I.O.S.

R R S DISCOVERY
CRUISE 128

2 MAY – 26 MAY 1982

GEOCHEMICAL AND BIOLOGICAL STUDIES IN THE GUINEA BASIN

CRUISE REPORT NO 134
1982

NATURAL ENVIRONMENT RESEARCH COUNCIL
INSTITUTE OF OCEANOGRAPHIC SCIENCES

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R.R.S. DISCOVERY

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Institute of Oceanographic Sciences,
Brook Road, Wormley, Godalming,
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ITINERARY

Depart Abidjan 1130 h 2 May 1982

Arrive Abidjan 0800 h 26 May 1982

SCIENTIFIC PERSONNEL

J.R. Badcock	I.O.S.
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G.V. Lodge	I.O.S.
Mrs. C.J. Ellis	I.O.S.
R.R. Gatten	Institute of Marine Biochemistry, Aberdeen.
P.J. Herring	I.O.S.
A.P.M. Lockwood	Department of Oceanography, University of Southampton
M.J. McCartney	I.O.S.
R.J. Morris	I.O.S. (Principal Scientist)
R.D. Peters	I.O.S.
Mrs. E.L. Poutanen	Institute of Marine Research, Helsinki.
P.R. Pugh	I.O.S.
P.S. Ridout	I.O.S.
H.S.J. Roe	I.O.S.
D.J. Smith	Organic Chemistry Unit, Bristol University.
Miss E. Tentori	Department of Oceanography, University of Southampton
R.A. Wild	I.O.S.
M. Beney	Computer Support, R.V.S. Barry

SHIP'S OFFICERS AND CREW

P.H.P. Maw	Master
S.D. Mayl	Chief Officer
S. Jackson	2nd Officer
G.P. Harries	3rd Officer
P. Taylor	Radio Officer
P. Higginbottom	P.C.O.
A.E. Coombes	Chief Engineer
D.E. Anderson	2nd Engineer

I. McGill	3rd Engineer
B.J. Entwistle	4th Engineer
K.T. Sullivan	5th Engineer
N. Davenport	5th Engineer
P.E. Edgell	Electrical Officer
D.S. Knox	C.P.O.
L. Cromwell	P.O.
G. Leonard	Seaman
A.M. Nogan	Seaman
J. Davies	Seaman
B.J. Lamb	Seaman
J.S. Hadden	Seaman
A.G. Hennah	Seaman
C. Clayton	Seaman
N.H.F. Johnson	Seaman
C. Hubbard	Chief Cook
J.R. Bussey	2nd Cook
B. Clappe	2nd Steward
C.J. Elliot	Steward
M.A. Craig	Steward
M. Harvey	Steward
A.F. Skelcher	Steward
R.D. Whitcombe	Steward
J.R. Cooker	Motorman 1A
F.G.S. Leonard	Motor 1A
M. Muthana	Motorman 1A

OBJECTIVES

The primary objective of the cruise was to take samples of the air/sea interface, near surface water, the sediment/water interface and deeper sediment from selected water columns in the Gulf of Guinea. It was planned to work mainly over local high spots both in the basin area and on the banks. From experience this gives the best chance of collecting sediments in their original time sequence. We wished to test our hypothesis that this is a suitably pure marine area of high productivity, free from significant terrigenous input, for detailed geochemical study of diagenetic processes.

The secondary objective was to examine the distribution of mid-water organisms in the area, and take good quality live plankton samples for subsequent shipboard biochemical/physiological experiments. It was hoped that the area would be rich enough to allow short duration net hauls and, together with the new cod-end system, allow the collection of good experimental material.

NARRATIVE

On joining Discovery during the morning of May 1st we learnt of an armed raid on board the previous night during which some of the scientific boxes in the hold had been broken into and some small items of equipment stolen. The scientific party then joined the officers in mounting a comprehensive night watch for the remainder of the port stop. The ship sailed the following day May 2nd at 1130 with no further problems. When in deep water the echo-sounder fish was launched and normal scientific watches were started.

The first station (10512) was reached at 0600 on the 4th of May. Satisfactory core samples were obtained with the Kastenlot corer in the centre of the Guinea Basin. The ship proceeded south-east and the first net station with the IOS multiple net was completed in the evening (10513). A further Kastenlot core sample was taken on the equator in the eastern part of the Guinea Basin (10514) and a net station (10515) completed in this vicinity during the evening.

Discovery then proceeded to the most northerly of that group of sea mounts in the general position 3°S 1°E. For the next few days a number of these sea mounts were surveyed with the echo sounder, and Box corer and Kastenlot core samples taken at various depths (10516, 10519, 10520, 10522). Biological sampling was carried out in the evenings (10517, 10518 10521) using neuston and oxfam nets in addition to the IOS multiple net.

After completion of the work on this group of sea mounts Discovery proceeded south to the north western edge of the Angola basin. Here the major part of the biological study was carried out, involving a day net series down to 2000 m over a 72-hour period (St 10523#1-19). The preliminary results indicated that the area was, in terms of the biology, extremely rich. In the vicinity of this net series a core sample was taken using the square box gravity corer fitted with a sediment-interface arrester plate (St 10524). The modification appeared to work well and a good sample was taken.

Discovery then proceeded to the northern end of the next group of sea mounts (general position 6°s 0) and an echo sounder survey carried out. An unusual feature was found which appeared to comprise a large crater with a central flat basin 3600 m deep and a very rugged rim varying from a few hundred to a few thousand metres high. A box core sample and a long (4 m) Kasten core sample were taken in the 'crater' basin (St 10525, 10527) and a series of shallow net hauls (St 10526) made in the same general area.

As a result of the interesting core samples taken at Stations 10524 and 10527 Discovery returned to the site of Station 10524 and a long (4 m) Kasten core sample taken (St. 10529). Wire tests of the closing cod end device (St 10530) were then carried out at depths ranging from 100-1000 m.

Discovery then proceeded south to the last study area, the most southerly of the sea mounts to be investigated. An echo sounder survey of the sea mount was carried out in between two day periods of fishing in deep water to the east of the sea mount which involved a light meter net series (10531#1-18). At the finish of the net series a number of core samples were taken (10532, 10533).

Discovery then moved south into deep water and a combination net fished with the experimental closing cod end (10534). At the most southerly point of the cruise, when Discovery was well into the Angola Basin, a long Kasten core sample was taken (10535). Discovery then immediately headed north, back to the sea mount in order to complete the echo sounder survey, fishing a number of experimental nets (10536, 10538, 10539, 10540) and taking a surface film sample with the ship's rubber boat (10537) on the way.

The echo sounder survey was completed and a note made of any magnetic anomalies observed by the bridge during this survey. Discovery then proceeded north and additional experimental nets were fished (10541, 10542, 10543, 10544, 10545) and another surface film sample (St 10546) was collected. One evening an experiment was conducted in order to observe the natural bioluminescence in the sea. Discovery was blacked-out as far as was safely possible, and all non-essential equipment and machinery was switched off. We then drifted for 2 hours during which time observations were made. The cooperation from the ship-side was extremely good and indicated the future possibilities of using Discovery as a floating platform for biological observations. Scientific work was stopped on the morning of May 25th and the echo sounder fish recovered. Discovery continued on to Abidjan arriving at 0900 on May 26th.

