Natural Environment Research Council

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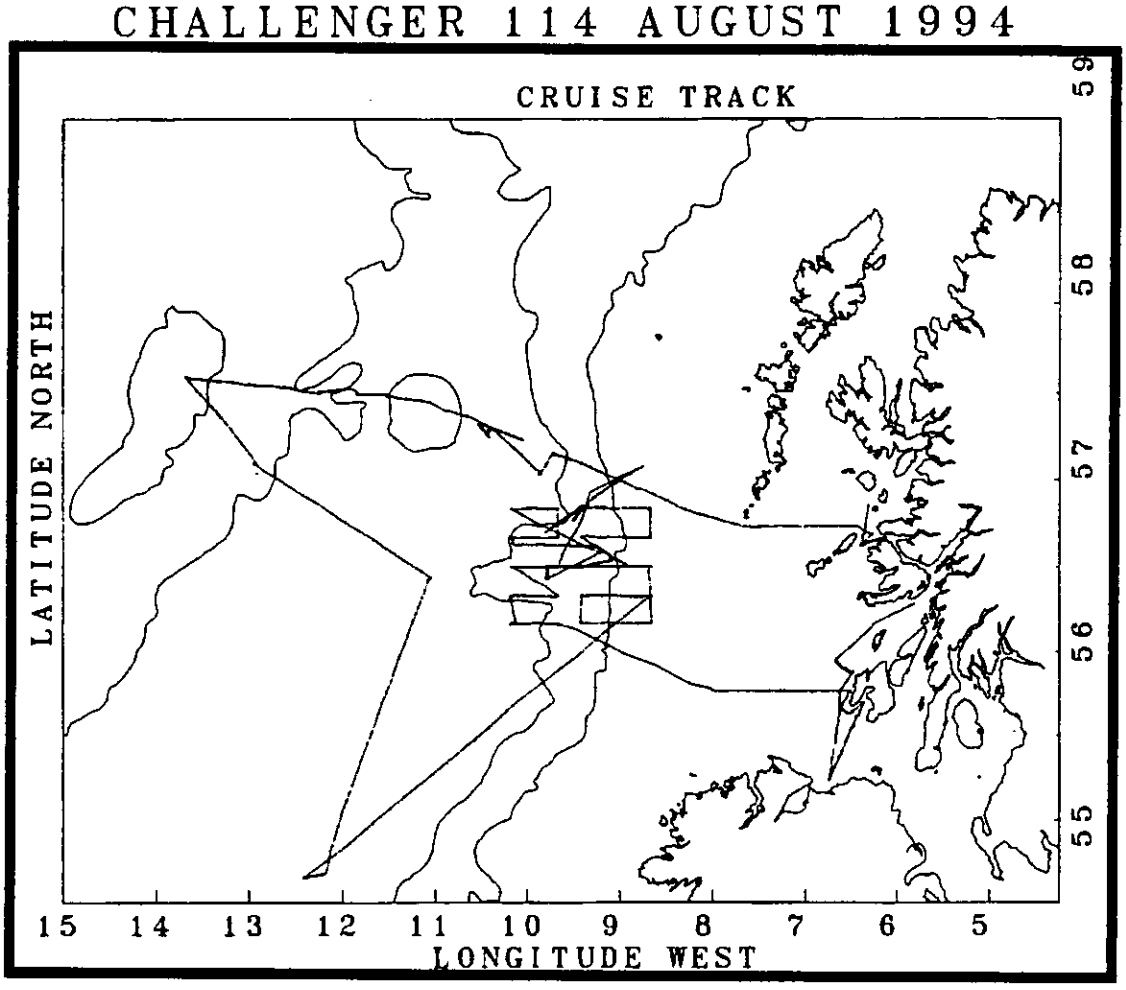
R.R.S "Challenger" Cruise 114/94



Mallaig to Oban
August 15th to August 29th 1994

Cruise Report

J.M. Graham, 9 Jan 1995

Scientific Staff

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DML	*Dunstaffnage Marine Laboratory, Oban*
SAMS	*Scottish Association for Marine Science, Oban*
SURRC	*Scottish Universities Research Reactor Centre, East Kilbride*

Aims

1) To work the CTD stations of the Anton Dohrn Seamount section, between the shelf-edge and Rockall to continue the Rockall Trough time-series as a UK contribution to WOCE Goal 2.

2) To recover and possibly redeploy a temperature-salinity recorder and thermistor chain at station M of the Anton Dohrn Section.

3) To service the DML current meter mooring in the Tiree Passage.

4) To obtain ^{137}Cs, ^{234}Th and ^{210}Pb samples at CTD stations in the Sea of the Hebrides for the DML/SURRC LOIS Special Topic.

5) To sample benthos at the SMBA Permanent Station (54° 40'N, 12° 16'W) using the epibenthic sled.

6) To collect a suite of physical, nutrient and biological profiles and samples, including coring, at the shelf-edge.

7) To obtain sulphate reduction and oxygen uptake measurements on multiple corer samples taken across the shelf edge on the LOIS line.

8) To sample benthos using the epibenthic sled on the 2500m contour and also at Station M and on the slope as time and weather permit.

9) To test the Strathclyde University multi-parameter instrument.

10)To collect samples for the EC MAST II Genetic variations in deep sea populations project.

Narrative

Staff joined Challenger on the evening of Sunday 14th August. The ship sailed at 1000z, Monday 15th August 1994 and proceeded to mooring site Y in the Tiree Passage. Mooring Y was successfully recovered at 1445z and the vessel headed to station 1G for CTD, nutrients and coring. On completion of the station Challenger returned to redeploy mooring Y; this was completed by 1920z. Work then resumed on the G line out past Barra in variable 3-4 winds, breaking off from the G line after station O to core at OC in continuing good conditions. Three 100% successful multiple corer drops were carried out between 0730z and 1130z. The ship then steamed to recover mooring M which was inboard by 1515z. The recovery position was 1.7nm SW off the deployment position. An epibenthic sled was also deployed near M and provided a reasonable sample. CTD and nutrient sampling was then resumed at station M followed by a cross calibration of the SeaBird Seacat S/N 1004 temperature and salinity logger at station N before heading west along the Rockall section, resuming station work at L where a cross calibration of the Seacat logger S/N 0933 was carried out. This instrument failed to perform satisfactorily and, together with the poor state of some of the wires recovered from the mooring, led to the abandonment of the possibility of redeploying mooring M later in the cruise. With the forecast indicating force 6 westerlies on 18 August Challenger continued to make steady progress towards Rockall. The wind, in fact, increased to force 7 limiting westward progress to about 6 knots.

After completing, station A at Rockall on Fri 19th, the ship headed SE to work 3 CTD stations, MS, KS and IS before making for the permanent benthic station at 0800Z Sat 20th in much quieter conditions. The permanent benthic station was worked successfully between 1900z, 20th August and 0030z, 21 August. Challenger then steamed for the coring station DD5 on the shelf, arriving at 1610z. Weather conditions remained very good. Only a few, relatively poor, cores were obtained at DD5, mainly of course sand. Work then started on CTD and water bottle stations in the inner part of the DML LOIS Box (between 56°10N and 56°50N and 8°40W and 9°25W). The weather began to deteriorate with force 5-7 E to SE predicted. Coring at site MH1 was unsuccessful due to sediment structure so a new site, designated MH0, was selected. 3 successful drops of the corer were achieved at MH0 followed by CTD and nutrient casts. Box stations were resumed in strong to gale force ESE winds. The Box stations up to AA3 were completed by 0700 Tuesday 23 August and the L line started from the SE end in much improved weather. Station work was interrupted at L4 to collect cores at MH4, the first of three successful drops being started at 1330z in 1666m depth. After a CTD and water bottle cast Challenger headed for station L5 to resume the CTD section which was completed at 0130z Wednesday 24 August. Course was set for the site of an epibenthic sled tow along the 1600m contour (56°30N , 09°47W approx), aiming to start about 0700z. Conditions were ideal and a good sample was obtained. The ship then steamed to coring station MH2 where another 3 successful sets of cores were taken followed by CTD and nutrient sampling. The ship then proceeded to the NW side of the LOIS box to resume CTD and nutrient sampling overnight. After working 4 deep stations the ship headed for the coring station MH3 where 3 more successful drops were carried out by 1500z Thursday 25th August. After completing CTD and water bottle casts at MH3 the CC line was worked westwards with several intermediate stations at the shelf edge. The wind was force 4-5 SW-W. The outer parts of the DD and EE lines were completed by 0100z 27 Aug.

