and 18th February.

All times G.M.T.

Locality: N.E. Atlantic (Madeira) 30°-35°N, 15°-20°W and stations on passage.

Scientific Staff:			
	Dr J. Gordon	Principal Scientist	SMBA
	Dr B. Hardy		SMBA
	Mr. J. Watson		SMBA
	Dr. M. Clarke		MBA
	Mr. R. Douglas	29th Jan-18th Feb	Stirling University
	Prof. W. Munz	29th Jan-11th Feb.	" "
	Dr. L. Ross	" "	" "
	Dr W. Wales	" "	" "
	Dr. E. Ferraro	" "	Université de Trieste
	Prof. E. Truman	" "	University of Manchester
	Dr. A. Packard	11th Feb-25th Feb	University of Edinburgh
	Dr. J. Henderson	" "	IMB
	Mr. G. Mouat	" "	Stirling University
	Dr. V. Pasztor	11th Feb-18th Feb	McGill University, Montreal.
	Dr. M. Ali	" "	Université de Montreal.

Ships Officers:		
	Master	G. Long
	Chief Officer	P. Coombs

2nd Officer	R. Coutts
3rd Officer	G. Harries
Fishing Skipper	F. Dunning
Chief Engineer	D. Rowlands
2nd Engineer	I. McGill
3rd Engineer	J. Richardson
4th Engineer	P. March

Aims (1) Physiological studies of mid-water and benthic animals. Specific problems included vision in fish and cephalopods, locomotion in cephalopods, comparative morphology and sensory systems of crustacea, swimbladder function in fish and wax ester biosynthesis in teleosts.

(2) To extend the meiobenthic coring work carried out in the Rockall Trough and the Porcupine Abyssal Plain to the Biscay and Iberian Abyssal plains. Also to collect meiobenthic cores from isolated seamounts and in shallow water around Madeira.

Weather Westerly and South-westerly gales during the outward passage and around Madeira caused a considerable loss of working time on the first leg. The weather during the 2nd leg and on the homeward passage was generally good.

Narrative

The scientific party joined ship on Sunday 28th January and Challenger sailed from Barry Dock at 09.30 (29th). Passage to the first station was delayed to await the arrival of two new crew members and for clarification of the position of the Portuguese observer who was expected on board on the 28th. The crew boarded by pilot cutter at 14.15 with the news that the observer was unable to leave Lisbon. Challenger sailed at 14.30.

The favourable light westerly winds soon gave way to south-westerly gales and Challenger remained hove to in the Bay of Biscay from 12.00 (31st) until 16.00 (1st Feb). Since there was little prospect of an improvement in the weather it was decided to abandon the first three coring stations (the proposed stations are given in Table 1) and proceed direct to station 4. Challenger was further delayed by fresh winds and eventually hove to on station at 04.00 (3rd Feb.). Two drops were made with the multiple corer in a depth of 5275 m but both failed to take cores. The RMT 8 was then fished successfully at a depth of approximately 750 m. The net was inboard at 14.30 and Challenger continued on passage while the corer was being checked for faults. A further drop with the corer was made at 20.12 and this time 12 good cores were obtained. Whilst on station rod and line fishing yielded four cephalopods which were used for physiological studies.

Passage to station 5 was delayed by freshening winds and eventually the corer was lowered at 10.20 (4th) in the deep depression in the Tore Seamount (5715 m). 12 good cores were obtained but unfortunately the corer was damaged during recovery in the heavy swell. Ever freshening winds prevented further work and Challenger steamed south

at reduced speed in the hope that the weather might improve and allow the RMT 8 to be fished. The net was finally shot at 0900 (5th Feb.) and recovered at 12.10. Challenger then steamed to coring station 6 (Josephine Seamount) and since the bottom looked favourable the Aggasiz trawl was shot at 15.25 (5th) at a depth of 800 m in an attempt to obtain some larger decapods and fish. However on recovery the net was found to be torn and no sample was obtained. The multiple corer was then lowered twice on top of the seamount in a depth of 670 m but on the first drop the mechanism failed to fire and on the second the core tubes were chipped indicating a hard bottom. The station was complete by 18.35 and Challenger proceeded towards coring station 7 (Lion seamount). At 0400 (6th Feb) Challenger hove to the north of the station and a series of five RMT 8 stations were worked until 20.25. Echo-soundings of the Lion Seamount indicated a hard bottom and it was decided not to risk further damage to the corer.

Challenger then steamed south towards the deep water north of Madeira heaving to three times during the night for hand lining and dip netting. On completion of the last station at 07.30 (7th Feb.) Challenger remained hove to whilst a noise in the engine room was investigated. It was found that a weir on one of the stabiliser tanks had broken free. Meanwhile the RMT 45 was rigged and was shot at 10.05. A good catch was obtained but during a second haul between 14.25 and 18.40 the top bar was badly bent. We were grateful to the ships engineers who made a temporary repair and enabled us to fish the net again between 20.38 and 23.55. A good catch was obtained but a substantial rip down on one side of the net meant that it had to be recovered inboard for repair. By this time Challenger was close to coring station 8 and the multiple corer was made ready and worked between 00.40 and 02.46 with only

partial success.

Challenger then steamed closer to the north of Madeira and on passage the damaged RMT 45 was repaired. The net was fished twice between 13.14 and 20.05 (18th Feb.) with good results but whilst shooting for a third time it was ripped beyound repair and had to be recovered. The RMT 8 was rigged, once more, and fished twice between 22.50 and 04.10. An unsuccessful search was made for an area suitable for coring and Challenger hove to for line fishing and dip netting until dawn. The RMT 8 was fished between 08.50 and 1.55 (9th Feb.) but during the haul the wind freshened to a steady 30–40 knots and it was decided to seek a lee off Deserta Grande.

On passage a new net consisting of an RMT 7 and RMT 8 fished in combination was rigged. This net was used successfully for three hauls between 20.07 (9th Feb.) and 05.44 (10th Feb.). During the night the weather conditions deteriorated and during recovery of the final haul the wind had reached a steady 50k. No further work being possible Challenger hove to in the lee of Deserta Grande. At 11.00 Challenger steamed back to the fishing area but by this time the wind was gusting to 70 knots and it was decided, since no work would be possible in the remaining 12 hours of working time, to enter Funchal early. During passage wind speeds of up to 85k were recorded and Challenger made fast at 19.45 (10th Feb.).