GEOCHEMISTRY

Core samples

The sediments in the Guinea basin were found to comprise a 15-20 cm oxic brown layer of sediment overlying a dark gray/green layered sediment at least 2 m in depth. The colour change was very sudden and in general appearance the sediment samples resembled those taken from the E. Mediterranean (Discovery Cruise 104) which included the sapropelic layers. Smear slide analysis indicated a gradual reduction in terrigenous input as distance from the land increased.

The sediments were found to contain distinct burrows and considerable evidence of mottling. In one core (10514), a live worm with an unusual green pigmentation was discovered at a depth of approximately 10 cm in the sediment.

The sediment samples from the northern group of sea mounts were at the same time disappointing and interesting. We had hoped that the tops and terraces of the sea mounts might have a sediment cover representative of the sedimentary water column overlying them but it appeared that the finer oganic detritus had been swept into deeper water, presumably by current action, leaving only the coarser sediment debris. Of considerable interest however were the results from Station 10516. Here a box corer sample was taken from the top of a sea mount in a water depth of 2400 m. The major part of the sample comprised coarse foraminifera debris but several large nuggets were also present which on preliminary analysis appeared to be metalliferous.

The preliminary echo sounder survey of the southern group of sea mounts studied indicated an unusual crater-like feature in the northern sector. Unusual magnetic abnormalities were also reported by the bridge in this area. Core samples were taken to the north east of this feature in the deep-water basin (10524) (4700 m) and from the centre of the 'crater' basin (3600 m) (10525, 10527). A dark 'sapropelic' layer was found to occur in these samples approximately 0.5-8 m below the interface, being particularly intense in the deeper water core (10524). As a result of this discovery a further long (4 m) Kasten sample was taken back at the site of St 10524 (St 10529). The 4 m core sample showed at least 3 major dark layers occurring, which were sapropelic in appearance. The preliminary smear slide and pore water analysis appear to show an enhanced organic content in these 'sapropelic' layers, in particular the phosphate values were high in the vicinity of these layers. We believe these results indicate that in this area, during the recent past, there have been periods of extremely high productivity in the surface waters which have resulted in preservation and incorporation of organic material in the underlying sediments, in spite of the deepness (4700 m) of the water columns. Such a situation may provide similarities to the periods of sapropel formation in the E. Mediterranean, and certainly for such events to occur in deep oceanic basins is extremely interesting.

Box core samples (St 10532) on the top (400 m) and a terrace (800 m) of the most southerly sea mount confirmed that these features are swept clean of the small grained/particulate detritus, presumably by strong currents which occur in the water column down to depths well below 1000 m. Only rock and shell fragments together with coarse grained foraminerifera sand were recovered.

At the last core station (St 10535) which was well into the Angola Basin (depth 4900 m) a long Kasten core sample again indicated dramatic changes in sediment type. A dark 'sapropelic' layer was dramatically sandwiched between layers of foraminerifera sand and the remaining core showed 3 other dark layers and very sharp boundaries between the intervening sediments.

Our general conclusions are that major, traumatic events, probably involving periods of intense productivity, have affected the sedimentary history of that whole area between the southern Guinea Basin and the northern Angola Basin in the relatively recent past. Such events are possibly related to periodic changes in the Benguela current and future work should involve a study of the sediments and the biology of the overlying waters further south, along the course of the Benguela current.

Sampling

Immediately the core samples were recovered on board a detailed photographic record was made together with a full colour and texture description. A prototype 'fixed-rig' system which records Kastenlot cores in 20 cm sections was used successfully on 2 metre barrels in the laboratory. Following some minor adjustments to the rig, it was subsequently possible to use this system for photographing 4 metre barrels directly on deck.

Samples were taken for smear slide analyses, deep-frozen storage, and pore-water squeezing. The latter samples were taken as quickly as possible and placed immediately in the squeezing cylinders under nitrogen at 4°C.

Ship-board analysis

a) Smear slides - the samples showed a rapid decrease in terrigenous components as distance from land increased. The main study areas appeared to be under the influence of almost entirely marine sedimentary conditions. In these areas, the predominantly foramic sediments were found to include several dark layers. Diatom debris was found to be plentiful in these layers, evidence possibly of enhanced periods of productivity in the surface waters.

b) Pore-waters - the sediments were squeezed through filters under nitrogen, at 4°C, using a system of hydraulic presses. Large volumes (50-100 ml) of clean pore waters were obtained from most samples which were analysed on board for phosphate, silicate, carbohydrate and amino acid content.

M.J. McCartney
R.J. Morris
E.-L. Poutanen
P.S. Ridout
D.J. Smith

SURFACE FILMS

Surface films were sampled at 2 stations and stored for lipid, carbohydrate, protein, amino acid and metal analyses. Although the weather conditions throughout the cruise were good, the wind (S-SE average force 3, up to force 6 at times) made the regular collection of film samples impossible.

R.J. Morris

BIOLOGY

In general the net hauls indicated that the study areas were biologically very rich.

Midwater fishes

The great abundance of mesopelagic fishes in the area denied anything but a cursory examination of the collections made during the vertical distribution series (St 10523). Approximately 90 species were represented and in general the species composition was more similar to that found earlier at 11°N 20°W (Cruise 21) than at the equatorial positions investigated further west (c 22½°W, Cruise 64). In particular, land-mass associated species such as *Cyclothone livida*, *Polyipnus polli* and *Argyropelecus gigas*, which were absent along 22½°W, were either very abundant or at least common in the present collections. As expected, *Cyclothone* (7 spp) dominated the catches whilst other stomiatoids, as well as the lantern fishes, were rather poorly represented in terms of both diversity and abundance. The inter- and intra-specific depth relations, however, were as would be expected and, in common with observations made at other tropical Atlantic positions, species were rather shallowly distributed.

A number of rather rare species were noted: e.g., *Monognathus*, Megalomycteridae, *Dolichopteryx*.

J.R. Badcock

Ostracoda

The analysis of the ostracods from the RMT 1+8M vertical series was begun on board ship and the data should prove a useful supplement to our knowledge of the geographic range and depth distribution of planktonic species. At present we have very few records from the South Atlantic. The Wild closing cod end trials provided a great many live ostracods and notes on the colours of *C. acuminata*, *C. ametra*, *C. atlantica*, *C. elegans*, *C. fowleri*, *C. inflata*, *C. Lophura*, *C. macroreticulata*, *C. magna*, *C. nasotuberculata*, *C. procera*, *C. secernenda*, *C. spinireticulata*, *C. stigmatica*, *C. subinflata* and *C. valdiviae* were made. Ostracods were rare in the neuston net catches and swarms of *C. spinirostris* and *C. curta* which were common in the neuston at night at 23°N 30°W in May and June 1981 were not apparent.

C.J. Ellis

Siphonophora

Siphonophores were plentiful in the catches, both in terms of numbers and species diversity. Unfortunately this meant that only a few samples could be studied in any detail and no concrete results yet can be described. Although over fifty species of siphonophore were noted, the shallow samples were dominated by relatively few, notably Diphyes dispar D. bojani and Lensi fowleri. However, it was not possible to assess whether any of these species underwent a substantial diel migration. It was hoped that the deeper hauls might contain some of the rarer siphonophore species, and a few interesting ones were noted. A very large specimen of Halistemma amphytridis appeared in one of these hauls, and another contained a somewhat unusual specimen of Erenna richardi. In addition, nectophores of a specimen of Marrus sp. were noted. A very long specimen of Bathyphysa conifera became entangled with the box corer wire and was retrieved with a certain degree of pain.