Challenger then steamed to the start of the D line into Islay which was started at 0740z and was completed by 1504z. This was followed by the C line from Loch Indaal over to Lough Foyle. Weather forecasts by this time were less than promising indicating an imminent westerly gale 8. This proved to be the case and prevented starting the P line from Islay to Skerryvore on the Sunday (28th) morning as intended. The ship hove to off the west of Islay. Unfortunately, by 0800z it became clear that the westerly gale was not going

to moderate in the short term and would, in fact, back to the SW. At this time the decision was made to run for shelter in the Firth of Lorne. Challenger docked at Oban railway pier the following morning at 0800 BST.

Programmes supported on this cruise:

WOCE goal 2
Covered by aims 1 and 2

LOIS SES programme
Covered by aims 6 and 7

SES Special Topic 14 (aim 4)
This study investigates the seasonal flux of oceanic water to the Scottish coastal current. For this purpose, the radionuclides ^{234}Th, $^{137}Cs/^{134}Cs$, ^{14}C, and ^{210}Pb are used as tracers to establish the marine processes occurring as a result of the interaction of oceanic water with coastal water . From this, the position of the coastal / ocean water front can be established. As the position of this front or fronts may vary on a seasonal basis, it is necessary to monitor the appropriate marine processes at different times of the year .

A. Stewart, SURRC

Benthic invertebrate sampling (aims 5,8 and 10)

a) ***SAMS ARP2 long term variation in deep sea populations***
This work continues the Scottish Association for Marine Science (SAMS) time-series at fixed stations, providing preserved fauna for several studies at SAMS and elsewhere. These include modelling of growth rates and longer term changes in populations.

Robin Harvey, SAMS

b) ***EC MAST II genetic variations in deep sea populations***
The species *Ledella pustulosa* is a deep sea protobranch. There are fourteen species of *Ledella* and four subspecies occurring in the Atlantic. The taxonomic status of the subfamily *Ladellinae* has been questioned and therefore both genetic and morphological methods are being used to investigate the possibility of depth dependent subspecies. as part of an EC MAST II funded programme examining variability and its causes in the deep-sea fauna.

Karen Schnauffer, John Moores University

Strathclyde University multi-parameter instrument (aim 9)
This instrument, still under development, combines the roles of fluorometer, transmissometer and nephelometer. It ran in a deck tank connected to the ship's non-toxic supply.

RESULTS

The cruise was almost entirely successful, the only disappointments being the failure to redeploy the mooring at station M and the inability to work the P and Q lines from Islay to Barra Head on the final day due to bad weather.

WOCE and LOIS Sections

CTD sections were worked using the WOCE Seabird 9/11 CTD system from the Sound of Mull to the shelf edge, the shelf edge to Rockall and the shelf edge in to Islay. For depths less than 500m the SeaTech fluorometer was attached to the CTD. For some deeper stations near the shelf edge the fluorometer remained attached to the CTD but lowering was restricted to 500m. Additionally, stations were worked on a line SE from Rockall, from Islay to Lough Foyle, a tightly spaced line working NE and crossing the Anton Dohrn section at station R, and an intensive set in and around the "LOIS Box" (8° 40'W to 10°10'W and 56°10'N to 56°50'N).

Tiree Passage Mooring

The mooring was successfully recovered at 1445z Monday 15th August and redeployed by 1920z. Full data sets were recovered from both Aanderaa current meters. Towards the end of the deployment period there was a dropout in the speed record from the top meter (10060), probably due to weed contaminating the rotor.

Mooring at Station M

The mooring was successfully recovered though it was found to be approximately 1.7nm off the deployment position. Previously, we had been able to communicate with all the Oceano acoustic releases via the acoustic fish on Challenger, but on this occasion, this was unsuccessful and we had to dip the small Oceano transducer over the side with the ship stopped. This made searching for the mooring more difficult than usual. Some of the wires had been kinked, the thermistor logger had failed after approximately 12 hours and the replacement Seacat logger would not run reliably (subsequently found to be due to contamination on a battery connector). For these reasons it was decided not to redeploy the mooring.

Multiple corer and Sholkovitch Cores

The multiple corer was successfully deployed at 5 stations and cores were taken at each station for the following determinations:
Sulphate reduction rate: two cores from each of three drops;
Oxygen uptake rate: two cores from each of three drops;
Pore water sulphate and ammonium, and porosity: one core;
Particle size analysis: one core.

Oxygen uptake was measured by incubation experiments carried out on board ship. Cores for sulphate reduction rate determination were processed on board; samples obtained from them were frozen for analysis back at the laboratory. Pore water samples were obtained by centrifuging sediment samples. The pore water was frozen for subsequent determination of sulphate and ammonium levels. Sediment samples of known volume were taken and stored frozen for subsequent determination of porosity and organic matter content. Whole 5cm sections were taken from one core for particle size analysis (not yet analyzed).

Station	Oxygen uptake rate ($mmol.m^{-2}.d^{-1}$)	Sediment Section (cm)	Sulphate reduction rate ($nmol.ml^{-1}.d^{-1}$)	Porewater sulphate ($mmol.l^{-1}$)	Porewater ammonium ($\mu mol.l^{-1}$)	Porosity	Organic matter (%)
MH0	3.617	0-5	1.62	*	*	0.443	1.63
		5-10	5.14	27.38	35.98	0.390	2.89
		10-15	0.87	29.88	57.03	0.473	4.38
		15-20	0.35	29.56	65.78	0.401	2.95
MH2	5.869	0-5	1.66	*	*	0.474	1.98
		5-10	1.19	*	*	0.453	1.15
		10-15	2.79	*	*	0.453	2.9
		15-20	2.02	28.40	36.87	0.588	8.1
MH3	6.148	0-5	3.29	27.86	12.84	0.441	1.82
		5-10	3.65	29.05	16.39	0.428	2.56
		10-15	2.04	28.66	16.85	0.552	5.53
		15-20	7.56	28.28	31.16	0.528	6.18
MH4	6.026	0-5	10.28	28.92	8.67	0.738	8.07
		5-10	1.41	28.98	9.75	0.651	5.71
		10-15	0.57	28.82	20.44	0.608	6.39
		15-20	0	28.28	31.66	0.609	5.81
OC	3.017	0-5	0.29	29.24	9.18	0.783	8.49
		5-10	0.32	28.08	13.49	0.739	8.74
		10-15	0.42	29.30	22.44	0.713	9.23
		15-20	0.76	29.14	31.62	0.675	6.92

* Because of the sandy nature of these sediments centrifuging failed to extract any porewater. Therefore no values for nutrient concentrations could be obtained.

S.M. Harvey

Sholkovitch cores were taken at two stations 1G and 10G and were sectioned on-board ship. The sections were stored in containers for later analysis.

EC MAST II Genetic variations in deep sea populations/ ARP2 Seasonal sampling for long term variation of deep sea invertebrate populations

Three epibenthic sled hauls, using a 0.5 mm mesh, were obtained from contrasting stations. These fulfilled two of the main requirements. Two of the samples, from 2200 and 2900 metres, continued the SAMS time-series at fixed stations, providing preserved fauna for several studies at SAMS and elsewhere. These include modelling of growth rates and longer term changes in populations.

R.Harvey

Freshly sieved material from these samples and a third station in 1650 m was sorted on board for the small protobranch bivalve *Ledella pustulosa* and related bivalve species. Genomic DNA was extracted from *Ledella* on board using fresh and frozen samples. A total of 72 DNA extractions were taken, 36 of which were fresh *Ledella* samples. These were stored frozen, to be taken back to Liverpool John Moores University for genetic analysis. Both (polymerase chain reaction) PCR direct sequencing and randomly amplified polymorphic DNA (RAPD) will be used to investigate the molecular taxonomy of this species.

K. Schnauffer

LOIS SES Special Topic 14

Samples were successfully taken at the following sites:-

WATER SAMPLE SITE	Th-234	Cs-137	Tc	TOTAL WATER	CORE SITES
1G SURF MID BOT	25L 25L 25L	25L	25L	125L	1G - S
4G SURF MID BOT	25L 25L 25L	25L	25L	125L	
7G SURF MID BOT	25L 25L 25L	25L		100L	
10G SURF MID BOT	25L 25L 25L	25L		100L	10G - S
15G SURF MID BOT		25L 25L 25L	25L	100L	
R SURF	25L	25L	25L	25L	

A. Stewart

CTD and water bottles

The WOCE SeaBird 9/11 CTD system performed well with only a hint of spiking on the Oxygen sensor at a couple of deep stations. The CTD wire was in a poor state and due to this the tail connection had to be remade twice. We know that since this cruise took place approximately 1000m of wire has been removed and the remainder appears to be in good condition. Water samples were collected with NIO bottles on the hydrographic wire.