Challenger sailed from Funchal at 12.00 (12th Feb.) to commence the second leg of the cruise. In order to give the scientists who had just joined time to set up their apparatus it was decided to steam south of Madeira in an attempt to find an area suitable for coring. The multiple corer was lowered three times between 19.50 (12th Feb.) and 05.30 (13th Feb.) in a depth of 4578 m.

The first two drops were blank and on the third five small cores were collected. The RMT 7 and 8 combination net was then rigged and shot at 0600 (13th Feb.) and a series of 11 hauls were successfully completed by 10.04 (15th Feb.). During this period line fishing was attempted between 19.00 and 22.00 (13th Feb.) and one drop with the multiple corer was made between 19.40 and 22.30 (14th Feb.). During the first leg of the cruise the pulse power amplifier and its spare of the PES III had become defective (a fairly frequent occurrence of Challenger in recent months) which meant that no bottom soundings could be taken but the pinger could still be received. During the drop with the corer a further fault developed and the pinger was ineffective. The attempt to determine bottom contact with the tension recording was unsuccessful in the depth of water. On the 15th February a rope fouled the rudder, but cleared itself later and the weir in the second stabiliser broke free.

Challenger then steamed to a new area to the west of Porto Santo with a stop for line fishing between 20.30 and 22.50 (15th Feb.). The RMT 7 and 8 combination was then fished twice between 00.42 and 07.30 (16th Feb.). Challenger then steamed closer to Porto Santo in an attempt to find an area suitable for shooting a long line. The first area chosen proved unsuitable but eventually an area of the slope to the north-west of Porto Santo was chosen. A long line of 50 hooks was shot between 10.17 and 10.55 in a depth of 1100 m. Challenger then moved off from the dhan buoy and the multiple corer was lowered but while paying out Challenger drifted off into an area of of precipitous slopes and the corer had to be recovered before bottom contact was made. Recovery of the long line began at 14.18 and it was inboard by 15.24. One of the anchor weights was missing and a disappointing catch of only two fish was obtained.

Challenger then steamed offshore into deeper water and the RMT

7 and 8 combination was fished 4 times between 16.30 (14th Feb.) and 13.56 (17th Feb.) with a stop for line fishing between 21.30 and 00.55. Challenger then steamed towards Funchal and the RMT 7 and 8 was fished twice between 17.05 (17th Feb.) and 04.20 (18th Feb.) with a stop for line fishing between 20.40 and 00.07. Challenger made fast alongside Funchal at 07.30 and after bunkering and landing three of the scientific party sailed for Barry at 12.00 (18th Feb.).

It was the original intention to work some of the coring stations which had been missed on the outward passage on the return passage. The loss of the PES III however, meant that the multiple corer could not be deployed in deep water and some of the spare time was used for line fishing. Challenger made fast alongside Barry Dock at 0.600 (25th Feb.).

RESULTS

(1) Midwater

(a) Fishing gear

On the outward passage a conventional RMT 8 was fished according to a standard routine which applied to all hauls throughout the cruise. The net was lowered at about 12 m/min for the first 200-300 m and when there was sufficient tension on the wire the speed of payout was increased to 0.40 m/min at a ships speed of 2 knots. When the required amount of wire had been payed out the net was fished for two hours still at 2 knots. Prior to hauling the ships speed was reduced to 1 knot and the net was hauled at 20 m/min. At stations 5, 8, 9, 10 and 11 an experimental catch protector was used in an attempt to improve the quality of the animals for physiological studies.

A prototype RMT 45 was tested and found to catch larger and less common species than the RMT 8. Unfortunately only 5 hauls were made with this net before it was irreparably damaged. We are grateful to the ships engineers and the fishing skipper for their help in maintaining this net.

The combination RMT 7 and 8 fished very well and produced catches in better condition than normal due to the slow rate haul at the reduced ships speed.

On two occasions (Stations 12 and 18) the nets were recovered in darkness. We are grateful to the Chief Officer for his handling of this difficult operation.

A disappointment of the cruise was our inability to catch squid and fish by hand lines and dipnets in the working area. These methods are usually successful in this area and we can only suppose that the lack of success was related to the season of the year.

(b) Cephalopods - Clarke, Trueman, Packard.

An unusually diverse and comprehensive collection of 337 cephalopods was made in 32 RMT hauls representing an unusually high number of 10 per haul. Many of these were very young specimens and will be very useful in interpreting growth and larval stages of North Atlantic cephalopods as well as providing a large number of statoliths for a study of their form and variation currently underway.

Many specimens were alive when brought on board and the first studies of locomotion of oceanic cephalopods were carried out. In all, cephalopods belonging to 19 genera and 15 families including octopods, vampyromorphs, sepiods and teuthoids were studied using a pressure transducer to measure mantle pressures during respiratory movements and

jet propulsion. The force generated by the jet thrusts was measured in some cases and films will help with the analysis of mantle, head and fin movements. Measurements included cephalopods varying in size from 600 g to less than 0.1 g and fast-swimming Ommastrephids to members of all but one of the slow-swimming, neutrally buoyant, ammonical squid families.

Several specimens of the very rare Joubiniteuthis, Pholidoteuthis and Neoteuthis were caught.

(c) Fish and cephalopod visual systems. Muntz, Douglas, Mouat.

The following experiments were carried out on the visual systems of fishes and cephalopods.

1) Dark adaptation in Gonostoma. This mesopelagic teleost has a tiered retina, so that only one of the layers of rods is in contact with the pigment epithelium. Since in most vertebrates visual pigment regeneration depends on such contact, it may be that in Gonostoma dark adaptation through pigment regeneration is not possible, except for the outermost layer of rods. On two occasions the trawl was brought aboard at night with the ship's lights extinguished, to provide fully dark-adapted specimens. On ten other occasions the fish were light adapted, and then placed in the dark for intervals ranging from 15 mins. to 45 mins. before being killed. The eyes of all specimens were dissected out and deep frozen for later analysis of the visual pigments at Stirling.