P.R. Pugh

Light Meter Hauls

Three light levels, corresponding to 85, 95 and 105 dB were fished over 2 consecutive days using the low level photometer and RMT 1+8M. These hauls were part of a series designed to evaluate the dependance of animals upon specific light levels. Unfortunately although the photometer worked well the hauls were bedevilled by monitor failures resulting in the loss of a number of samples and the abbreviation of others. The water was opaque, light of 105 dB reached a maximum depth of 380 m. - some 200 m shallower than previous series further north. The animal populations apparently spread over all 3 decades of light intensity, although euphausiids were most abundant at 105 dB, Diaphus vanhoeffeni at 95 dB, and siphonophores at 85 dB. These preliminary observations generally agree with those of previous series, as yet no positive example of a population restricted to a narrow light regime has been found.

Visual Systems of Pontellid Copepods

A number of observations were made on behalf of Dr. M. Land (Sussex University) on the eyes and pigmentation patterns of pontellid copepods. Surprisingly few pontellids were caught and only 3-4 species. Nevertheless useful observations were made on Labidocera acutifrons and were recorded on video tape. These confirm Dr. Land's conclusions that the eyecups beneath the dorsal eyes of the males are highly mobile and estimates of the angle and speed of movement were made.

H.S.J. Roe

Bioluminescence

Observations on the bioluminescence of species captured during the course of the general biological sampling programme concentrated upon the characteristics of the emission spectra. These have been determined for a wide range of species, from dinoflagellates to fishes, and the measurements form part of a long-standing programme of study of the causes and consequences of the emission spectra in different oceanic animals. The present data confirm earlier suggestions that narrow band widths are characteristic of euphausiids and dinoflagellates, whereas broad band widths are a feature of the spectra of Pyrosoma and many fish and squids.

Particularly interesting aspects of the data were the structured spectra observed in several cranchilid squids, the amphipod Parapronoe and the organs of Pesta of the shrimp Sergestes. Not only are there indications of two peaks but also of a time-dependent variation in the relative contribution of the two peaks to the resulting emission spectra. It has also been possible to obtain spectra from the dwarf shark Isistius and the octopod Vitreledonella as well as the suborbitals of several stomiatoid fishes and the pyloric organis of Howella.

Observations of sea luminescence have been correlated with neuston net samples and samples from the clean seawater supply. A window installed in this system has made it possible to monitor ambient luminescence in the supply as an indication of the situation in the sea. The method has worked well and indicates the greatly increased rate of luminescence at night, which in the area investigated seems from the surface samples to reflect the circadian rhythm of dinoflagellate luminescence more than changes in the surface fauna at night. The method has considerable potential for general luminescence surveys.

Direct observations of dinoflagellate (Noctiluca ?) luminescence were made possible by a period of darkened ship during one evening and revealed quite clearly the differences between surface and subsurface luminescence. This will be of considerable help in the interpretation of bioluminescence reports routinely received from the Voluntary Observing Fleet.

It has been possible to collect and freeze material from the red-emitting fishes *Pachystomias* *Aristostomias* and *Malacosteus* and it is hoped that this will enable the emitting system to be partially characterized.

P.J. Herring

BIOCHEMISTRY AND PHYSIOLOGY

Natural product metal-organic associations

A range of mid-water animal species were required to provide good working material for method development in a study of trace metal-organic associations. Good quality specimens of coelenterates, decapods, euphausiids, fish, mysids and squid were taken from a number of biological hauls. Following identification, the animals were deep frozen for storage. Care was taken to prevent sample contamination during handling.

P.S. Ridout

Analysis of fatty acyl acid/fatty alkyl components in lipids from a tropical mid-water food-chain

a) Objectives - Previous work has shown that specific fatty acids may be traced through a simple food-chain in a large sea-water enclosure providing direct biochemical evidence of the prey-predator relationship within such an environment. Gas chromatographic analysis of the lipid components of tropical mid-water animals may give similar evidence for some of the prey-predator relationships which occur in an environment where food availability is likely to be intermittent. It is known that, in this environment, emphasis is placed on the storage of lipids for energy, specially the lipid class wax ester.

b) Methods - Animals were taken from mid-water trawl nets. Species taken for lipid analysis were nominally classed as either prey or predator on size distribution within each catch and also on advice from the I.O.S. biologists.

Depending on size, the animals were homogenised either whole or dissected into discreet tissues before lipid extraction in chloroform → methanol (2:1 by Vol.). Particular care was taken to gut fish which were not dissected in order to eliminate contamination from any lipids in the gut contents. Wet weights of animal/tissues were measured on torsion balances. Where suitable amounts of lipid (5-10 mg) could be extracted these also were weighed on the torsion balance. High accuracy in weighing could not be relied upon however due to the continual movement of the ship.

Individual lipid samples were qualitatively analysed on high performance thin-layer chromatography plates (10 x 10 cm) which were developed in hexane: diethyl ether: glacial acetic acid (90:10:1 by vol.). Lipid zones were identified using standards run concurrently. Iodine vapour was used to stain the lipid zones and a visual estimate of the percentage amount of each lipid zone was noted.

For subsequent GC analysis on shore the individual total lipids were separated using 10 x 10 cm TLC plates preparatively. Major lipid zones were scraped and eluted with diethyl ether. Polar lipid and triacylglycerol zones were transmethylated in 1% H_2SO_4 dissolved in absolute methanol. Wax esters were saponified in 10% K-t-butoxide dissolved in absolute methanol. Methyl esters and saponified wax esters were extracted into Hexane: ether (1:1 by vol.) and stored under nitrogen in dichloromethane containing BGT as an antioxidant.

c) Preliminary Results - The percentage content of total lipid in the muscle of predatory fish species varied from about 0.3% to about 20% of the wet weight. 3 species of gonostomatid fish (bristle months) and 1 species of stylephorid were found to contain wax esters. Where dissections were carried out on a bristle mouth and a stylephorid, wax esters were found to be restricted to the liver and gonad (ovary). In Stylephorus which contained about 20% total lipid per wet weight of muscle, the major lipid class in this tissue was triacylglycerol.

High percentages of wax esters were seen in the total lipids of the mid-water calanoid copepods and some of the decapods and euphausiids also contained this lipid class.

Several specimens of Stylephorus were analysed after it was discovered that this animal contained so much storage lipid, and tissue dissections were made of male, female and a young fish to further study the distribution of lipid in this species. Also, stomach contents were identified to reveal a diet consisting mainly of copepods and small euphausiids. The highly specialized nature of the anatomy of the head of this fish indicates a specialization towards this diet and makes the fish an ideal example for further biochemical analysis with regard to the fatty acids in this particular food-chain.

