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RRS CHARLES DARWIN

CRUISE 9A/85

16 - 28 NOVEMBER 1985

PHYSICAL OCEANOGRAPHIC STUDIES IN THE NORTH-EAST ATLANTIC OCEAN

CRUISE REPORT NO. 180

1986

INSTITUTE OF OCEANOGRAPHIC SCIENCES

NATURAL ENVIRONMENT RESEARCH COUNCIL

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WORMLEY

RRS CHARLES DARWIN

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Physical oceanographic studies in the north-east Atlantic Ocean

Principal Scientist

W.J. Gould

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The work described in this report has, in part, been carried out under contract for the Department of the Environment. The results will be used in the formulation of Government Policy but at this stage they do not necessarily represent that policy

CONTENTS

SCIENTIFIC PERSONNEL

W.J. Gould	IOS (Wormley)	Principal Scientist
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T.J.P. Gwilliam	"	
N.W. Millard	"	
J.A. Moorey	"	
G.R.J. Phillips	"	
I.P. Rouse	"	
P.M. Saunders	"	
J.R. Swane	"	(Industrial Training Student)
I. Waddington	"	

G.H. Evans	RVS Barry
S. Jones	"
R.A Phipps	"
Kay E Potter	"
J. Sherwood	"

SHIPS OFFICERS

G. Long	Master
S. Jackson	Chief Officer
S. Sykes	2nd Officer
R. Chamberlain	3rd Officer
J.G.L. Baker	Radio Officer
C. Storrier	Chief Engineer
D. Anderson	2nd Engineer
A. Grattidge	3rd Engineer
P. Edgell	Elect. Officer

Bob Macdonald C.P.O. Deck

Acknowledgements

It is a pleasure to acknowledge the willing and capable assistance of all the officers, petty officers and crew of RRS Charles Darwin on this cruise.

Cruise Objectives

1. Recovery and redeployment of current meter moorings at GME (31°30'N 25°00'W)
2. Recovery and redeployment of Bathysnap (current/camera mooring) at GME
3. Deployment of a moored, recording transmissometer.
4. Recovery and redeployment of four Autonomous Listening Stations (ALS)
5. Working of CTD stations
6. Testing of new BBC micro computer based XBT logger.

Narrative

RRS Charles Darwin sailed from Funchal, Madeira at 0900Z 16 November 1985. After clearing the land course was set towards the GME area at approximately 11 knots. At 1000z/17th the vessel hove to for a CTD station (CTD1) and wire test of acoustic releases. This was preceded by a brief test of the winch which revealed the outboard sheave to be jammed out of line. This was eventually freed and after some initial problems with the CTD a station worked to full ocean depth (see Table 2 for details of CTD stations). On completion of the station at 1630Z the PES fish was deployed and course resumed towards GME. At 2130Z the vessel stopped again and three acoustic release units were tested to 4000 m. These were completed at 0130/18th and GME mooring 391 reached at 0630. The mooring was recovered uneventfully by 0930. Moorings 389 and 387 were recovered between 1040 and 1324 and between 1405 and 1623. All were in good condition and recoveries were uneventful in good weather. Course was set for Bathysnap 1 but when it was reached there was insufficient time to carry out recovery in daylight.

A replacement for mooring 389 (mooring 399) was deployed between 1930 and 2114/18th and overnight two CTD stations (CTD2 and 3) were worked (one at the site of mooring 387 and the second near Bathysnap 2).

Bathysnap 2 was released from the sea bed at 0719/19th prior to the completion of CTD3. The Bathysnap was recovered at 0940 and course set for Bathysnap 1. This was reached at 1215 but even though the release was put through its release sequence the unit did not separate from its base. After 30 minutes of repeated release attempts the Bathysnap was abandoned and course was set for the deployment of mooring 400 (a replacement for

mooring 391). This full depth mooring was deployed, buoy first, between 1350 and 1854. The final current meter mooring (401 replacing 387) was deployed between 2100 and 2227/19th.

Overnight CTD4 was worked 5 miles N of mooring 400. Two hours were spent clearing a tangled wire on the winch and the CTD station was not completed until 0630/20th. The moored transmissometer and Bathysnap mooring were then deployed and course set towards the southernmost ALS at 1042.

On passage XBT drops were made (see Table 3) and a CTD station (CTD5) worked between 2220/21st and 0233/22nd. (A previous attempt to work a CTD station at 2000/21st was abandoned when it was found that a newly fitted conductivity sensor had fractured).