2) Spectral absorbance of retinas, corneas and lenses. The spectral absorbances of small portions of these structures were measured using a special purpose spectrophotometer with a 0.1 x 0.8 mm measuring

spot. In all 39 such experiments were carried out. Several teleosts and one cephalopod were shown to have yellow lenses, and specimens of these lenses were frozen. An attempt to identify the pigments responsible will now be made. Most of the teleost retinas examined had typical deep-sea pigments absorbing at short (about 470 nm) wavelengths, which bleached in a typical way to colourless photoproducts. In a number of cases, however, bleaching resulted in a photoproduct very similar in shape to the parent pigment and only shifted slightly to shorter wavelengths (about 460 nm), and no amount of light exposure was able to cause further bleaching. These data were obtained by measuring the spectral absorbance of intact retinas, but specimens were also frozen so that conventional visual pigment extracts can now be made.

3) Electroretinograms. Attempts were made to record the electroretinogram. From the electronics point of view no problems were encountered: AC interference was minimal, the vibration and movements of the boat did not interfere with recording, and on one occasion a very small ERG was obtained. This was, however, the only success, and it seems clear that specimens are needed in better physiological condition than those obtained.

4) All specimens used were fixed, and are being identified for us by Dr. Merrett, at the Institute of Oceanographic Sciences. Eyes from most of the species used were also fixed, and are being prepared for histological examination.

(d) Crustacean sensory systems. Wales and Ferraro

Although some interesting specimens were captured the vital

staining techniques were unsuccessful, not due to faulty technique but due to the very small size of the nerves and neurone somata. In order to obtain the desired data, specimens of the more interesting crustaceans were fixed for conventional light and electron microscopy. However, the vital staining technique did enable us to make observations on the organisation of the nervous system in some bathypelagic amphipods.

Specimens of the more interesting species were collected and catalogued for identification. Two identical collections were made to facilitate co-operation between Dr Wales at Dunstaffnage and Dr Ferrero at Trieste.

The eyes of several species of Decapoda, Ostracoda, Amphipoda and Mysidacea representing a wide range of morphological adaptation were fixed and processed for both transmission and scanning electron microscopy.

(e) Crustacean musculature. Pasztor

The original plan to study the proprioreceptors of swimming decapod crustacea was abandoned because of a lack of suitable animals. Instead a study of the muscle ultrastructure of Cystostoma was undertaken. Five specimens were captured, mostly in the night hauls, ranging in size from 1.0 - 3.0 cm. They were totally devoid of chromatophores so that the internal organs could be viewed easily in the living material. The musculature is remarkably small, a segment of an appendage being powered by two small muscle bundles only 20% of the length of that segment. Since these animals presumably perform vertical migration, the efficiency of these

muscles presents an enigma.

One animal was perfused with methylene blue. The muscles took up the stain but the nerves did not. A permanent whole mount was made. Two specimens were preserved in Bouins fluid for subsequent light microscopy. The remaining two animals were perfused, whilst living, with Gluteraldehyde-Formaldehyde preservative for subsequent examination by electron microscopy.

Two other, more common, species of amphipod were also fixed in Gluteraldehyde. Their musculo-skeletal systems appeared to be more typical of crustacea and should make interesting comparisons with the Cyclostoma material.

(f) Fish eyes. Ali

The aim of this study was to (1) study the morphology of the isolated photoreceptors, particularly in the species with tiered retinas and (2) to study the synaptic relationship between the photoreceptors and the components of the external nuclear layer (horizontal cells and bipolar cells). 24 species belonging to a variety of midwater families were used. Their retinas were fixed in a gluteraldehyde-paraformalidehyde mixture and some were treated with pronase to disrupt the tissue. Some material was examined on board but most was stored in a buffer solution for examination at Montreal. The ultrastructural relationship between the photoreceptors and the external nuclear layer will be studied in an attempt to shed some light on the structure of the tiered and grouped retinas of deep-sea fish.

(g) Physiology of mesopelagic fish swimbladders - Ross

An attempt was made to continue work on the physiology of mesopelagic fish swimbladders, begun in 1975. Hand-netted fish were pressurised to 100 m in an attempt to learn something of their buoyancy adjustment capabilities. Due to the poor weather conditions experienced on the first leg, few results were obtained. The buoyancy responses of those fish tested, however, were of interest. Fish could not be induced to secrete gas using this technique and in every case rapid gas resorption took place. It is hoped to consolidate this work at a later date.

(h) Wax ester biosynthesis in teleosts

(b) Wax ester biosynthesis in teleosts. Henderson

Although many marine species of teleosts have been shown by analytical procedures to contain wax ester as a major lipid component, very little is known concerning the biosynthesis of these wax esters. It was intended therefore, to determine approximately the wax ester content of tissues excised from freshly caught fish, and to use those tissues containing wax ester in experiments designed to yield information on the synthesis of this lipid from low molecular weight precursors.

To this end lipids extracted quickly from portions of liver, muscle and intestinal caecae were analysed rapidly by HPTLC (high performance thin layer chromatography) to determined whether wax esters were present in these tissues. Several species, notably the Gonostomatidae and Synaphobranchus, were found to be rich in wax esters, whereas the Myctophidae species examined contained purely triglyceride as neutral lipid.

Portions of liver, muscle and intestinal caecae were incubated separately in physiological teleost saline containing 4% albunium along with U - ^{14}c glucose or U - ^{14}c alanine (1 mM, 2.5 uCi) in sealed bottles under an atmosphere of O_2 : CO_2 (95 : 5). Similar portions of tissues, were set aside for DNA analysis. After the required length of time (up to 8 hours), the incubations were stopped. $^{14}CO_2$ produced from the ^{14}C-labelled substrates was collected in centre wells which were placed in scintillation vials for measurement of radioactivity on shore. 5 ml of chloroform : methanol (2 : 1) were added to each incubation and the whole system stored for further lipid extraction and measurement of ^{14}C -labelled

substrate incorporation in the shore laboratory.

(2) Meiofauna. Hardy and Watson.

The multiple corer was used on 10 occasions, only 4 of which were successful, during the cruise and provided 33 usable cores. Two sets of twelve good cores were collected from greater depths than had previously been sampled by this corer, from 5476 and 5715 m respectively on the Iberia Abyssal Plain and in the deep centre of the Tore seamount.