R.R. Gatten

Inorganic ion levels in the blood of oceanic crustacea

a) Objectives - The aim of the research was to investigate the blood inorganic ion levels of mid-water crustacea with a view to establishing whether those species which undertake large vertical migrations show lower levels of magnesium and higher levels of copper than those with a more limited migration pattern.

b) Methods - Copper and magnesium were measured by absorption flame spectrophotometry and potassium and sodium by emission spectrophotometry using a Pye-Unicam SP90 and air-acetylene flame. This is the first time we have used such equipment at sea and there were some pre-cruise doubts as to the practicality of attempting such measurements. In the event the equipment proved extremely reliable and, whilst there was some loss of sensitivity due to the unstable nature of the platform, it proved quite possible to measure at micro-molar concentrations.

Pipetting microlitre quantities posed no problem on shipboard but a double exclusion method based on the sodium and potassium values allowed rejection of any sub-standard samples.

c) Animals - One of the stated purposes of the cruise was to obtain animals in good conditions for animal experimentation. Unfortunately practical considerations precluded the use of the closing cod end until the last week of the cruise and the sharp temperature gradient at the thermocline resulted in the death of most of the catch over the first three weeks. The lack of cold room facilities on board compounded the difficulties in maintaining the few individuals which did survive to the surface.

d) Results - In view of the lack of living organisms at the start of the cruise, a number of dead specimens were used for analysis. Almost invariably sodium concentrations were below 400 mtl/l and potassium levels were above those typical for marine animals. A limited number of measurements of osmotic pressure indicated that the blood approximated to isosmoticity with sea water. Consequently it was assumed that in these tropical waters a rather rapid deterioration of the tissues post portem results in ionic imbalance between the inter and extracellular water components with the risk of consequent bulk flow from one compartment to the other. It was deemed advisable therefore to restrict all measurements to animals which showed signs of life.

Living animals became more readily available (a) with the use of short single net hauls near the surface and (b) during the last four days of the scientific phase of the cruise when the closing cod end was deployed.

Analyses were restricted to decapods and amphipods. Within these groups some 20 species were examined though substantial numbers (>10) of individuals within species was only possible for six of these. In all 244 individuals were analysed and some 1200 individual samples run. In most cases it was feasible to measure magnesium, potassium and sodium for each individual. Copper analysis, which required a minimum of 100µl, often necessitated pooling blood from several specimens.

e) Conclusions - Detailed conclusions must await the complete analyses of the spectrophotometer data charts and the application of the double analysis data exclusion process to eliminate individual bad items of data. Preliminary concousions however are:-

(1) None of the species measured had strikingly different sodium and potassium levels from those of comparable neritic forms.

(2) In all species the average magnesium concentration was of the order of half the level in sea-water or less. In no species was the rather high magnesium typical of sub-littoral Brachyuras found.

(3) Particularly low magnesium levels were found in _Acanthephyra_, _Systellapis_ and _Funchalia_ amongst the decapods. The Sergestids tended to have higher levels though it is possible that the difficulties involved in handling the blood of sergestids (due to rapid coagulation) may have influenced this result.

(4) In general the amphipods showed magnesium levels about twice as high as those of the decapods though some individuals of _Cystisoma_ displayed strikingly low levels; the reason for which merits additional study in relation to the maintenance of body volume in such a 'watery' form.

(5) Fewer copper measurements were made than for the other ions but the results were particularly interesting. Typical concentrations for _Acanthephyra_, _Systellasis_ and _Funchalia_ were of the order of 1000-2000µm/l which is approximately

twice as high as that typically found for an active crab such as Carcinus. By contrast the copper concentration of the blood of the amphipods was markedly lower (Platyscelis circa 200μ/1).

A.P.M. Lockwood
E. Tentori

SAMPLING GEAR

Midwater trawling and gear handling

The multiple net (RMT 1+8M) was fished 21 times, with 6 failures, and the RMT 1+8 13 times - on 9 occasions with the new closing cod end. The relatively high failure rate of the RMT 1+8M was due to various monitor problems, some at least of which were associated with the extremely high surface temperatures and temperature shock at the very marked thermocline at ca 40 m depth. All of the failures involved the nets pre-triggering, resulting in the loss of some hauls and curtailment of others.

Apart from a few test hauls with the RMT 1+8 on Cruise 124 this was the first time that routine midwater trawling has been done with the new winch/Schat davit system and the first time that the multiple net has been used with it.

We found the trawl warp badly kinked over several hundred metres which caused problems throughout the cruise. It rapidly became apparent that the winch would not haul in or pay out slack wire because the jockey pulley would not grip the warp. The slack would run onto the haulage drums and jump off - usually starting at a kink. This problem was overcome by pulling off sufficient wire before launching or recovering the nets although this technique is only feasible during the extremely calm weather conditions experienced throughout the cruise.

The second serious problem concerned the Shat davit. Difficulty was experienced throughout the cruise in slewing the davit to recover the nets. On many occasions this was only accomplished by manually threading a rope through the grommet on the monitor cross and pulling this to the after rail. Slewing was improved when the slip ring system was replaced by pipes but clearly the davit does not readily slew under the loads imposed on it by the trawls. It will also not slew when the ship rolls or pitches, the 6ft swell which we experienced once caused problems recovering the trawl which were only overcome with a rope. The failure of the winch to cope with slack wire and inability of the davit to slew readily will pose severe problems for trawling in other than extremely calm weather.

Two trawls were successfully towed off the port A frame but the line of communication between here and the winch control room is rather tortuous. Some kind of radio system would greatly improve communications between the davit/A frame control and winch room. A general smoothing-off of the projections on the davit jib is desirable as the crane wire frequently fouls these, and a meter read out of wire out and emergency stop buttoms would be extremely useful near the after rail.

Generally speaking once the trawl is outboard and fishing, or being paid out or hauled, the winch is perfectly satisfactory. However the successful trawling which we did accomplish would have been impossible without the continuous efforts of the three engineers.

H.S.J. Roe

Closing cod-end

Trials of an acoustically operated closing cod-end on the RMT8, designed to capture deep water species and bring them to the surface in good conditions, have proved very successful. The device encloses the catch in a wide bore tube between two ball valves. Closure of these valves is activated by an acoustic signal and the catch brought to the surface enclosed in a large volume of water, with little thermal or mechanical shock. Out of nine tows with the device four were completely successful and the conditions of the catch was in remarkable contrast to that of similar unprotected hauls. The sharp gradient in temperature (over 20°C between the surface and 500 m) was clearly a major factor in the death of most species in normal tows. The activity of several stomiatoid fishes, the mysid Eucopia and the gonostomatid Cyclothone bore witness to the dramatic improvement in catch condition consequent upon the use of the closing cod-end and augurs well for future studies of these and other species.

R.J. Herring
R.A. Wild

Acoustics/Electronics

For the coring work a single 10kHz beacon fitted in a 6 inch dia. 30 inch long net monitor type tube was used exclusively. This device is fitted with the externally mounting version of the 35.5 kHz transducer recently developed at IOS, in order to convert the unit into a Near Bottom Echo Sounder. The first 150 metres range of the transducer is stretched by a factor of 16 and telemetered to the surface as a delayed pulse at 10kHz.

The trial technique mentioned in Cruise Report 125 was pursued whereby the pinger was clamped to the wire 70 metres above and not either directly or as close as is practicable to a corer.