Strathclyde University multi-parameter instrument

The instrument showed a lack of sensitivity on fluorescence. A firmware modification would have been necessary to improve sensitivity and the necessary equipment was not available on board ship to do this. Further laboratory development continues.

Acknowledgements

The cooperation of Captain R. Plumley and the officers and crew of the Challenger was invaluable in achieving the aims of this cruise.

The cruise was supported by the Natural Environment Research Council as part of the WOCE and LOIS programmes.

CHALLENGER CRUISE C11494 - LIST OF STATIONS WORKED

Sound of Mull - Shelf-edge

Station	**Disk** /Dip	Lat ° ' N	Long ° ' W	**Date/** Time GMT	Water Depth metres	CTD Depth metres	Sample Depth (m) for *Nutrient;* Chlorophyll/**DCMU**	Other Work
1G	**01**/001	56°40.0	06°08.0	**15/** 1553	202	170	5~160	SC Esmb
2G	**01**/002	56°41.0	06°17.0	2018	42	35	5~20	
3G	SS	56°42.5	06°22.0	2057				
4G	**01**/003	56°44.0	06°27.0	2119	93	85	5~80	Esmb
5G	SS	56°44.0	06°36.0	2259	-	-		
6G	**01**/004	56°44.0	06°45.0	2355	42	35	5~20,30	
7G	**01**/005	56°44.0	07°00.0	**16/** 0121	142	130	5~80	Esmb
8G	SS	56°44.0	07°10.0	0330	-	-		
9G	**01**/006	56°44.0	07°20.0	0421	160	150	5~80	
10G	**01**/007	56°44.0	07°30.0	0520	219	210	5~160	SC Esmb
11G	**01**/008	56°44.0	07°40.0	0813	64	55	5~40,55	
12G	SS	56°45.5	07°50.0	0853	-	-		
13G	**01**/009	56°47.0	08°00.0	0936	123	115	5~80,115	Es
14G	SS	56°48.5	08°10.0	1030	-	-		
T	**01**/010	56°50.2	08°20.0	1137	136	120	5~80,130	
15G	**01**/011	56°53.0	08°30.0	1251	131	120	5~80,125	Esmb
S	**01**/012	56°57.0	08°47.0	1522	129	121	5~80,125	
16G	**01**/013	57° 00.0	09°00.0	1633	136	125	5~80,125	Es

Anton Dohrn Seamount section

Station	**Disk** /Dip	Lat ° ' N	Long ° ' W	**Date/** Time GMT	Water Depth metres	CTD Depth metres	Sample Depth (m) for *Nutrient;* Chlorophyll/**DCMU**	Other Work
R1	**01**/014	57° 01.5	09°06.5	**16/** 1741	156	145	5~80	
Q	**01**/015	57° 03.0	09°13.0	1741	316	310	5~160	
Q1	**01**/016	57° 04.5	09°19.5	2014	754	730	5~600,730	
P	**02**/017	57° 04.5	09°19.5	2118	1414	1400	5~1200,1370	
P1	**02**/018	57° 07.5	09°33.5	**17/** 0114	1780	1750	5~1500,1710	
O	**02**/019	57° 09.0	09°42.0	0309	1939	1920	5~1500,1910	
OC	-	57° 02.0	09°52.0	0723	2040	-		MC
M	**03**/020	57° 18.0	10°23.0	2110	2200	2200	5~1500,2000	XC
N	**03**/021	57° 14.0	10°03.0	**18/** 0226	2114	2095	5~1500,2095	
L	**04**/022	57° 22.0	10°40.0	0615	2162	2127	5~1500,2127	
K	**04**/023	57° 24.0	10°52.0	1017	793	760	5~600,760	
J	**04**/024	57° 27.0	11°05.0	1151	591	570	5~150,300	
I	**04**/025	57° 28.0	11°19.0	1438	757	720	5~600	
H	**05**/026	57° 29.0	11°32.0	1605	2028	1995	5~1500,1995	
G	**05**/027	57° 29.5	11°51.0	2058	1802	1765	5~1500,1765	
F	**05**/028	57° 30.5	12°15.0	**19/** 0018	1815	1780	5~1500,1780	
E	**06**/029	57° 32.0	12°38.0	0546	1650	1635	5~1500,1635	
D	**06**/030	57° 32.5	12°52.0	0805	1065	1060	5~900	
C	**06**/031	57° 33.0	13°00.0	1017	297	263	5~150,263	
B	**06**/032	57° 34.0	13°20.0	1232	182	160	5~150	
A	**06**/033	57° 35.0	13°38.0	1457	118	105	5~80	

Part of Rockall - Malin Head CTD section

Station	**Disk** /Dip	Lat ° ' N	Long ° ' W	**Date/** Time GMT	Water Depth metres	CTD Depth metres	Sample Depth (m) for *Nutrient;* Chlorophyll/**DCMU**	Other Work
MS	**06**/034	57° 06.0	12°56.0	**19/** 1938	1681	1670		
K	**07**/035	56°47.0	12°03.0	**20/** 0035	2315	2290		
IS	**07**/036	56°26.0	11°03.0	0614	2468	2455		

Stations worked in and around the DML LOIS Box

Station	**Disk** /Dip	Lat ° ' N	Long ° ' W	**Date/** Time GMT	Water Depth metres	CTD Depth metres	Sample Depth (m) for *Nutrient;* Chlorophyll/**DCMU**	Other Work
DD5	**07**/037	56°20.0	8°40.0	**21/** 1653	153	145	5~80,140	
DD4A	**07**/038	56°20.0	9°05.0	1907	161	150	5~150	
DD4	**07**/039	56°20.0	9°10.0	1945	587	500	5~160	
DD3B	**07**/040	56°20.0	9°15.0	2054	923	500	5~160	
DD3A	**08**/041	56°20.0	9°20.0	2142	1136	500	5~160	
DD3	**08**/042	56°20.0	9°25.0	2248	1274	500	5~160	
EE3	**08**/043	56°10.0	9°25.0	**22/** 0022	1075	500	5~600	
EE4	**08**/044	56°10.0	9°10.0	0242	189	165	5~160	
EE5	**08**/045	56°10.0	8°40.0	0434	126	123	5~80,123	
CC5	**08**/046	56°30.0	8°40.0	0703	138	135	5~90,135	
CC4	**08**/047	56°30.0	9°10.0	0907	676	500	5~600	
CC3	**08**/048	56°30.0	9°25.0	1202	1158	500	5~600	
MH1	-	56°32.0	9°05.0	1400	365	-		mc
MH0	**08**/049	56°33.1	9°06.1	1603	433	425	5~300,425	MC
BB3	**08**/050	56°40.0	9°25.0	1836	1327	500	5~600	

Station	**Disk** /Dip	Lat ° ' N	Long ° ' W	**Date/** Time GMT	Water Depth metres	CTD Depth metres	Sample Depth (m) for *Nutrient;* Chlorophyll/**DCMU**	Other Work
BB4	**08**/051	56°40.0	9°10.0	2011	939	500	5~600	
BB5	**08**/052	56°40.0	8°40.0	**23/** 0004	131	87	5~80,120	
AA5	**08**/053	56°50.0	8°40.0	0118	129	126	5~80,120	
AA4	**09**/054	56°50.0	9°10.0	0441	1010	500	5~600	
AA3	**09**/055	56°50.0	9°25.0	0556	1583	500	5~600	
MH4	**09**/060	56°46.1	9°29.7	1651	1665	1650	5~1500,1650	MC
MH2	**10**/072	56°35.0	9°12.2	**24/** 1442	750	740	5~600,740	MC
AA1	**10**/073	56°50.0	10°10.0	2021	2064	2055	5~1500,2055	
AA2	**10**/074	56°50.0	9°40.0	2330	1832	1811	5~1500,1811	
BB2	**11**/075	56°40.0	9°40.0	**25/** 0404	1623	1610	5~1500,1610	
BB1	**11**/076	56°40.0	10°10.0	0657	2090	2078	5~1500,1950	
MH3	**11**/077	56°37.0	9°15.2	1516	968	960	5~900	MC
CC4C	**11**/078	56°30.0	8°55.0	1719	144	138	5~80,138	
CC4B	**11**/079	56°30.0	9°00.0	1813	152	140	5~80,140	
CC4A	**11**/080	56°30.0	9°05.0	1846	385	378	5~300,378	
CC4	**11**/081	56°30.0	9°10.0	2013	682	500	5~600	
CC3B	**12**/082	56°30.0	9°15.0	2059	905	500	5~600,890	
CC3A	**12**/083	56°30.0	9°20.0	2247	1064	1056	5~900,1056	
CC3	**12**/084	56°30.0	9°25.0	**26/** 0010	1177	1168	5~900,1168	
CC2	**12**/085	56°30.0	9°40.0	0403	1521	1500	5~1200,1500	
CC1	**12**/086	56°30.0	10°10.0	0719	1138	1125	5~900,1111	
DD2	**13**/087	56°20.0	9°40.0	1213	1524	1500	5~1200,2020	
DD1	**13**/088	56°20.0	10°10.0	1515	1881	1861	5~1500,1861	
EE1	**13**/089	56°10.0	10°10.0	2006	2032	2020	5~1500,2020	
EE2	**13**/090	56°10.0	9°40.0	2323	1583	1570	5~1200,1570	