Sampling stations in the Biscay area had to be abandoned because of severe weather conditions. Severe weather also prevented sampling at some of the planned stations in the neighbourhood of Madeira. In addition the tops of seamounts (e.g., Josephine) and the area around Madeira were found to be too rocky and precipitous for coring and attempts at coring there had to be abandoned because of fears of severely damaging or losing the corer. The corer was in fact damaged on one occasion during recovery in rough seas, the framework was badly twisted and one leg had to be replaced. Repairs required the assistance of the ships' engineers.

Coring operations were also hampered by the failure of the power pulse amplifier in the P.D.R. This was replaced and lasted for 24 hours before it also failed. As this was the only spare unit on board, we were no longer able to determine depths below 1600 fathoms, the maximum depth of the Atlas echo-sounder. As the P.D.R. receiver was still operational, we were still able to make use of the pinger on the corer until the 3rd week, when the receiver itself

became defective. This left us with no knowledge of how much wire to pay out to reach the bottom, with the result that coring had to be abandoned.

As in a number of previous cruises, the digital display panel of the metering gear was unreliable and we had to depend on a single mechanical counter on the winch control panel. The rate of pay-out meter is still inoperative. The failure of both stabiling tanks on the Challenger also made handling of the multiple corer very difficult on the after deck.

(3) Other bottom work.

The Agassiz trawl was only used once and was badly torn. No areas suitable for bottom trawling were found in the working area. The long line was shot once but only yielded 2 fish.

J.D.M. Gordon.

MARCH 1979.

TABLE I

Proposed Meiofauna coring stations.

1.	Biscay Abyssal Plain (North)	46°30'N 11°20'W
2.	North Charcot Seamount	45°07'N 13°20'W
3.	Biscay Abyssal Plain (South)	44°17'N 13°30'W
4.	Iberia Abyssal Plain	41°0'N 13°0'W
5.	Deep centre Tore Seamount	39°22.5'N 12°51'W
6.	Josephine Seamount	36°52.5'N 14°20'W
7.	Lion Seamount	35°15'N 15°41'W
8.	Deep, North of Madeira	34°10'N 16°26'W
9.	North of Madeira	33°04'N 16°44'W

TABLE II STATION LIST

Stat.No.	Gear	Date	Time	Position at start	Sounding (m)	Remarks
1	Multiple corer	3/2	06.00-10.40	41°36.0'N 12°48.7'W	5275	2 drops - both unsuccessful
2	RMT 8	3/2	11.16-14.33	41°34.5'N 12°48.5'W	5270	1500 m were out for 2 hours
3	Multiple corer	3/2	20.12-22.57	40°49.5'N 12°57.2'W	5476	1 drop - 12 cores. 4 squid caught on lines
4	Multiple corer	4/2	10.21-12.58	39°23.8'N 12°49.9'W	5715	1 drop - 12 cores, corer damaged on recovery
5	RMT 8	5/2	09.00-12.10	37°13.8'N 14°12.4'W	2800	1500 m wire out for 2 hours
6	Agassiz Trawl	5/2	15.25-16.56	36°51.2'N 14°20.4'W	800	Net torn - no sample
7	Multiple corer	5/2	17.40-18.35	36°49.2'N 14°21.2'W	670	2 drops - No cores - hard bottom
8	RMT 8	6/2	04.10-07.34	35°48.0'N 15°23.4'W	c.3000	1500 m wire out for 2¼ hours
9	RMT 8	6/2	07.41-11.03	35°45.9'N 15°31.2'W	2500-1700	2000 m for 14 min. 1500 m for 1 hour 34 min.
10	RMT 8	6/2	11.05-13.45	35°43.0'N 15°37.3'W	c.2000	600 m wire out for 2 hours
11	RMT 8	6/2	13.52-17.25	35°40.3'N 15°41.7'W	c.3000	2000 m wire out for 2 hours
12	RMT 8	6/2	18.11-20.25	35°34.3'N 15°49.6'N	c.3000	1500 m for 1 hour - haul at 20 m/min 400 m for 10 min - dark
13	Line Fishing	6/2	20.40-21.20	35°30.5'N 15°48.7'W	c.3000	No success
14	Line Fishing	6/2	22.50-24.00	35°18.8'N 15°51.7'W	c.3000	" "
15	Line Fishing	7/2	05.40-07.30	34°26.0'N 16°12.3'W	c.3000	" "
16	RMT 45	7/2	10.05-14.17	34°26.0'N 16°12.3'W	c.3000	1500 m wire out for 2 hours

TABLE II cont.

Stat.No.	Gear	Date	Time	Position at start	Sounding (m)	Remarks
17	RMT 45	7/2	14.25-18.40	34°16.5'N 16°16.9'W	c.3000	2000 m wire out for 2 hours. Top bar bent
18	RMT 45	7/2	20.38-23.55	34°00.7'N 16°27.6'W	c.3000	600 m wire out for 2 hours - tear in net - dark
19	Multiple corer	8/2	00.40-02.46	33°54.6'N 16°27.6'W	4050	1 drop 6 small cores - line fishing unsuccessful
20	RMT 45	8/2	13.14-15.50	32°49.6'N 16°43.1'W	c.1000	400 m wire out for 2 hours
21	RMT 45	8/2	15.55-20.05	32°51.7'N 16°46.6'W	c.1500	800 m wire out for 2 hours - net badly damaged
22	RMT 8	8/2	22.50-01.36	32°55.1'N 16°54.5'W	c.1500	600 m wire out for 2 hours
23	RMT 8	9/2	01.40-04.10	32°51.7'N 16°47.4'W	c.1500	400 m wire out for 2 hours
24	RMT 8	9/2	08.51-11.55	32°50.1'N 16°41.8'W	c.1500	800 m wire out for 2 hours
25	RMT 7 & 8	9/2	20.07-23.24	32°32.0'W 16°25.6'W	2500-3000	200 m wire out for 2 hours - wind gusting 40 k
26	RMT 7 & 8	9/2	23.30-02.20	32°27.7'N 16°21.8'W	2500-3000	400 m wire out for 2 hours
27	RMT 7 & 8	10/2	02.35-05.44	32°30.5'N 16°22.0'N	> 3000	600 m wire out for 2 hours - wind gusting 50 k
				FUNCHAL		
28	Multiple corer	12/2	19.50-05.30	32°06.4'N 17°44.2'W	4578	3 drops - 2 blank - 1 with 5 cores
29	RMT 7 & 8	13/2	06.00-09.30	32°06.9'N 17°47.8'W	> 4500	1200 m wire out for 2 hours
30	RMT 7 & 8	13/2	09.36-14.02	32°12.0'N 17°53.3'W	> 4500	2000 m wire out for 2 hours
31	RMT 7 & 8	13/2	14.57-19.00	32°16.2'N 18°03.2'W	> 4500	2500 m wire out for 2 hours

TABLE II cont.