Since this pinger is considerably more powerful than the units used in previous chemical cruises excellent bottom reflections were obtained chiefly from the reference pulse whilst the Near Bottom Echo Sounder telemeters its precise distance from the corer.

After adjustments were made following its use on the first two Kastenlot cores the unit functioned in an exemplary manner on the first Box Core station and subsequently on the remaining core stations. On the second box corer station it was at first felt that the corer had pre-triggered - this was recovered and found to be still cocked - it was then realised that the pinger clamps must have slipped on the very greasy wire and that the pinger had in fact crept up the wire during paying out. After the corer had touched bottom the NBES indicated that the corer was not further away as was to be expected but nearer to the pinger, thus indicating that a turn of the warp was around the corer, this subsequently proved to be the case. Once the Mufax operator is familiar with the working of the device it is possible to maintain very fine control over the placement of a corer in the sea-bed with a consequent minimisation of the amount of wire overrun required.

After several dips the multiplication factor of this device was increased to X100 over the range of 60 to 73.5 metres from the device. This has the advantage from the point of view of the operator that provided the device is firmly fixed to the cable within the range mentioned above the instrument to be monitored, the reference pulse can now be taken to indicate 60 metres and each subsequent 100 metres, as measured on the Mufax between the reference pulse and the delayed pulse, can be added as an additional one metre.

After the initial teething troubles were sorted out the modification proved to be most successful and was used in this mode for the remainder of the coring work.

An acoustic control and monitor unit for an experimental closing cod-end was completed during the cruise and after some difficulties were overcome the device showed promise of proving to be a useful tool.

Operation of the net monitors was notably less successful and a whole catalogue of faults developed on them particularly unit J3, the deep-sea photometer monitor. Unfortunately their cause tended to be obscured by various minor mishaps. For instance on the first two hauls the monitor was fished without its vibration damping fin, thus it was felt initially when the monitor triggered prematurely and then ceased its chirping for several minutes that vibration had loosened components. Loose components were indeed found and the switch also proved to be faulty but these factors tended to obscure the chief causes of the difficulties namely thermal shock and that the transducer leads on one of the battery packs had been transposed, imperfections in the anodising once the monitor was in the water were then causing intermittent shorting of the power pulses. Premature operations of the release gear were due to the oscillations of the channel filter caused by thermal shock as the units were cooled by the thermocline after having baked on deck in the tropical sun. It was not thought initially de-sensitising the filters was too good an idea since it was felt that it might cause a range impairment, but after attempts to solve the problem by cooling the monitors on deck had failed to provide a complete cure, this was done and solved the problem. The adoption of this course of action necessitated a slightly longer period of transmission from the ship to activate the release gear.

Although at the time these events felt fairly disastrous in fact 15 successful multi-net hauls were completed out of a total of 21 and 13 1+8 net hauls were fished successfully out of a total of 13. 9 of the latter were in conjunction with trials of the closing cod-end.

E. Darlington

Aft hydraulic winch system

This was the first opportunity for fully testing the system since the problems that occurred during cruises 125 and 126.

The coring warp was only used on the first deployment due to the high ambient (32°C) and seawater cooling (29°C) temperature. The traction winch motors reached 72°C and at this time had to be cooled with a seawater hose whilst running. All other station work was carried out using the trawl warp and, even with the high ambient temperatures involved, there was no overheating.

The system worked well for coring operations, particularly the Box Corer. By using the crane davit there is far less possibility of disturbing the surface of the sample collected than by the old method of using the ship's crane. Difficulty was experienced however in obtaining sufficient speed to run the Kastenlot Corer into the sediment. This was due to the incorrect reeling gear on the storage drum. Additional fairleads on the crane davit and deck pedestle will need to be fitted in order to allow an unobstructed passage for shackles, swivels, etc.

There are two main difficulties when launching or recovering nets. Firstly, when there is no load on the warp, either reeving or hauling, it is necessary to have at least two people keeping tension on by hand. This is a particular problem on recovery where, due to the height and speed required of the ship's crane, the traction winch cannot pay out fast enough without getting slack warp. This, in turn, can jump the lays on the winch drums. Secondly, the crane davit will not slew under load or if the ship's trim is in excess of 5°. This makes net launch and recovery difficult even in very calm weather. At one point the davit would not slew at all and it was found that the ship ring seals had failed. It was necessary to remove this complete assembly and replace it with directly coupled hoses. A continuous check, therefore, has to be kept to ensure that neither hoses or wires become snagged on the warp, particularly at launch and recovery times.

There were 49 equipment deployments using the aft hydraulic system during the cruise amounting to 115 hours winch time. The maximum warp out was 6500 metres and the maximum load recorded was 8 tons. Speeds in excess of 1.0 m/s were achieved both in veering and hauling with 5000 metres of warp out and registering loads between 4 and 5 tons.

G.V. Lodge
P.D. Peters
R.A. Wild

STN.	DATE 1982	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS	MEAN SOUND M.
10512 # 1	4/ 5	0 59.7N	1 1.9W	KASTENLOT	5000-5000	0835-	2M. BARREL - GOOD SAMPLE	5000
10513 # 1	4/ 5	0 35.8N 0 35.1N	0 41.0W 0 41.4W	RMT1M-1 RMT8M-1	5- 50	1749-1805 DUSK	MONITOR PROBLEMS - SEE BIO LOG. FLOW DIST. 1.29 KM.	4996
10513 # 2	4/ 5	0 35.1N 0 32.0N	0 41.4W 0 42.3W	RMT1M-2 RMT8M-2	50- 450	1805-1911 DUSK	MONITOR PROBLEMS - SEE BIO LOG.	4986
10514 # 1	5/ 5	0 2.2S	0 30.0E	KASTENLOT	4868-4868	1200-	2M. BARREL - SUCCESSFUL CORE	4868
10515 # 1	5/ 5	0 10.2S 0 11.8S	0 27.0E 0 26.6E	RMT1M-1 RMT8M-1	0- 300	1856-1932 NIGHT	FLOW DIST. 3.03 KM.	4880
10515 # 2	5/ 5	0 11.8S 0 13.2S	0 26.6E 0 26.4E	RMT1M-2 RMT8M-2	300- 600	1932-2000 NIGHT	LOWER DEPTH & FLOW EST. -SEE BIO LOG FLOW DIST. 1.68 KM.	4880
10515 # 3	5/ 5	0 13.2S 1 0.0N	0 26.4E 0 26.0E	RMT1M-3 RMT8M-3	600-1000	2000-2033 NIGHT	UPPER DEPTH & FLOW EST. -SEE BIO LOG FLOW DIST. 1.86 KM.	4880
10516 # 1	6/ 5	0 35.9S	1 33.1E	BOX CORER	2230-2230	1600-	VERY SMALL SAMPLE	2230
10517 # 1	6/ 5	0 39.2S 0 41.2S	1 31.0E 1 29.5E	RMT1M-1 RMT8M-1	205- 400	2041-2142 NIGHT	FLOW DIST. 4.12 KM.	4631
10517 # 2	6/ 5	0 41.2S 0 42.9S	1 29.5E 1 28.1E	RMT1M-2 RMT8M-2	400- 600	2142-2242 NIGHT	FLOW DIST. 3.64 KM.	4631
10518 # 1	7/ 5	2 4.1S 2 4.3S	1 15.5E 1 15.4E	RMT1M-1 RMT8M-1	10- 50	1901-1908 NIGHT	NETS CLOSED PREMATURELY FLOW DIST. 0.53 KM.	
10518 # 2	7/ 5	2 4.3S 2 6.4S	1 15.4E 1 15.4E	RMT1M-2 RMT8M-2	45- 200	1908-2008 NIGHT	RMT8 CATCH LOST - COD END DETACHED FLOW DIST. 3.09 KM.	