High Density SW - NE line Crossing Anton Dohrn Section at R

Station	**Disk** /Dip	Lat ° ' N	Long ° ' W	**Date/** Time GMT	Water Depth metres	CTD Depth metres	Sample Depth (m) for *Nutrient;* Chlorophyll/**DCMU**	Other Work
L1	**09**/056	56°42.0	9°48.0	**23/** 0830	1813	500		
L2	**09**/057	56°45.0	9°40.0	1008	1750	500		
L3	**09**/058	56°48.0	9°32.0	1110	1722	500		
L4	**09**/059	56°51.0	9°24.0	1223	1560	500		
L5	**09**/061	56°54.0	9°16.0	1904	1267	500		
L5A	**09**/062	56°54.8	9°14.0	1935	1183	500		
L6	**09**/063	56°55.5	9°12.0	2006	1031	500		
L6A	**09**/064	56°56.2	9°10.0	2038	747	500		
L7	**09**/065	56°57.0	9°08.0	2112	388	382		
L7A	**09**/066	56°57.8	9°08.0	2148	185	175		
L8	**10**/067	56°58.5	9°04.0	2219	145	135		
L8A	**10**/068	56°59.2	9°02.0	2246	141	133		
R	**10**/069	57°00.0	9°00.0	2319	135	125		
L9	**10**/070	57°02.3	8°52.5	**24/** 0015	141	135		
L10	**10**/071	57°05.0	8°45.0	0114	132	125		

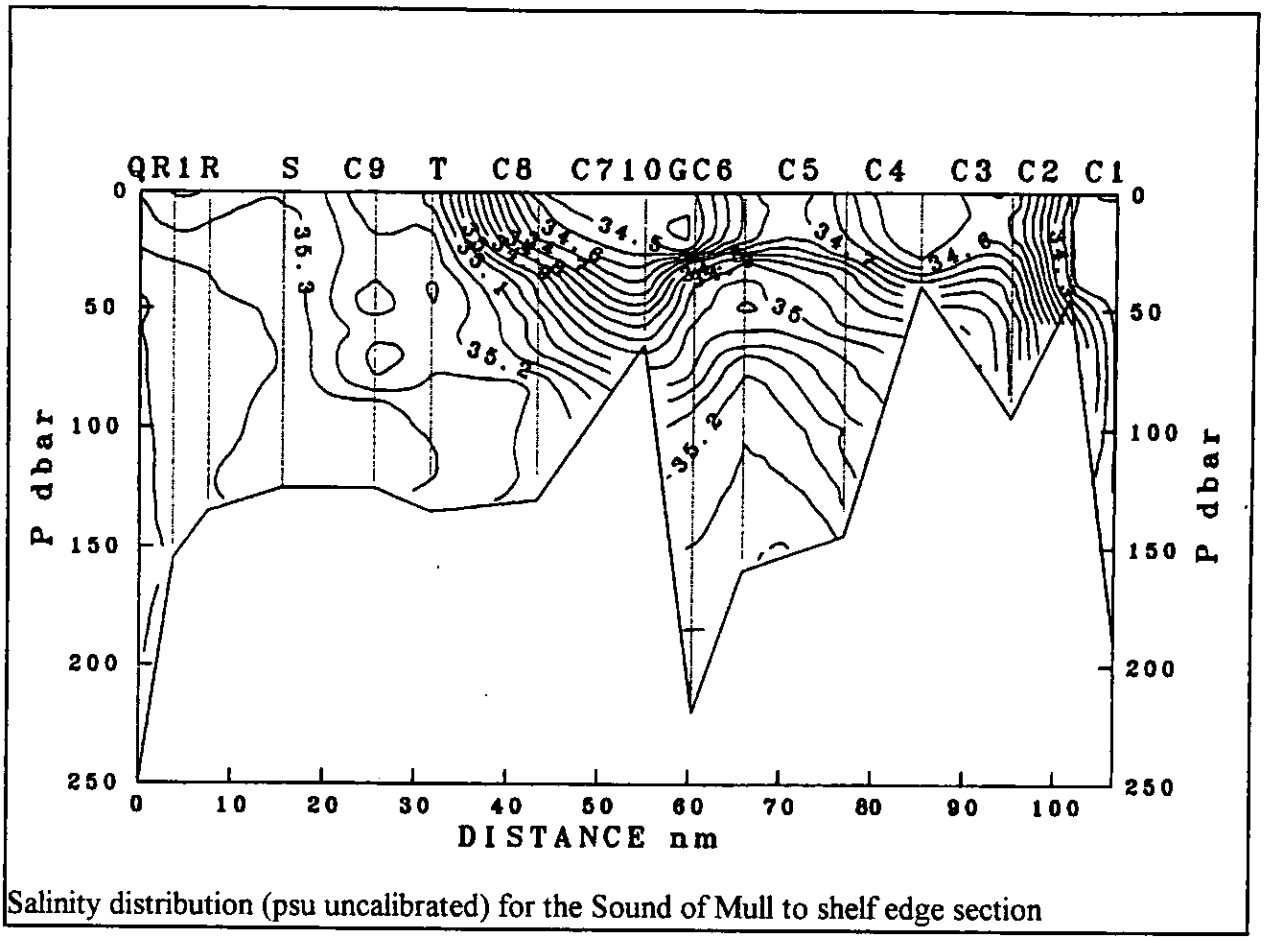
Stations from the shelf edge to Islay

Station	**Disk** /Dip	Lat ° ' N	Long ° ' W	**Date/** Time GMT	Water Depth metres	CTD Depth metres	Sample Depth (m) for *Nutrient;* Chlorophyll/**DCMU**	Other Work
0D	**13**/091	55°46.0	8°00.0	**27/** 0742	107	98		
1D	**13**/092	55°46.0	7°41.5	0906	86	75		
2D	**13**/093	55°46.0	7°29.0	1005	60	50		
3D	**13**/094	55°46.0	7°16.5	1059	63	50		
4D	**13**/095	55°46.0	7°04.0	1159	52	40		
5D	**14**/096	55°46.0	6°55.5	1243	49	40		
6D	**14**/097	55°46.0	6°46.5	1333	48	40		
7D	**14**/098	55°46.0	6°37.5	1423	60	50		
8D	**14**/099	55°46.0	6°34.0	1504	26	20		
7C	**14**/100	55°42.0	6°22.0	1722	30	20		
6C	**14**/101	55°37.3	6°25.8	1802	68	60	5~40,60	
5C	**14**/102	55°32.7	6°29.7	1903	104	95		
4C	**14**/103	55°28.0	6°33.5	1951	97	90	5~40,75,90	
3C	**14**/104	55°23.3	6°37.3	2046	90	80		
2C	**14**/105	55°18.7	6°41.2	2135	75	65		
1C	**14**/106	55°14.0	6°45.0	2223	26	18	5,18	