Stat.No.	Gear	Date	Time	Position at start	Sounding (m)	Remarks
32	Line fishing	13/2	19.00-22.00	32°16.8'N 18°13.5'W	>4500	No success
33	RMT 7 & 8	13/2	22.45-01.52	32°16.0'N 18°11.1'W	>4500	600 m wire out for 2 hours
34	RMT 7 & 8	14/2	02.07-04.55	32°19.1'N 18°24.3'W	>4500	600 m wire out for 2 hours
35	RMT 7 & 8	14/2	05.10-08.35	32°25.4'N 18°30.5'W	>4500	600 m wire out for 2 hours
36	RMT 7 & 8	14/2	08.40-14.31	32°25.3'N 18°26.9'W	>4500	2000 m wire out for 2 hours
37	RMT 7 & 8	14/2	14.40-19.10	32°33.7'N 18°35.6'W	>4500	2000 m wire out for 2 hours
38	Multiple corer	14/2	19.40-22.30	32°33.4'N 18°40.7'W	4100	1 drop - No cores - No pinger
39	RMT 7 & 8	14/2	23.04-02.28	32°35.0'N 18°42.2'W	4200	600 m wire out for 2 hours
40	RMT 7 & 8	15/2	02.44-05.30	32°38.0'N 18°42.6'W	c.4000	400 m wire out for 2 hours - Rope foul on rudder
41	RMT 7 & 8	15/2	06.05-10.04	32°44.4'N 18°48.9'W	c.4000	1200 m wire out for 2 hours
42	Line fishing	15/2	20.30-22.50	32°54.6'N 17°04.9'W	-	No success
43	RMT 7 & 8	16/2	00.42-03.35	32°54.2'N 16°46.9'W	>2000	600 m wire out for 2 hours
44	RMT 7 & 8	16/2	04.00-07.30	32°58.4'N 16°46.0'W	>2000	800 m wire out for 2 hours
45	Long line & Multiple corer	16/2	10.17-15.24	33°08.7'N 16°28.7'W	1100	2 fish on long line - corer aborted
46	RMT 7 & 8	16/2	16.30-21.15	33°03.0'N 16°30.3'W	>2000	2000 m wire out for 2 hours
47	Line fishing	16/2	21.30-00.55	32°57°N 16°36'W	>2000	No success

TABLE II cont.

Stat.No.	Gear	Date	Time	Position at start	Sounding (m)	Remarks
48	RMT 7 & 8	17/2	01.03-05.09	32°55'N 16°35.4'W	2200	1 hour at 200, 400 and 600 m wire out
49	RMT 7 & 8	17/2	05.25-09.30	33°08'N 16°32'W	> 2000	1200 m wire out for 2 hours
50	RMT 7 & 8	17/2	09.45-13.56	33°06.8'N 16°31.8'W	> 2000	775 m wire out for 3 hours - Winch failure
51	RMT 7 & 8	17/2	17.05-20.40	32°38.1'N 16°41.4'W	> 2000	1600 for 1 hour 1200 for 20 min.
52	Line fishing	17/2	20.40-00.07	32°33.4'N 16°42.9'W	> 2000	No success
53	RMT 7 & 8	18/2	00.07-04.20	32°33.6'N 16°37.7'W	c.1800	1200 m wire out for 3 hours
				FUNCHAL		
54	Line fishing	19/2	20.10-22.04	36°57.2N 14°11.4'W	-	No success
55	Line fishing	20/2	20.20-22.10	40°13.5'N 12°11.8'W	-	1 Squid

See ROSCOP no 2205 for track charts

NATURAL ENVIRONMENT RESEARCH COUNCIL

INSTITUTE FOR MARINE ENVIRONMENTAL RESEARCH — CRUISE REPORT

IMER/2/79
RVS Ref No C/4/79

VESSEL: RRS CHALLENGER

CRUISE PERIOD: 20 March-3 April 1979

PERSONNEL

R Williams	-	PSO (Senior Scientist)
H Bottrell	-	SSO
D V P Conway	-	HSO
T Kendall	-	SO
R Howland	-	SO
D Robins	-	ASO
A Pomeroy	-	ASO
M Somerville-Woodward	-	ASO

ITINERARY:

19 March	Monday		Personnel and equipment to Barry.
20 "	Tuesday	11.00	Departed Barry. Anchored, heavy fog.
		15.24	Started monitoring track with horizontal profiling: station checks every 15 min. Station 13 first plankton haul, see Fig. 1, Table 1.
22 "	Thursday	09.10	Completed monitoring track at station 14; set course for Celtic Sea.
		20.30	Arrived Celtic Sea site, deployed Flygt pump.
		21.07	Commenced Survey I (Appendix Ia, Ib).
23 "	Friday	07.47	Completed grid survey.
		17.20	Vertical profile at station 31 (Appendix Ic).
		21.22	Vertical profile at station 25.
		22.45	Live plankton collections.
24 "	Saturday	00.31	LHPR haul 1 (Appendix Id).
		07.01	LHPR haul 2.
		08.57	Vertical profile at station 30.
		13.53	LHPR haul 3.
		14.20	Vertical profile at station 6, weather detiorating.
		18.52	LHPR haul 4.
		19.18	Ceased overside operations.
25 "	Sunday	08.00	Set course for Carmarthen Bay. Gale force winds.
26 "	Monday	09.43	Anchored off Tenby.
		10.00	Coring at DZ 2 buoy at anchor, Appendix IId.
27 "	Tuesday		At anchor.
28 "	Wednesday	10.29	Commenced Survey 1 (Appendix IIa, IIb).
		20.41	Completed grid survey.
29 "	Thursday	07.00	Anchored off Tenby.
30 "	Friday	08.50	Coring at station 31.
		09.28	Vertical profile at station 31.
		11.06	Station 1, Flygt pump breakdown.
		13.34	Vertical profile at station 1.
		16.10	Vertical profile at station 6.
		18.02	Vertical profile at station 29.
		20.33	Vertical profile at station 25.
31 "	Saturday	08.00	Live plankton collections.
		12.04	Vertical profile at station 6.
		12.34	All profiling equipment inboard, set course for Celtic Sea site.
		19.50	Arrived Celtic Sea station 31, live plankton collections.