Mooring 393 was released from its anchor at 0729/22nd, recovered and redeployed without difficulty by 1150. Course was then set towards the next ALS (Mooring 395 at 42°43'N 19°00'W). Passage northward continued throughout the remainder of the 22nd and the mooring position was reached at 1630/23rd. During the passage the south easterly wind had increased and with it the sea and swell. The mooring was recovered in rough conditions and was redeployed by 2233/23rd (Mooring 405).

The weather and sea conditions and weather forecast suggested that it would be impossible to reach the northernmost ALS and after the vessel had tried to progress eastwards overnight, passage towards the easternmost ALS was started at 0900/24th. The weather gradually moderated through the 24th and the easternmost ALS was reached at 1330/25th, recovered and relaid by 2140. After steaming courses to fix the mooring position the vessel proceeded southwards for a line of CTD station (CTDs 6, 7 and 8).

These were completed by 0440/27th and the vessel set course towards Lisbon. The pilot station was reached at 0700/28th and the vessel berthed at 1000.

Individual project reports

Mooring Work: (Gould, Waddington, Phillips, Grohmann)

This consisted for the most part of the recovery and redeployment of current meter and listening station moorings deployed in February and April 1985 on Charles Darwin Cruises 1 and 3/85.

The mooring work proceeded very smoothly and mooring components and instruments were recovered in excellent condition. The details of mooring positions are given in Table 1. Moorings were handled by the IOS self-contained double-barrelled winch working over a block suspended at half the "A" frame height. Moorings in the GME area were deployed "anchor first" with the exception of mooring 400, a full depth current meter mooring. This, as with the ALS, moorings was streamed "buoy first" and the anchor allowed to free fall to the sea bed.

No analysis of the Aanderaa data was made on board. Details of the ALS instruments are given in the appropriate section.

ALS recoveries and deployments: (Millard, Rouse, Gould)

Three ALS moorings were recovered and redeployed. A fourth at 45°N 15°W could not be reached due to bad weather. It is scheduled for recovery in January 1986 during Charles Darwin's passage back to the U.K.

The ALS data were translated at sea on a Sea Data decoder and transferred to half inch computer tapes. The data were then plotted using a BBC Microcomputer-based analysis programme. The data were of high quality but ALS 17 showed several parity errors on the tape. Time checks on the ALS clocks were made against a satellite clock locked to the GOES west satellite. These checks revealed that clock errors were as follows.

ALS 13 Gained 5.910 ms day^{-1}

ALS 15 Gained 5.325 ms day^{-1}

ALS 17 Lost 2.620 ms day^{-1}

The Channel 7 plots showed good signal reception from all floats operated by the MAFF Lowestoft laboratory in the Iberia basin and from several floats launched by COB Brest France near the mid Atlantic ridge. ALS 17, the southernmost one also heard signals from the IOS floats in the Maderia basin (launched in February 1985 near 32°N 24°W). On Channel 5 there were good signals from floats launched by WHOI in the Maderia basin.

Long Term Transmissometer Mooring (Gwilliam)

Requested by Department of the Environment this equipment was developed to record transmissometer data at the GME site for a one year period.

Apart from the transmissometer, two other sensors are included; a

temperature sensor and digiquartz pressure sensor. The data from these sensors are recorded on a well proven Mk.4 tide gauge logger system. The logger and the temperature and pressure sensors were kindly loaned by R. Spencer, IOS, Bidston.

The transmissometer data is spot sampled once every 30 minutes and averaged over a 225 second period again every 30 minutes. The sampling period for the pressure and temperature sensors is 30 minutes. The data from the latter two sensors will provide tidal information and may also provide evidence of correlation between the tidal and transmissometer information.

The logger tube, which also contains the batteries, together with the pressure and temperature sensors is mounted vertically between two five foot rods. The transmissometer is mounted directly above these tubes but at right angles to them. All the rods, plates, nuts and bolts are made in titanium.

The mooring assembly is made up of a chain anchor clump; 3 metres above this the IOS release and transmissometer/logger frame is attached. The transmissometer will be approximately 5 metres above the sea bed when in place. The buoyancy, consisting of four 17 inch and 10 inch glass spheres, is attached to the top of the frame by a 50 metre 8mm polyester braid line.

The logger and tape was switched on at 16 hrs 09 mins 22.5 secs. GMT on 19.11.85 and the complete assembly deployed 0723 hrs on 21.11.85 (day 324). Position 31° 33'.6N, 24° 4'3.4W.

It is intended to release the mooring, replace the tape and relay the mooring during May 1986 from RRS Discovery.