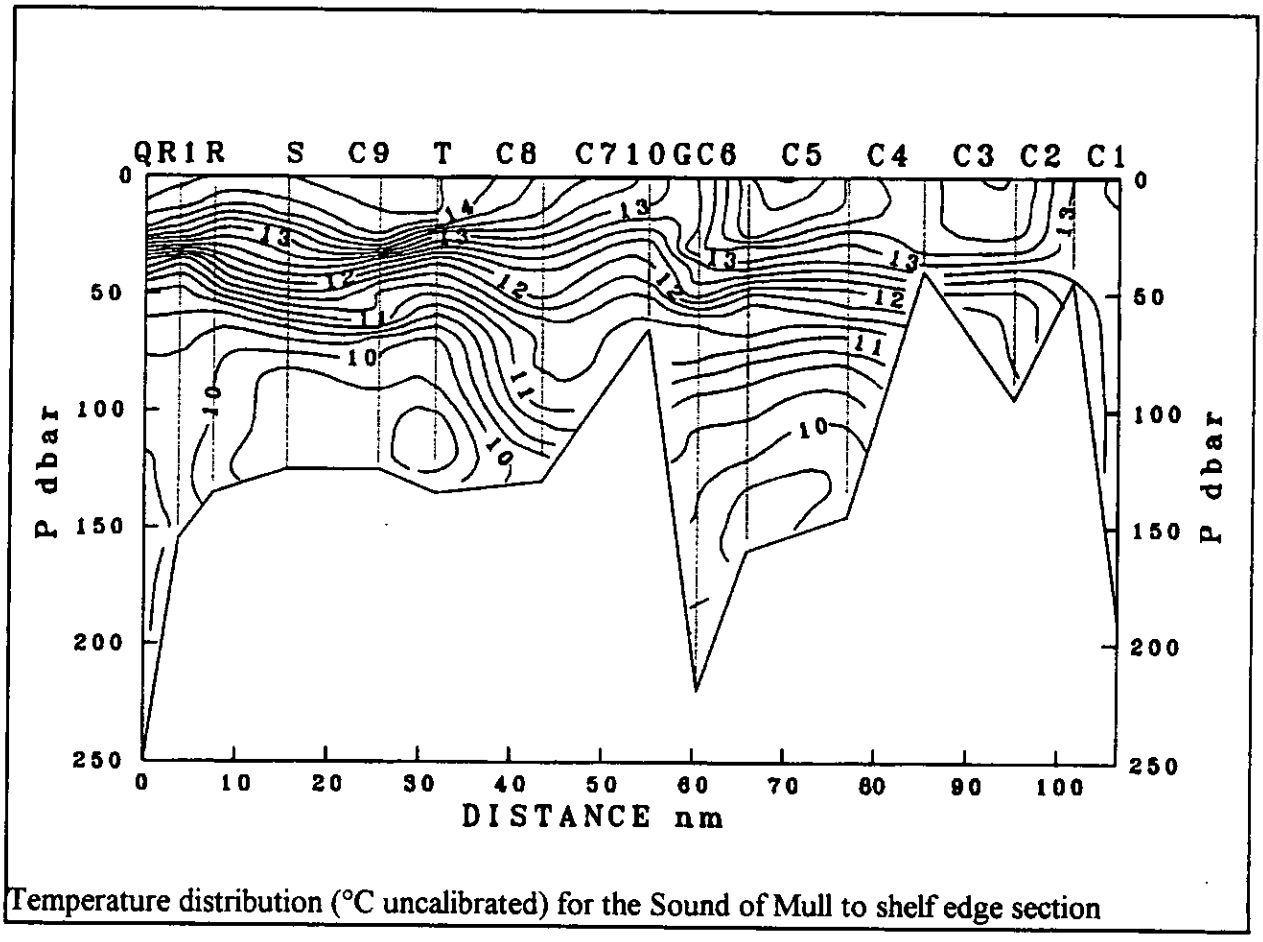
Epibenthic sled sampling

Station	Date	Lat °N	Long°W	Depth m	Status
M"	17	57 16.0	10 27.0	2243	GOOD
PBS	20	54 39.0	12 18.0	2900	GOOD
EB1	24	56 28.0	09 47.0	1652	HUGE

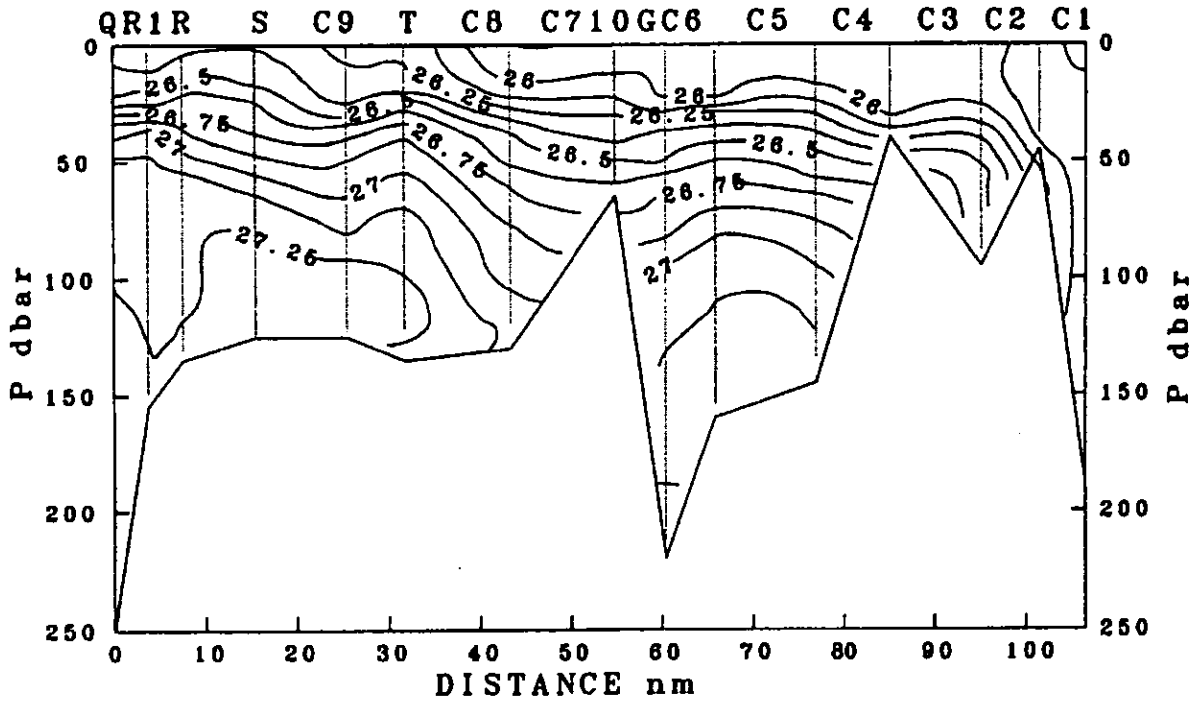
MC - Successful multiple corer samples (3 drops);
mc - Unsuccessful multiple corer samples
XC - Cross calibration of SEACAT logger with SeaBird 9/11 CTD
SC - Sholkovitch core
E - Water samples for SURRC (s - surface, m - mid-water, b - bottom)



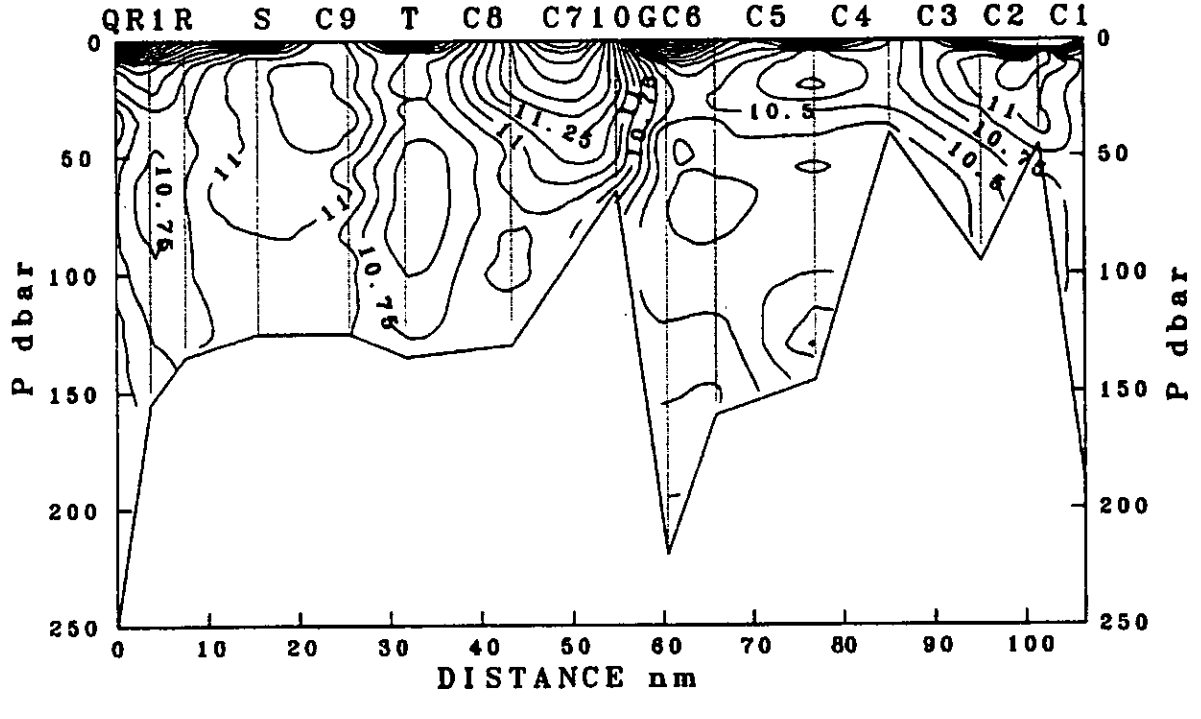
Salinity distribution (psu uncalibrated) for the Sound of Mull to shelf edge section