STN.	DATE 1982	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS	MEAN SOUND M.
10518	7/ 5	2 6.4S	1 15.4E	RMT1M-3	200- 400	2008-2108		
# 3		2 8.6S	1 15.7E	RMT8M-3		NIGHT	FLOW DIST. 3.62 KM.	
10519	8/ 5	2 3.7S	1 19.3E	KASTENLOT	2130-2130	0710-	2M. BARREL - NO SAMPLE	2130
# 1								
10520	8/ 5	2 18.4S	1 10.4E	BOX CORER	4530-4530	1405-	GOOD SAMPLE INCLUDING INTERFACE	4530
# 1								
10521	8/ 5	2 19.7S	1 12.4E	RMT1M-1	100- 300	1852-1952		
# 1		2 21.7S	1 12.3E	RMT8M-1		NIGHT	FLOW DIST. 3.46 KM.	
10521	8/ 5	2 21.7S	1 12.3E	RMT1M-2	295- 500	1952-2051		
# 2		2 23.6S	1 12.3E	RMT8M-2		NIGHT	FLOW DIST. 3.21 KM.	
10521	8/ 5	2 23.6S	1 12.3E	RMT1M-3	500- 700	2051-2151		
# 3		2 25.6S	1 12.3E	RMT8M-3		NIGHT	FLOW DIST. 2.88 KM.	
10522	9/ 5	3 0.8S	0 45.9E	BOX CORER	240- 240	1415-	VERY VERY SMALL SAMPLE	240
# 1								
10523	10/ 5	5 24.0S	0 30.7E	RMT1M-1	500- 600	0701-0831		3230
# 1		5 26.8S	0 30.8E	RMT8M-1		DAY	FLOW DIST. 5.00 KM.	
10523	10/ 5	5 26.8S	0 30.8E	RMT1M-2	600- 700	0831-1001		
# 2		5 30.2S	0 30.8E	RMT8M-2		DAY	FLOW DIST. 5.78 KM.	
10523	10/ 5	5 30.2S	0 30.8E	RMT1M-3	700- 800	1001-1131		2265
# 3		5 33.8S	0 30.3E	RMT8M-3		DAY	FLOW DIST. 6.00 KM.	
10523	10/ 5	5 36.5S	0 30.2E	RMT1M-1	200- 300	1246-1346		3230
# 4		5 38.9S	0 29.7E	RMT8M-1		DAY	FLOW DIST. 3.22 KM.	
10523	10/ 5	5 38.9S	0 29.7E	RMT1M-2	300- 400	1346-1516		
# 5		5 41.9S	0 29.4E	RMT8M-2		DAY	FLOW DIST. 6.29 KM.	

STN.	DATE 1982	POSITION LAT	POSITION LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS	MEAN SOUND M.
10523	10/ 5	5 41.9S	0 29.4E	RMT1M-3	400- 500	1516-1646		4575
# 6		5 44.5S	0 28.0E	RMT8M-3		DAY	FLOW DIST. 5.25 KM.	
10523	10/ 5	5 36.7S	0 30.3E	CTD	0-2000	1849-1954		3640
# 7		5 36.3S	0 29.7E					
10523	11/ 5	4 55.8S	0 26.4E	RMT1M-1	1400-1600	1541-1711		4675
# 8		4 52.4S	0 23.9E	RMT8M-1		DAY	FLOW DIST. 7.55 KM.	
10523	11/ 5	4 52.4S	0 23.9E	RMT1M-2	1600-1800	1711-1841		
# 9		4 49.5S	0 21.5E	RMT8M-2		DUSK	FLOW DIST. 6.29 KM.	
10523	11/ 5	4 49.5S	0 21.5E	RMT1M-3	1805-2005	1841-2011		4557
# 10		4 46.8S	0 19.4E	RMT8M-3		NIGHT	FLOW DIST. 5.71 KM.	
10523	12/ 5	4 50.6S	0 30.2E	RMT1M-1	800- 895	0722-0854		4646
# 11		4 52.6S	0 27.0E	RMT8M-1		DAY	FLOW DIST. 5.94 KM.	
10523	12/ 5	4 52.5S	0 27.0E	RMT1M-2	895-1000	0854-1028		
# 12		4 54.1S	0 23.6E	RMT8M-2		DAY	FLOW DIST. 6.82 KM.	
10523	12/ 5	4 54.1S	0 23.7E	RMT1M-3	995-1100	1028-1158		
# 13		4 55.0S	0 20.0E	RMT8M-3		DAY	FLOW DIST. 5.99 KM.	
10523	12/ 5	4 55.1S	0 17.1E	RMT1M-1	0- 5	1318-1324	NETS CLOSED PREMATURELY	
# 14		4 54.9S	0 16.9E	RMT8M-1		DAY	FLOW DIST. 0.36 KM.	
10523	12/ 5	4 54.9S	0 16.9E	RMT1M-2	0- 100	1324-1424		
# 15		4 53.1S	0 15.0E	RMT8M-2		DAY	FLOW DIST. 4.06 KM.	
10523	12/ 5	4 53.2S	0 15.1E	RMT1M-3	100- 200	1424-1524		
# 16		4 51.7S	0 13.1E	RMT8M-3		DAY	FLOW DIST. 4.28 KM.	
10523	13/ 5	5 8.3S	0 29.0E	RMT1M-1	1090-1205	0730-0900		4670
# 17		5 5.0S	0 29.5E	RMT8M-1		DAY	FLOW DIST. 4.82 KM.	