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1 April	Sunday	01.01	LHPR haul 5.
		04.00	Plankton collections.
		07.35	Hydro-cast for ^{14}C incubation experiment.
		12.36	Lowestoft 30" combination net trials.
		14.21	Completed work at Celtic Sea site.
		21.19	Started monitoring track with horizontal profiling; station checks every 15 min., Fig. 2. Station 23 first plankton haul, Table II.
3 "	Tuesday	09.38	Completed monitoring track at station 22.
		10.42	Flygt pump onboard, set course for Barry.
		20.50	Docked Barry.
4 "	Wednesday	Equipment and personnel to Plymouth.	

OBJECTIVES:

Programme Objectives

1. To compare the rates and processes which control the seasonal development of two species of copepod at two contrasting sites; one a near-shore embayment (Carmarthen Bay), the other offshore with a seasonally stratified water column (Celtic Sea site).
2. To compare seasonal differences in the rates of nutrient turnover at the two sites with emphasis on sediment-water column interactions at the Carmarthen Bay site.

Cruise Objectives

1. a) To measure levels of nutrients, chlorophyll, total suspended matter, organic matter and the zooplankton and phytoplankton populations.

   b) To characterise the hydrographic conditions at the two sites.

   c) To measure the feeding rates and development times of two species of copepods at the two sites.
2. To continue a series of cruises to monitor the performance of the Bristol Channel area to update the validation of the ecosystem model GEMBASE.

PROCEDURE AND METHODS:

As outlined in the Cruise Programme. The grids and station positions are amended to suit the prevailing conditions (Fig. 1 and 2, Appendices I and II).

EQUIPMENT AND OTHER FAILURES

Four days were lost through gale force winds (25-27 and 29 March). Further days would have been lost through bad weather if we had used a vessel smaller than CHALLENGER. Time was lost through the breakdown of the Flygt pumps - see internal report 10.4.79.

Both monitoring cruises were successfully completed (Fig. 1 and 2) although station 12 was lost on the first grid and station 11 at Avonmouth was not was not occupied on the second grid . The water was too shallow at this station for CHALLENGER, the log having grounded on the first grid.

One complete grid survey (Appendix Ia) and a series of vertical profiles (Ic) were completed in the Celtic Sea site. The survey will be used to investigate the temporal and spatial distribution of particulate and dissolved organic carbon, nitrate, nitrite, reactive phosphate, reactive silicate, phytoplankton species, chlorophyll, particle size, microseston and net zooplankton (Appendix Ib). Five successful hauls (117 samples) were taken by the LHPR (Appendix Id) which will be used to investigate vertical abundance and diurnal migration. Net hauls provided material for the determination of length, dry weight, calorific value, carbon,

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nitrogen, lipids and gut contents. One ^{14}C phytoplankton production experiment was completed at four simulated light levels.

One complete grid survey Appendix IIa, IIb) and six vertical profiles (IIc) were completed in Carmarthen Bay. Net haul material was difficult to obtain although sufficient Calanus helgolandicus were obtained for feeding experiments. The feeding rates of Copepodites V and adults were determined using natural particulates and ambient conditions at both sites. A total of 25 feeding bottles containing 10-20 Calanus and 9 control bottles (no copepods) were set up and analysed using the multi-channel TAII Coulter Counter.

A number of sediment cores (Appendix IId) were taken and experiments set up to measure oxygen and ammonia exchange from the sediment pore water.

Prepared by: R Williams

Approved by: R S Glover

Date: 19 April 1979

Monitoring Track - Plankton station positions 20-22/3/79

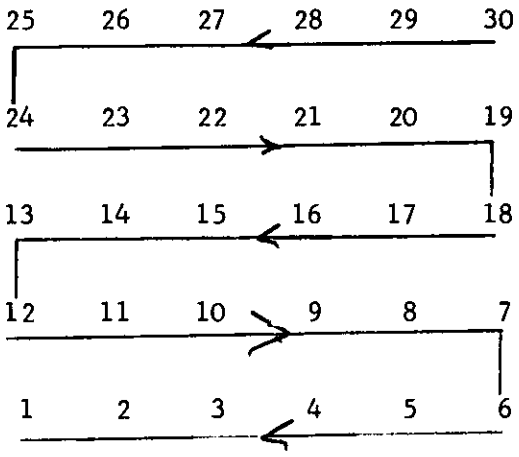
Station		Time Shot	Decca Position Red	Green	Purple	Time Hauled (BST)	Decca Position Red	Green	Purple
13	20/3/79	15.24	C14.16	-	B71.98	15.58	C15.16	-	B75.16
11	"	19.58	D 9.10	-	B76.60	20.22	D 7.28	-	B77.90
10	"	23.02	C16.68	-	C53.48	23.29	C14.32	-	C53.54
34	21/3	00.50	B 1.76	-	C52.78	01.20	B21.20	-	B76.42
15	"	01.40	B18.02	-	B70.21	02.04	B15.05	-	B58.62
16	"	02.34	-	C42.36	A70.38	03.00	-	C44.95	A70.06
17	"	03.51	-	D33.66	B54.86	04.21	-	D35.47	A77.07
35	"	05.17	-	D35.80	J77.66	05.49	-	D38.89	J69.60
18	"	07.33	-	E32.26	J57.78	07.44	-	E33.94	
19	"	10.04	-	E34.82	H52.76	10.37	-	E38.36	H55.20
20	"	11.21	-	E45.10	H65.12	11.53	-	F32.62	H69.08
21	"	14.22	-	F45.66	I50.38	14.44	-	G30.40	I52.88
22	"	15.26	-	G36.36	I58.12	15.41	-	G37.11	I60.50
23	"	17.44	-	G30.38	J64.00	18.14	-	F45.78	J71.82
24	"	19.00	-	F43.08	A52.88	19.29	-	F39.82	A58.18
25	"	21.00	-	F33.34	J78.48	21.34	-	F32.08	J70.40
26	"	22.32	-	F30.78	J51.60	21.56	-	E45.52	J59.84
27	"	23.39	-	E39.24	J79.58	24.00	-	E36.98	A55.78
28	22/3	01.51	-	D43.00	B69.04	02.16	-	D42.75	B67.15
29	"	03.00	-	D43.04	B52.44	03.20	-	D42.28	A77.00
30	"	04.05	-	D39.90	A64.58	04.25	-	D38.75	A61.15
31	"	05.35	-	D30.68	A57.66	05.58	-	D30.16	A65.84
32	"	06.49	-	C46.26	B61.94	07.07	-	C44.74	B62.66
33	"	07.54	-	C38.26	B50.54	08.17	-	C35.84	B52.74
14	"	0840	C01.30	_	B57.24	09.10	C04.96	-	B56.48