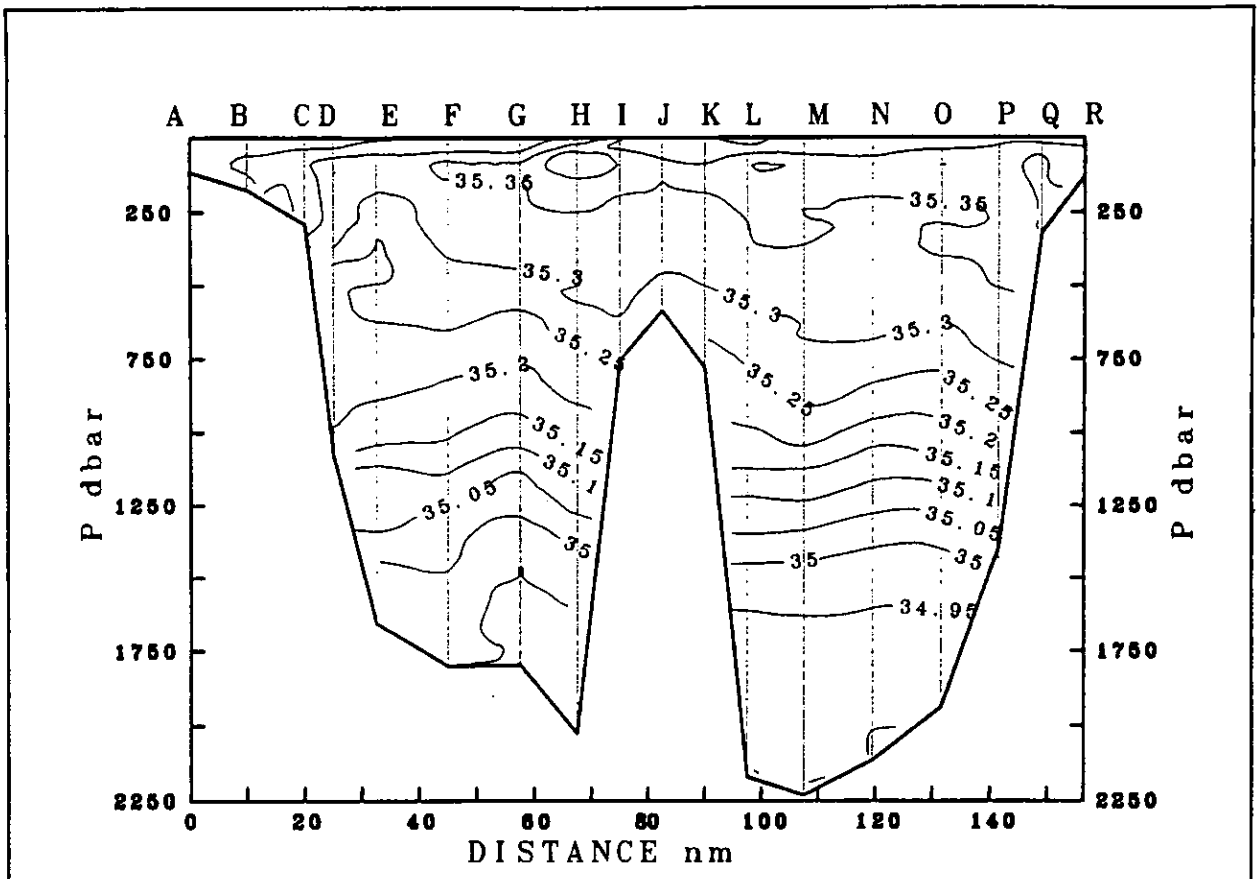
Temperature distribution (°C uncalibrated) for the Sound of Mull to shelf edge section



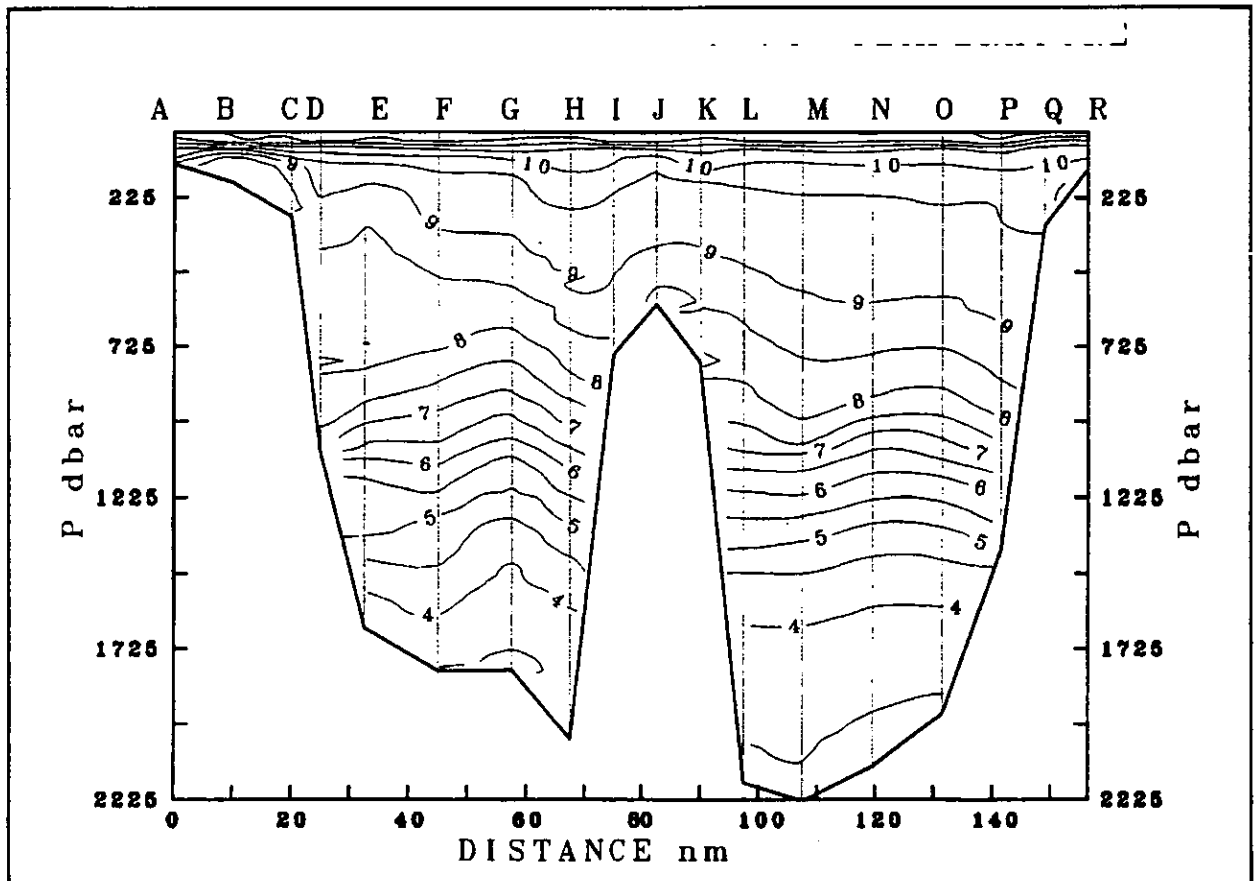
Sigma-t distribution (kgm^{-3} uncalibrated) for the Sound of Mull to shelf edge section