CTD Stations: (Saunders, Gwilliam, Moorey)

On this short cruise eight stations were worked, all from the midship winch: like the curate's egg all were good in parts. In support of the NBIS CTD, samples were taken for salinity and dissolved oxygen utilising a General Oceanics multisampler: samples were taken at pre-selected levels on the up cast (stopped). On the first two stations a Sea Tech 1 m path transmissometer was also lowered with the CTD: subsequently the transmissometer was deployed on a long-term mooring in the GME area. IOS releases were also tested on a number of stations. To complete the

instrumentation list - a near-bottom echo sounder with range about 12-200 m installed to facilitate lowering the CTD close to the sea bed even in rough terrain.

CTD performance was good though both oxygen and conductivity sensors exhibited excessive noise on stations 5 and 2-4 respectively. Both were replaced, the former straightforwardly and the latter with difficulty; during installation the replacement conductivity sensor was broken so in the absence of further spares the faulty one was re-installed. Happily it showed no trace of its previous behaviour but the cell constant was markedly changed(!).

The multisampler worked well and after the first three stations, so too did the near bottom echosounder - but the winch performance was deplorable. The winch motor cut out two or three times per cast (fortunately never very near the bottom) and the winding of the wire on the drum required constant adjustment of both the level-wind gear and of the hauling speed. The dedicated care of RVS personnel is gratefully acknowledged.

Logging of the CTD data was achieved on the ships A, B, C level system and graphs and lists of provisionally calibrated data were furnished. The back-up system of Digidata tape deck was initially erratic in performance but improved. A real time display of the measurements was also provided by a BBC Microcomputer.

BBC Micro-based XBT Recorder (Millard)

The first sea trials were carried out on a new low cost digital XBT system which uses a standard BBC Microcomputer to process the data.

The changing resistance of the XBT probe is converted to a voltage and digitised by a 12 bit A/D converter at a rate of 8.5 samples/sec. This gives a depth resolution of 0.7 m and a theoretical temperature resolution of 0.01°C. The BBC processor uses the same algorithms for computing depth and temperature as the Bathysystems HP85 and in practice agreement to 0.1°C was achieved between the two systems.

After several test drops to sort out teething problems brought about by bad earths, programming etc. a short section of 7 drops was made.

The data from each drop can be saved onto disk, listed to a printer or plotted with a resolution of 1000 steps for depth and 900 steps for

temperature with scales selectable via the BBC keyboard.

The results provided sufficient encouragement to continue the development of the system into a compact, cheap, easy to use system providing better presentation of the data than exists at present.

Computing System (Sherwood, Potter)

The shipboard computer was used to record navigation (based on E.M. log, gyrocompass and Transit Satellite Navigator), CTD dips, and echo soundings.

The 'Level A' CTD interface developed on Cruise 3 earlier this year was used without modification, producing reduced data at one second intervals. These data were used to compute derived variables, and X-Y plots and data listings were produced for each dip.

The computer functioned reliably throughout the cruise with a few exceptions. One of these was a tendency for the 'Level B' data logger to accept only alternate one second CTD data scans. When this occurred resetting the multiplexing adaptor temporarily cured the problem. The only other problem which affected data recording was a failure of the scientific clock, which caused data to be logged with erroneous times. However this was corrected later on the 'Level C' data processing computer.

Ten KHz Acoustics (Phillips)

General

It was possible to interrogate all the acoustic releases at ranges in excess of two miles while travelling at speeds in excess of 11 knots. This was achieved using the PES single element in the towed fish and the Darwin's electric propulsion.

It was noticeable, particularly on CTD stations, that the hull transducer is now about 12db less sensitive than the PES fish (in May they were comparable). The value of the fish was also well illustrated during the rougher weather experienced in the latter part of the trip when signal losses experienced by the hull transducer due to ship motion and aeration frequently exceeded 70%.

Mechanical problems were experienced with both PES facsimile units; they require a thorough overhaul!.

Moorings

All the deployed CR200 units responded consistently and as required (including the 'lost' Bathysnap).

All the moorings redeployed used CR200 units recovered earlier this year and inspected, rebatteried, and retested on this cruise; they will all require thorough overhaul at IOS before further re-use.

The three GME moorings were fitted with 'free' running long life transponders but the unit fitted to mooring 400 (the plain mooring) ceased functioning after deployment

Titanium hardware used with the unit on mooring 391 was of the earliest batch produce for IOS; it had then been in the sea for a total of more than 30 months without any sign of corrosion; it was relaid.

One of the units supplied by Bidston for use on the 'transmittance' mooring was fitted with a receiver battery outside its rated storage life; it was repowered and both units were thoroughly checked and tested prior to deployment.

Bathysnaps

The mooring fitted with CR2553 was recovered normally and in excellent condition. The flash unit was checked and repowered. The camera was checked and then replaced by a new half frame unit; the camera window (previously plastic) was replaced with a glass version; the camera pressure case was reorientated to accommodate the new camera. The whole was relaid as mooring 403.