Monitoring Track - Plankton station positions 1-3/4/79

Station	Date	Time Shot (BST)	Decca Position Red	Green	Purple	Time Hauled (BST)	Decca Position Red	Green	Purple
	1/4/79		-	G30.70	J63.82	20.37		F47.06	J68.18
24	"	22.02	-	F40.32	A58.84	22.18	-	F38.73	A60.92
25	2/4/79	23.49	-	F35.16	J77.37	00.04	-	F34.92	J74.48
26	"	01.16	-	F31.71	J54.93	01.31	-	F31.24	J51.88
27	"	03.00	-	E39.62	J77.04	03.23	-	E37.99	A53.32
28	"	05.11	-	D43.34	B67.46	05.31	-	D42.65	B68.83
29	"	06.19	-	D42.25	B55.10	06.40	-	D42.10	A79.96
30	"	07.28	-	D38.84	A64.44	07.54	-	D35.63	A61.90
31	"	08.20	-	D30.18	A58.48	08.42	-	D47.24	A66.78
32	"	09.24	-	C46.06	B59.34	09.45	-	C45.36	B64.20
33	"	10.42	-	C38.36	B51.44	11.00	-	C37.00	A79.02
34	"	12.04	B23.38	-	B76.82	12.28	B23.12	-	C50.72
12A	"	15.04	C16.50	-	B76.92	15.25	C17.56	-	B77.81
12B	"	16.22	C19.60	-	C51.92	16.34	C18.56	-	C50.23
13	"	17.00	C15.53	-	B73.61	17.10	C14.81	-	B72.56
14	"	19.08	C01.76	-	B56.80	19.27	C00.45	-	B56.92
15	"	20.34	B19.30	-	B68.90	20.57	B18.54	-	B71.88
16	"	22.58	-	C41.70	A70.67	23.21		C43.06	A68.96
17	"	23.29	-	D33.84	B55.08	23.51	-	D35.64	B50.10
35	3/4	00.46	-	D37.29	J79.70	01.00	-	D37.24	J74.40
18	"	01.51	-	E31.48	J56.05	02.22	-	E34.98	J75.12
19	"	03.58	-	E34.88	H55.28	04.21	-	E37.21	H53.60
20	"	04.57	-	E44.60	H61.57	05.18	-	E47.42	H65.06
21	"	06.47	-	F44.74	I51.16	07.18	-	F47.92	I53.37
22	"	08.07	-	G36.50	I57.70	08.38	-	G37.65	I63.56

Appendix IA

Celtic Sea site - Cruise track and station positions 22 - 23 March 1979



Station Positions

Station	Time (BST)	Decca Positions		Station	Time (BST)	Decca Positions	
730	2103	J30.80	I52.20	714	0313	J43.88	H69.62
729	2126	J33.40	I50.80	713	0336	J46.53	H68.25
728	2147	J36.00	H79.30	712	0403	J47.46	H64.72
727	2215	J39.40	H77.30	711	0425	J44.76	H66.14
726	2236	J42.00	H75.90	710	0441	J42.22	H68.03
725	2257	J44.60	H74.70	709	0509	J38.58	H69.40
724	2320	J45.50	H71.40	708	0529	J35.90	H70.82
723	2340	J42.80	H72.60	707	0551	J33.07	H71.94
722	2359	J40.20	H74.10	706	0612	J34.37	H68.25
721	0026	J36.90	H76.30	705	0630	J36.98	H66.81
720	0049	J34.14	H77.54	704	0647	J39.80	H65.28
719	0110	J31.52	H79.16	703	0713	J43.28	H63.85
718	0138	J32.30	H75.44	702	0732	J46.16	H62.64
717	0202	J35.15	H73.92	701	0748	A30.59	H61.44
716	0224	J37.84	H72.80				
715	0252	J41.30	H71.08				

Nutrients, chlorophyll, salinity, temperature, particle size, microseston, and DOC were measured at all stations. Selected stations were sampled for POC and phytoplankton species counts.

Appendix Ib

Celtic Sea Site - 22-23 March 1979
Lowestoft 20" sampler

		Time (BST)		Decca Positions			
Haul No.	Date	Shot	Recovered	Shot		Recovered	
1	22.3	21.11	21.36	J31.70	I52.90	J34.60	I50.28
2	"	21.51	22.39	J36.48	H79.12	J42.30	H76.14
3	"	23.23	23.52	J45.28	H71.69	J41.30	H73.72
4	"	00.01	00.32	J40.04	H74.72	J36.31	H76.57
5	23.3	00.37	01.00	J35.60	H76.90	J32.78	H78.70
6	"	01.40	01.56	J32.50	H75.38	J34.48	H74.42
7	"	02.02	02.27	J35.12	H73.97	J38.20	H72.69
8	"	02.33	03.24	J38.98	H72.18	J45.14	H68.92
9	"	04.06	04.51	J47.15	H64.84	J40.90	H68.67
10	"	04.57	05.44	J39.96	H68.94	J34.00	H71.56
11	"	0616	06.51	J34.98	H68.04	J40.50	H64.90
12	"	06.57	07.28	J41.32	H64.56	J45.70	H63.02

Appendix Ic

Celtic Sea Site - Vertical Profiles 23-24 March 1979

Station	Time cast		Decca Position		Depth (m)
	Start	Finish			
731	1840	2010	J39.84	H72.42	85, 54, 35, 20, 10, 5, 1
732	2145	2230	J44.74	H74.82	75, 62, 40, 20, 5, 1
733	0915	0957	J31.24	I52.50	72, 57, 41, 11, 1.
734	1436	1604	J34.06	H68.58	70, 50, 40, 10, 1

Nutrients, chlorophyll, salinity, temperature, microseston, particle size, phytoplankton species counts, POC and DOC were measured at all depths.