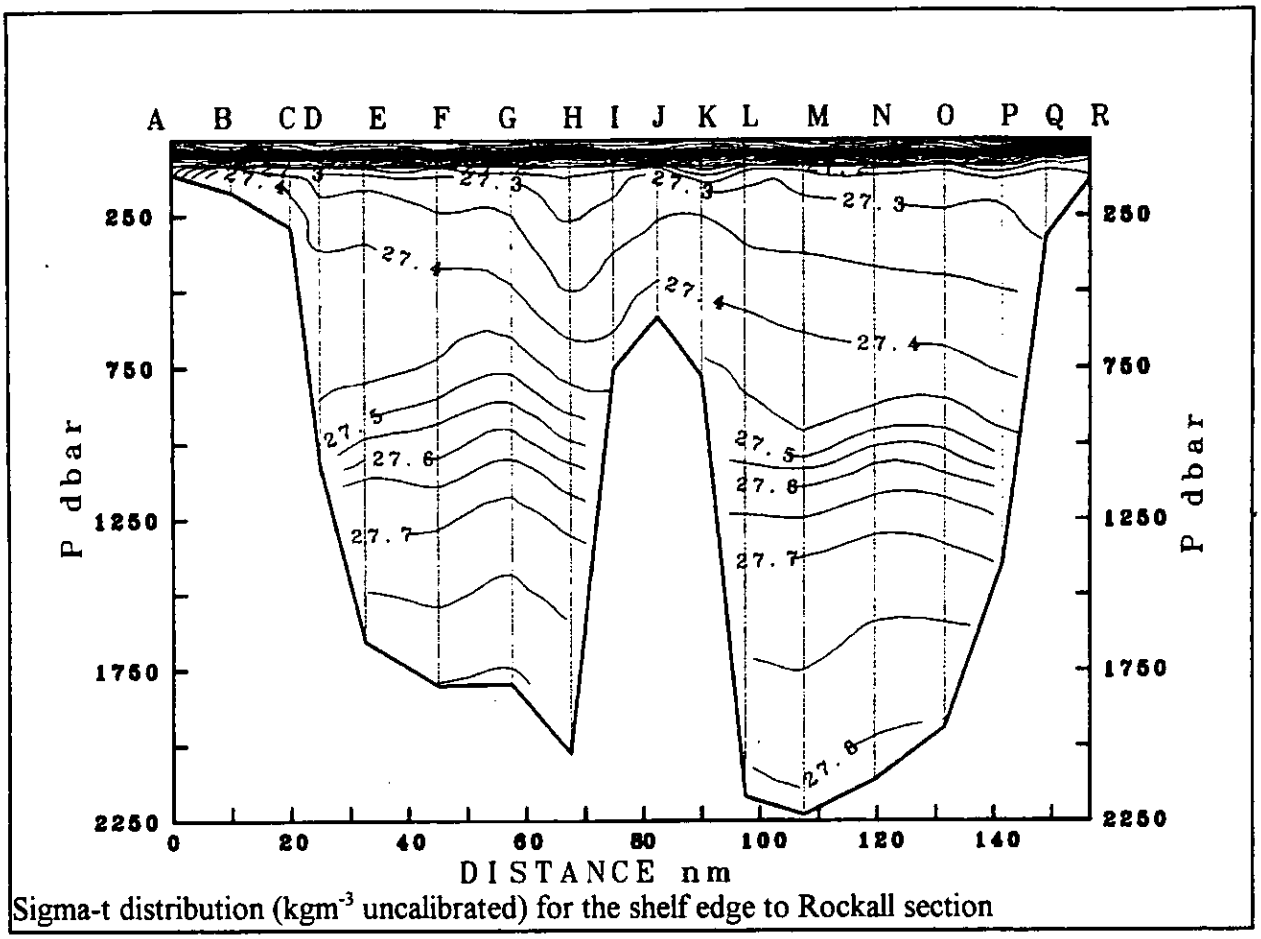
Oxygen distribution (mg/l uncalibrated) for the Sound of Mull to shelf edge section



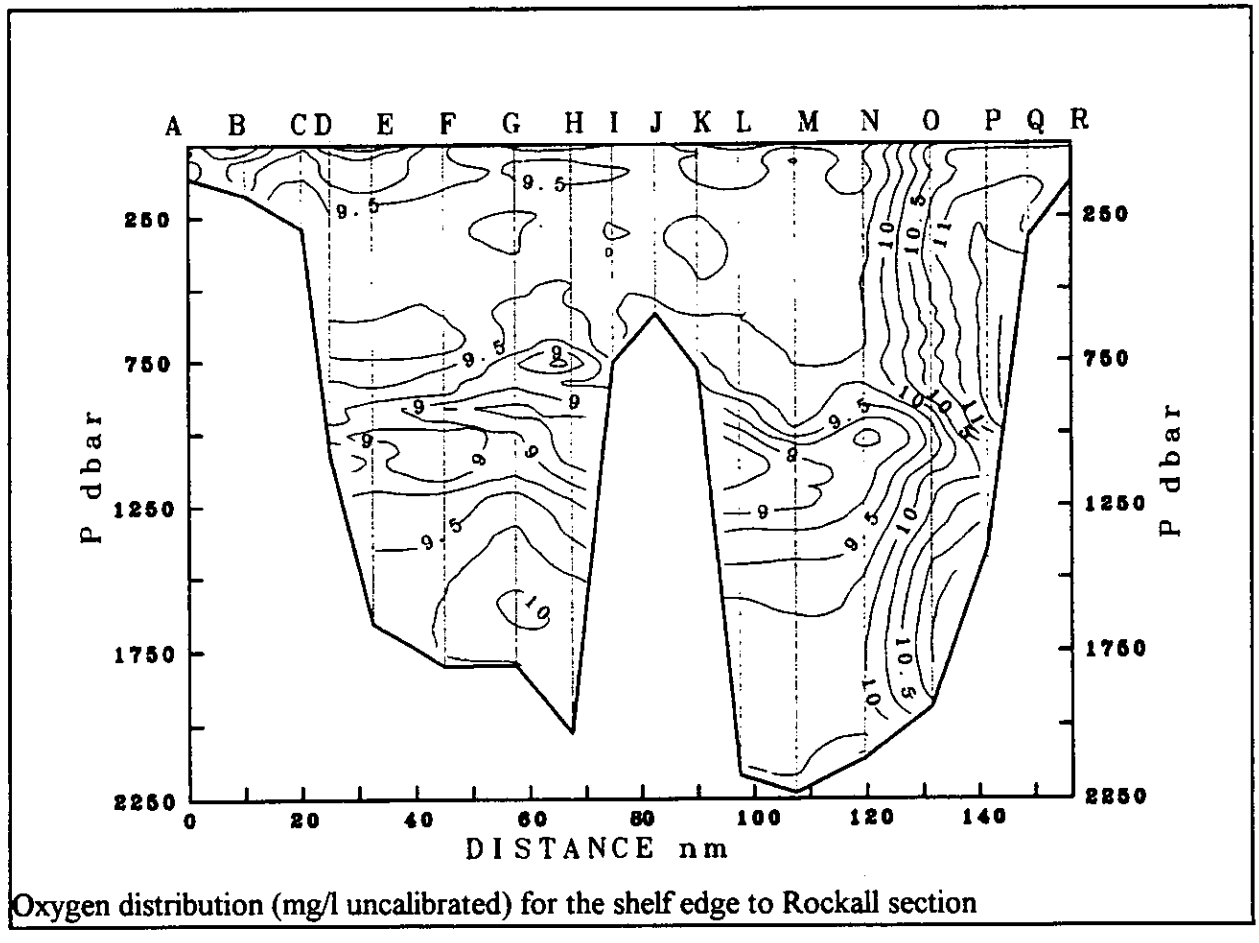
Salinity distribution (psu uncalibrated) for shelf edge to Rockall section