The second mooring was fitted with unit CR2307; this unit behaved normally. Particular care was taken to ensure maximum operating time for the firing relay - which indicated it had been taken advantage of; the relay was successfully operated 15 times - the package did not leave the seabed. This is the first loss of this design of mooring. CR2307 had been successfully used previously this year and had successfully fired test devices immediately prior to deployment on this mooring. The relay's firing circuits are duplicated and independent from battery to Pyrolease; a dual failure with good relay operation indication is most unlikely. The most likely cause of loss would appear to be mechanical failure or fouling.

Standard Systems

Command system deck units - all three were operational but not one was fault free.

Near bottom echosounders - three were on board; only one was useable and then only after two rebuilds.

10 KHz bottom finding pingers - two were on board; one was useable, again after a rebuild.

All these units were from the 'Discovery instruments' support package and have not been overhauled for two years - they require major physical and electronic overhaul before re-use.

Preparation for Cruise 9B

Driscoll corer arming release - CR2556-329-480-2.00 - aligned, assembled, and satisfactorily wire tested.

Sediment trap mooring release - of the 12 units available only CR2101 did not clash with existing or proposed release deployments in the GME area; this unit was overhauled and repowered but could not be made to perform satisfactorily on wire tests (two attempts). CR2314 was prepared and tested successfully but restricts deployment of the mooring to areas well clear (10nm) of mooring 401 and any proposed deployment area of the 5 KHz long range acoustic navigation array.

Long term disposable transponders - four units were aligned and tested including the building of powerful lithium battery packs - they should be capable of reliable operation for at least ten years. Thanks are due to the Bosun and his men who spliced the transponders, buoyancy, and anchors into their nets and rope ready for deployment.

The long term transponder laid by the Marion du Fresne earlier in 1985 was interrogated on passage between CTD stations at moorings 400 and 401 - it was working normally.

TABLE 1

Moorings

Mooring	Deploy/ Recover	Date	Lat N	Long W	Depth	Notes
387	R	18.XI	31°29'6	25°09'6	4989	GME. 3 Aanderaas 10, 100, 1000m above bottom
389	R	18.XI	31°30'4	25°03'1	5433	GME. 3 Aanderaas 10, 1000, 1000m above bottom
391	R	18.XI	31°30'2	24°45'2	5438	GME. 3 Aanderaas 10, 100, 1000m above bottom (nominal)
393	R	22.XI	37°18'2	18°39'0	3548	Recovery ALS 17
394	R	25.XI	41°30'1	13°28'7	5350	Recovery ALS 15
395	R	23.XI	42°43'3	19°00'2	4083	Recovery ALS 13
399	D	18.XI	31°32'4	25°01'0	5444	Replacement of 389
400	D	19.XI	31°28'8	24°43'8	5444	Replacement of 391. Six Aanderaas at nominal 200, 1000, 3000m depth and 10, 100, 1000m above bottom
401	D	19.XI	31°29'4	25°08'5	5055	Replacement of 387
402	D	20.XI	31°33'6	24°43'4	5444	Recording transmissometer
403	D	20.XI	31°33'1	24°42'5	5444	Bathysnap deployment
404	D	22.XI	37°18'1	18°37'8	3720	ALS 16 replaces ALS 17
405	D	23.XI	42°44'6	18°56'3	4000 (approx)	ALS 17 replaces ALS 13.
406	D	25.XI	41°28'8	13°27'9	5352	ALS 13 replaces ALS 15
Bathysnap 1	R	19.XI	31°14'9	25°26'6		
Bathysnap 2	R	19.XI	31°19'9	24°54'7		Did not separate from anchor.