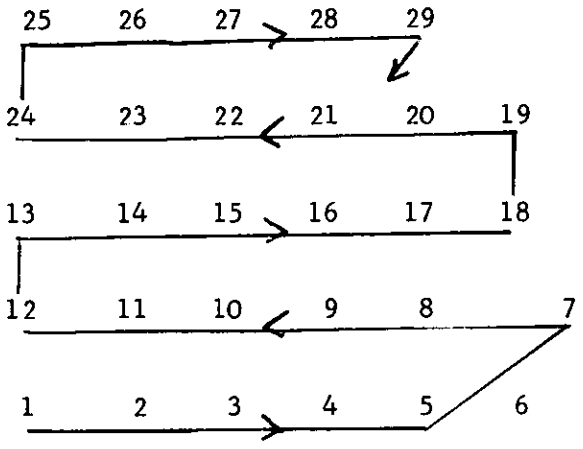
Appendix Id

Celtic Sea site - Longhurst Hardy Plankton Recorder Hauls

Haul No.	Date	Time (BST)	Shooting Position		Hauling Position		No. of samples
1	24.4.79	0031	J39.71	H71.58	J40.52	H69.32	28
2	"	0701	J39.82	H71.72	J40.34	H70.24	24
3	"	1253	J39.93	H68.87	J39.60	H67.76	17
4	"	1852	J40.02	H72.30	J39.99	H71.48	20
5	1.4.79	0101	J39.30	H72.74	J39.92	H70.86	28

Appendix IIa

Carmarthen Bay Site - cruise track and station positions 28 March 1979



Station Positions

Station	Time (BST)	Decca Positions		Station	Time (BST)	Decca Positions	
501	1029	F42.00	J66.90	516	1619	F34.53	A56.56
502	1105	F39.20	J69.90	517	1635	F31.98	A60.00
503	1136	F36.80	J73.50	518	1645	F30.55	A61.80
504	1211	F33.48	J77.05	519	1709	F31.08	A65.20
505	1233	F30.94	A51.58	520	1724	F32.43	A63.16
				521	1752	F35.20	A60.27
507	1305	E46.96	A59.56	522	1819	F38.49	A55.63
508	1328	F31.48	A55.78	523	1846	F40.97	A52.46
509	1351	F34.16	A52.60	524	1909	F43.60	J79.32
510	1422	F37.52	J78.12	525	1931	F42.85	A54.14
511	1443	F40.18	J75.02	526	1944	F41.07	A56.62
512	1504	F42.88	J71.86	527	2001	F38.40	A58.90
513	1524	F42.90	J75.92	528	2028	F35.30	A63.10
514	1540	F40.48	J79.20	529	2041	F33.60	A65.20
515	1557	F37.90	A52.17				

Nutrients, chlorophyll, salinity, temperature, particle size, DOC and microseston were measured at all stations. DON and DOP were measured at alternate stations and selected stations were sampled for POC and phytoplankton species counts.

Appendix IIb

Carmarthen Bay site - 28 March 1979

Lowestoft 20" sampler

	Time (BST)		Decca Positions			
Haul No.	Shot	Recovered	Shot		Recovered	
1	10.33	11.07	F41.96	J67.48	F39.32	J70.34
2	11.14	11.28	38.72	J70.98	F37.56	J72.56
3	11.34	11.49	F36.97	J73.37	F35.71	J74.78
4	13.10	13.29	E47.42	A59.88	F31.62	A55.67
5	13.52	14.13	F34.38	A52.42	F36.67	J79.32
6	14.44	15.03	F40.43	J74.73	F42.78	J72.02
7	15.25	15.39	F42.70	J76.57	F40.40	J79.42
8	15.57	16.16	F37.77	A52.46	F34.80	A56.36
9	16.35	16.52	F31.60	A60.62	F30.54	A63.10
10	17.13	17.30	F31.48	A64.59	F33.12	A62.69
11	17.51	18.08	F35.26	A60.30	F37.08	A57.62
12	18.43	19.05	F40.77	A52.84	F43.18	J79.72
13	19.33	20.05	F42.50	A54.71	F38.21	A59.90

Appendix IIc

Carmarthen Bay site - Vertical Profiles - 30-31 March 1979

Station					
530	0928	0938	F35.60	A52.20	25, 13, 1.
531	1334	1405	F42.62	J67.58	30, 15, 1
532	1610	1625	E47.92	A53.36	13, 1
533	1802	1820	F33.88	A65.78	9, 1
534	2033	2047	F42.16	A53.56	15, 1
535	1204	1311	F30.97	A52.50	20, 16, 11, 8, 4, 1

Nutrients, chlorophyll, salinity, temperature, microseston, particle size, phytoplankton species counts, POC and DOC were measured at all depths. DON and DOP were measured in top and bottom samples.

Appendix IId

Carmarthen Bay - Sediment Cores 26 - 30 March 1979

Station	Date	Time (BST)	Decca Position		Variable measured
Off Tenby	26.3.79	1315-1350	F44.00	A53.98	2 cores for continuous measurement of oxygen and ammonia in the water above the core. 1 core for measurement of ammonia in the pore water.
Off Tenby	27.3.79	0830-0850	F43.95	A54.02	2 cores for continuous measurement of oxygen and ammonia in the water above the core. 2 cores for measurement of ammonia in the pore water.
530	30.3.79	0856-0914	F35.70	A52.50	1 core for ammonia pore water analysi
531	30.3.79	1423-1441	F43.50	J66.68	2 " " " " " "
532	30.3.79	1549-1607	F30.70	A52.42	1 " " " " " "

All cores were subsequently frozen for carbon, nitrogen and percentage water content analysis.

Institute for Marine Environmental Research

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