STN.	DATE 1982	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS	MEAN SOUND M.
10523	13/ 5	5 5.1S	0 29.5E	RMT1M-2	1205-1300	0900-1030		
# 18		5 1.8S	0 29.8E	RMT8M-2		DAY	FLOW DIST. 5.62 KM.	
10523	13/ 5	5 1.8S	0 29.8E	RMT1M-3	1300-1400	1030-1200		4660
# 19		4 58.4S	0 29.8E	RMT8M-3		DAY	FLOW DIST. 5.69 KM.	
10524	13/ 5	4 57.5S	0 28.2E	GRAV CORER	4647-4647	1520-	1M. BARREL - VERY GOOD SAMPLE	4647
# 1								
10525	14/ 5	5 28.3S	0 16.1W	BOX CORER	3760-3760	1450-	EXCELLENT SAMPLE INCLUDING INTERFACE	3760
# 1								
10526	14/ 5	5 22.5S	0 5.1W	RMT1M-1	200- 300	1940-2011		
# 1		5 23.8S	0 5.1W	RMT8M-1		NIGHT	FLOW DIST. 1.82 KM.	
10526	14/ 5	5 23.8S	0 5.1W	RMT1M-2	300- 400	2011-2041		
# 2		5 24.9S	0 5.0W	RMT8M-2		NIGHT	FLOW DIST. 1.78 KM.	
10526	14/ 5	5 24.9S	0 5.0W	RMT1M-3	400- 500	2041-2111		
# 3		5 26.1S	0 5.0W	RMT8M-3		NIGHT	FLOW DIST. 1.80 KM.	
10526	14/ 5	5 27.5S	0 5.2W	RMT1M-1	0- 55	2222-2251	FISHED ABOVE THE THERMOCLINE	
# 4		5 28.5S	0 5.2W	RMT8M-1		NIGHT	FLOW DIST. 1.73 KM.	
10526	14/ 5	5 28.5S	0 5.2W	RMT1M-2	55- 100	2251-2321		
# 5		5 29.4S	0 5.3W	RMT8M-2		NIGHT	FLOW DIST. 1.73 KM.	
10526	14/ 5	5 29.4S	0 5.3W	RMT1M-3	100- 210	2321-2351		3680
# 6		5 30.3S	0 5.6W	RMT8M-3		NIGHT	FLOW DIST. 1.45 KM.	
10527	15/ 5	5 25.0S	0 15.6W	KASTENLOT	3795-3795	1040-	4M. BARREL - EXTREMELY GOOD SAMPLE	3795
# 1								
10528	15/ 5	4 53.9S	0 2.2E	RMT 1	110- 200	1938-2023	MATERIALS HAUL	3836
# 1		4 55.5S	0 3.0E	RMT 8		NIGHT	FLOW DIST. 2.78 KM.	

STN.	DATE 1982	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS	MEAN SOUND M.
10528 # 2	15/ 5	4 56.2S 4 57.8S	0 3.6E 0 4.0E	RMT 1 RMT 8	150- 250	2128-2213 NIGHT	MATERIALS HAUL FLOW DIST. 2.66 KM.	
10528 # 3	15/ 5	4 58.5S 4 59.7S	0 4.1E 0 4.4E	RMT 1 RMT 8	50- 150	2256-2341 NIGHT	MATERIALS HAUL FLOW DIST. 2.47 KM.	3895
10529 # 1	16/ 5	4 56.8S	0 27.7E	KASTENLOT	4735-4735	1135-	4M. BARREL - SUPERB SAMPLE	4735
10530 # 1	16/ 5	5 51.5S 5 51.6S	0 27.4E 0 27.2E	XX	0-1000	2054-2143	CLOSING COD END TRIALS	4575
10531 # 1	17/ 5	6 23.7S 6 25.6S	0 31.3E 0 32.4E	RMT1M-1 RMT8M-1 LLP	90- 290	0524-0626 DAWN	105 DB. FLOW DIST. 3.52 KM.	4200
10531 # 2	17/ 5	6 25.5S 6 27.5S	0 32.3E 0 33.3E	RMT1M-2 RMT8M-2 LLP	235- 280	0626-0727 DAWN	95 DB. FLOW DIST. 3.66 KM.	
10531 # 3	17/ 5	6 27.5S 6 29.5S	0 33.3E 0 34.2E	RMT1M-3 RMT8M-3 LLP	220- 245	0727-0827 DAY	85 DB. FLOW DIST. 3.78 KM.	
10531 # 4	17/ 5	6 30.5S 6 32.3S	0 34.7E 0 35.5E	RMT1M-1 RMT8M-1 LLP	350- 380	0917-1013 DAY	105 DB.-MONITOR FAILURE HAUL ABORTED FLOW DIST. 3.04 KM.	4725
10531 # 5	17/ 5	6 33.7S 6 35.5S	0 34.9E 0 35.7E	RMT1M-1 RMT8M-1 LLP	275- 340	1319-1419 DAY	95 DB. FLOW DIST. 3.39 KM.	4728
10531 # 6	17/ 5	6 35.5S 6 37.5S	0 35.7E 0 36.7E	RMT1M-2 RMT8M-2 LLP	240- 275	1419-1522 DAY	85 DB. FLOW DIST. 3.64 KM.	

STN.	DATE 1982	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS	MEAN SOUND M.
10531	17/ 5	6 37.5S	0 36.6E	RMT1M-3	270- 310	1522-1622	95 DB.	
# 7		6 39.5S	0 37.5E	RMT8M-3		DAY	FLOW DIST. 3.75 KM.	
				LLP				
10531	17/ 5	6 39.0S	0 36.6E	RMT1M-1	210- 325	1720-1756	105 DB.	
# 8		6 38.1S	0 35.4E	RMT8M-1		DUSK	FLOW DIST. 2.63 KM.	
				LLP				
10531	17/ 5	6 38.2S	0 35.5E	RMT1M-2	40- 210	1756-1830	105 DB.	4730
# 9		6 37.5S	0 34.5E	RMT8M-2		DUSK	FLOW DIST. 2.44 KM.	
				LLP				
10531	18/ 5	6 25.7S	0 30.2E	RMT1M-1	70- 295	0519-0621	105 DB.	
# 10		6 28.0S	0 30.5E	RMT8M-1		DAWN	FLOW DIST. 3.89 KM.	
				LLP				
10531	18/ 5	6 28.0S	0 30.5E	RMT1M-2	245- 290	0621-0721	95 DB.	
# 11		6 30.2S	0 30.9E	RMT8M-2		DAWN	FLOW DIST. 4.19 KM.	
				LLP				
10531	18/ 5	6 30.2S	0 30.9E	RMT1M-3	230- 250	0721-0821	85 DB.	
# 12		6 32.3S	0 31.4E	RMT8M-3		DAY	FLOW DIST. 3.69 KM.	
				LLP				
10531	18/ 5	6 34.1S	0 31.8E	RMT1M-1	360- 380	0913-0945	105 DB.-MONITOR FAILURE HAUL ABORTED	
# 13		6 35.3S	0 32.0E	RMT8M-1		DAY	FLOW DIST. 1.89 KM.	
				LLP				
10531	18/ 5	6 38.0S	0 32.3E	RMT1M-1	310- 350	1130-1230	95 DB.	
# 14		6 40.1S	0 33.0E	RMT8M-1		DAY	FLOW DIST. 3.91 KM.	
				LLP				
10531	18/ 5	6 40.1S	0 33.0E	RMT1M-2	275- 315	1230-1329	85 DB.	
# 15		6 42.0S	0 33.9E	RMT8M-2		DAY	FLOW DIST. 3.84 KM.	
				LLP				