TABLE 2

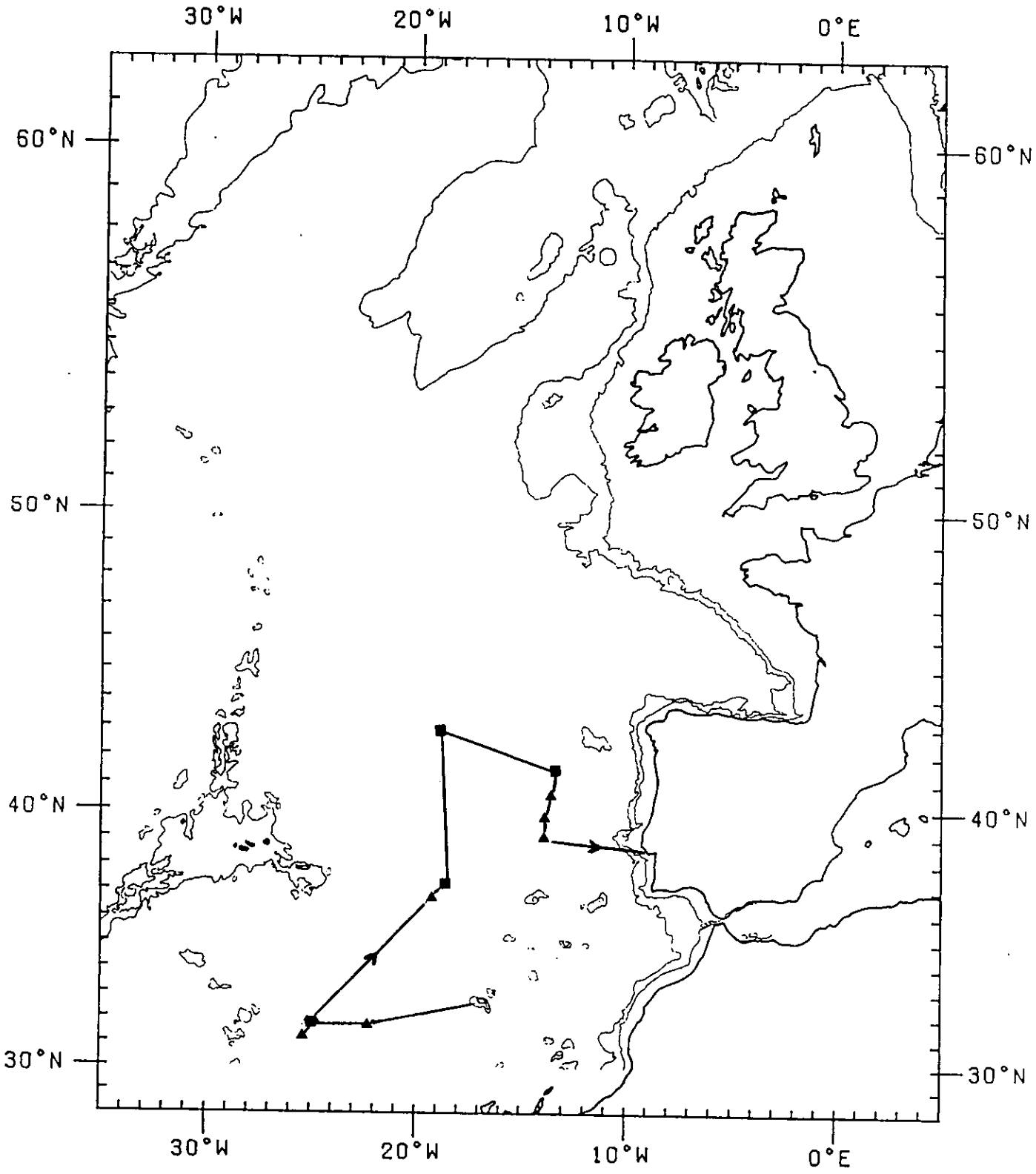
CTD Station List

Station	Time Down	Date Nov. 1985	Day of Year 1985	Lat. N	Long. W	Water Depth, m	Bottom Closest Approach	Comments
1	1348	17	321	31 39.5	22 33.5	5220	8	Transmissometer fails. Repeat Darwin 1/85 stn 17.
2	2345	18	322	31 29.7	25 10.0	5035	50	At GME - top of hill: NBES fails 300m above bottom.
3	0630	19	323	31 15.0	25 25.9	5450	10	Transmissometer record doubtful: In 100km^2 box.
4	0441	20	324	31 34.4	24 42.8	5444	2130	Transmissometer was discontinued: On Plain - curtailed.
5	0008	22	326	36 43.6	19 14.9	5213	10	Oxygen sensor noisey on recovery.
6	0717	26	330	40 26.2	13 48.4	5355	15	New oxygen sensor.
7	1946	26	330	39 30.8	14 01.5	5366	12	Reterminated wire before launch.
8	0304	27	331	38 58.5	14 00.8	4706	15	No samples: water depth from CTD.

TABLE 3

XBT Data

No.	Date	Time	Lat N	Long W
1				
2	20/XI	1900	32 44.7	23 28.7
3	"	2300	33 20.7	22 51.3
4	21/XI	0735	34 37.7	21 31.4
5	"	1100	35 07.5	20 58.5
6	"	1500	35 42.3	20 21.0
7	"	1955	36 27.0	19 35.2



RRS Charles Darwin Cruise 9A/85

Track Chart

■ Moorings

▲ CTD Stations