STN.	DATE 1982	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS	MEAN SOUND M.
10531 # 16	18/ 5	6 42.0S 6 43.9S	0 33.9E 0 34.7E	RMT1M-3 RMT8M-3 LLP	310- 340	1329-1424 DAY	95 DB.-MONITOR FAILURE HAUL ABORTED FLOW DIST. 3.46 KM.	
10531 # 17	18/ 5	6 41.7S 6 40.5S	0 33.1E 0 32.5E	RMT1M-2 RMT8M-2 LLP	265- 350	1651-1737 DUSK	105 DB. FLOW DIST. 2.34 KM.	
10531 # 18	18/ 5	6 40.5S 6 39.7S	0 32.5E 0 31.7E	RMT1M-3 RMT8M-3 LLP	30- 265	1737-1821 DUSK	95 DB. FLOW DIST. 2.57 KM.	4726
10532 # 1	19/ 5	6 23.9S	0 14.4E	BOX CORER	460- 460	1030-	VERY SMALL SAMPLE WITH LIVE MOLLUSC	460
10533 # 1	19/ 5	6 21.3S	0 16.3E	BOX CORER	750- 750	1323-	SMALL SAMPLE	750
10534 # 1	19/ 5	6 39.3S 6 40.1S	0 11.0W 0 11.8W	RMT 1 RMT 8	100- 200	2031-2102 NIGHT	CLOSING COD END (CCE) WORKED WELL FLOW DIST. 1.84 KM.	
10535 # 1	20/ 5	7 28.9S	0 5.3W	KASTENLOT	4830-4830	0830-	4 M. BARREL - MAGNIFICENT SAMPLE	4830
10536 # 1	20/ 5	7 8.6S 7 0.2S	0 10.4W 0 15.2W	RMT 1 RMT 8	2370-3240	1500-1900	 FLOW DIST. 14.65 KM.	4800
10537 # 1	21/ 5	5 26.4S	0 33.7W	*XX	0- 0	1100-	SURFACE FILM STATION	
10538 # 1	21/ 5	5 35.8S 5 33.8S	0 33.1W 0 32.1W	RMT 1 RMT 8	310- 500	1431-1520 DAY	CCE FAILED TO OPERATE FLOW DIST. 2.42 KM.	3842
10539 # 1	21/ 5	5 32.6S 5 34.9S	0 33.5W 0 34.2W	RMT 1 RMT 8	290- 505	1748-1848 DUSK	CCE FAILED TO OPERATE FLOW DIST. 3.37 KM.	

STN.	DATE 1982	POSITION LAT	LONG	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS	MEAN SOUND M.
10540	22/ 5	5 21.1S	0 8.8W	RMT 1	300- 595	1049-1150	CCE VALVES FAILED TO CLOSE	
# 1		5 22.0S	0 11.2W	RMT 8		DAY	FLOW DIST. 4.14 KM.	
10541	22/ 5	5 26.3S	0 16.3W	RMT 1	300- 400	1400-1432	CCE CLOSED NEAR THE SURFACE	
# 1		5 26.1S	0 15.2W	RMT 8		DAY		
10542	22/ 5	5 25.7S	0 14.0W	RMT 1	400- 500	1604-1634	CCE OPERATED SUCCESSFULLY	
# 1		5 25.4S	0 12.8W	RMT 8		DAY	FLOW DIST. 1.64 KM.	
10543	22/ 5	5 21.9S	0 8.7W	RMT 1	500- 650	1835-1935	CCE OPERATED SUCCESSFULLY -RMT1 LOST	
# 1		5 19.8S	0 9.6W	RMT 8		DAY	FLOW DIST. 3.78 KM.	
10544	23/ 5	3 36.8S	0 50.8W	RMT 8	550- 600	0854-0930	CCE VALVES FAILED TO CLOSE	
# 1		3 35.6S	0 51.7W			DAY	FLOW DIST. 2.30 KM.	
10545	23/ 5	3 27.7S	0 55.8W	RMT 8	600- 660	1134-1212	CCE OPERATED SUCCESSFULLY	
# 1		3 26.2S	0 56.4W			DAY	FLOW DIST. 2.18 KM.	
10546	24/ 5	0 20.0N	2 12.7W	*XX	0- 0	1540-	* SURFACE FILM STATION	
# 1								

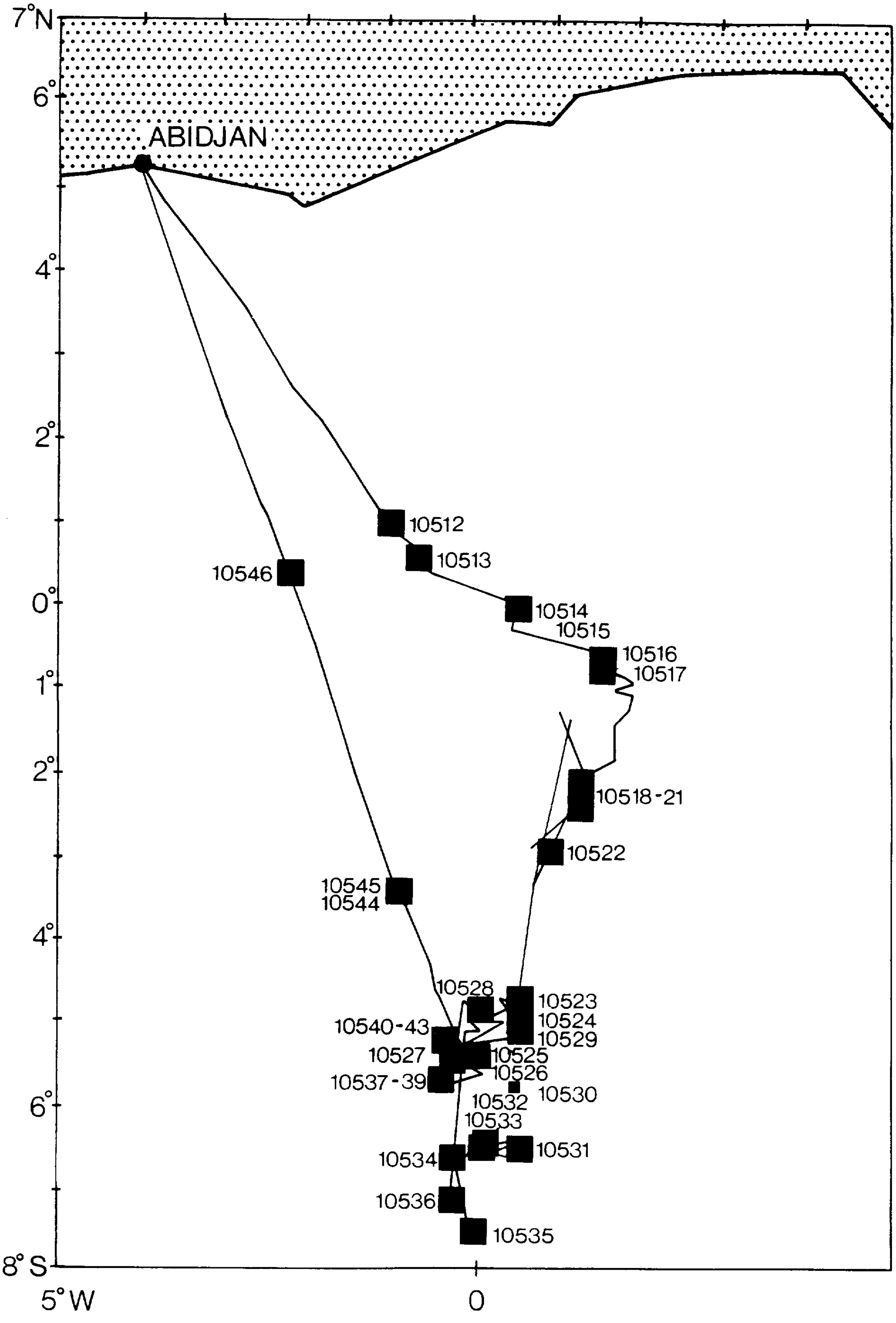

Figure 1. DISCOVERY CRUISE 128 ship's track