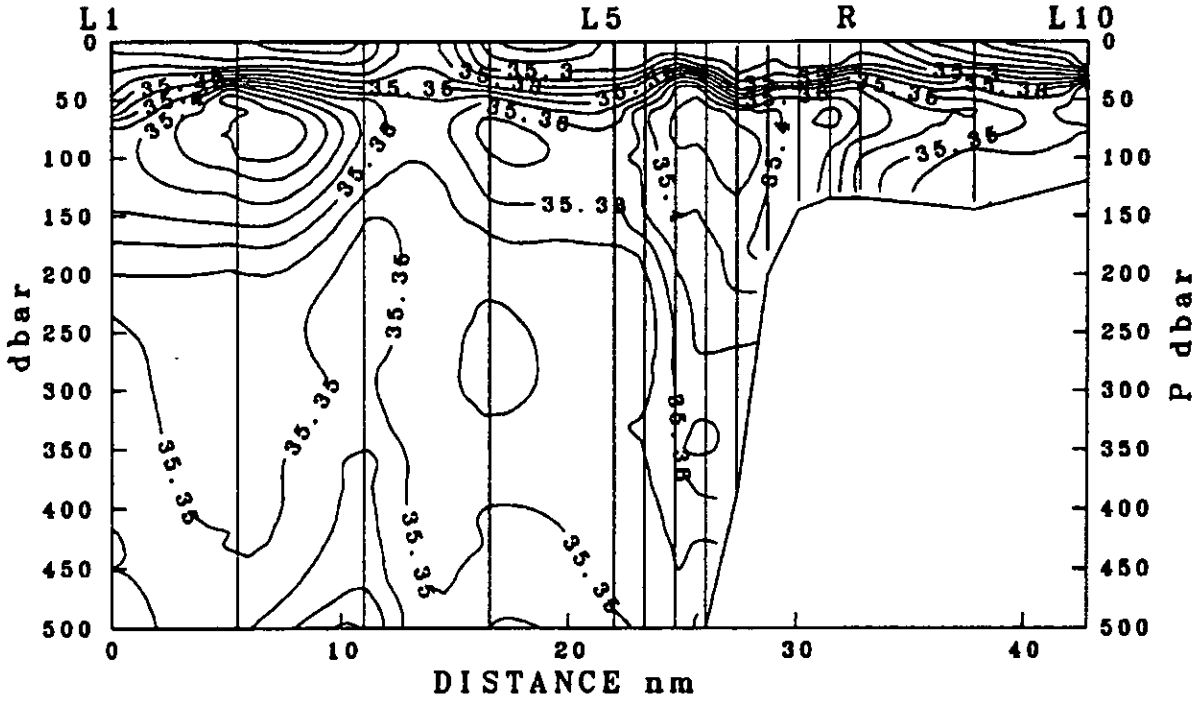
Temperature distribution (°C uncalibrated) for the shelf edge to Rockall section



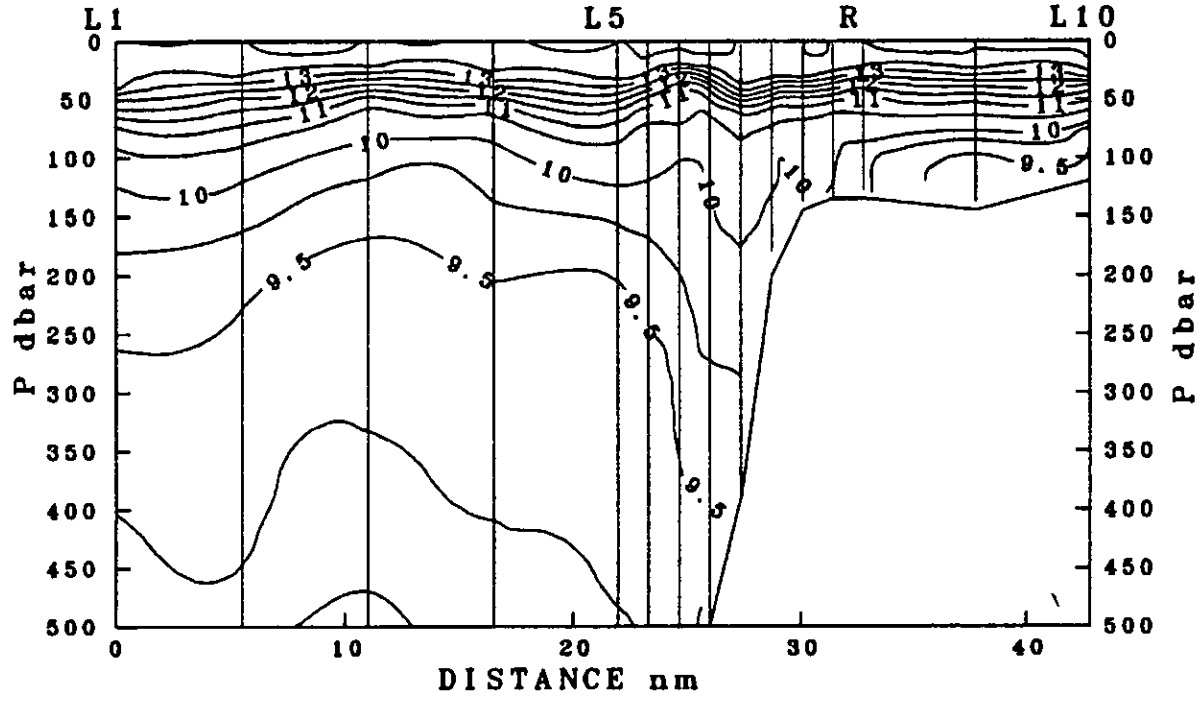
Sigma-t distribution (kgm^{-3} uncalibrated) for the shelf edge to Rockall section



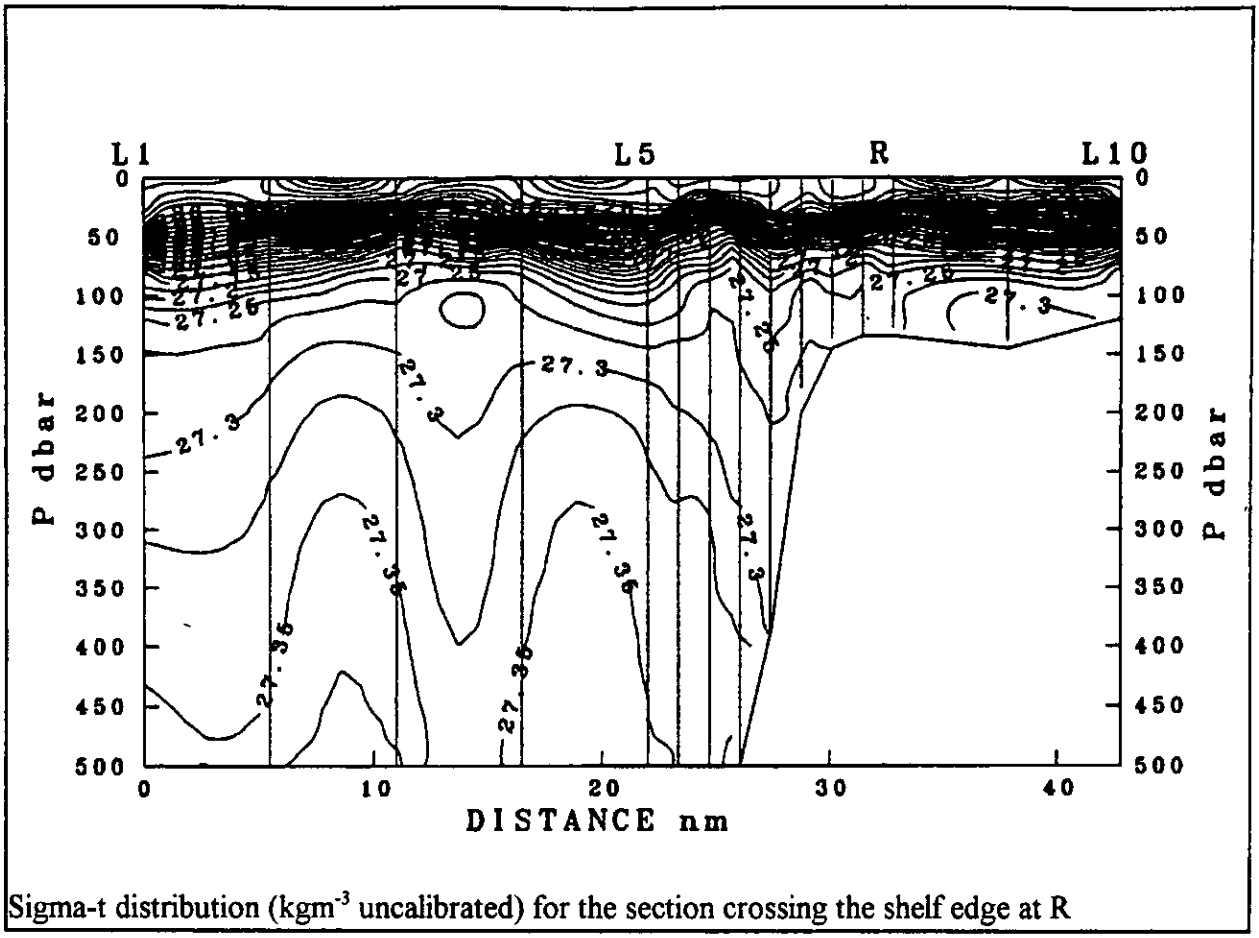
Oxygen distribution (mg/l uncalibrated) for the shelf edge to Rockall section



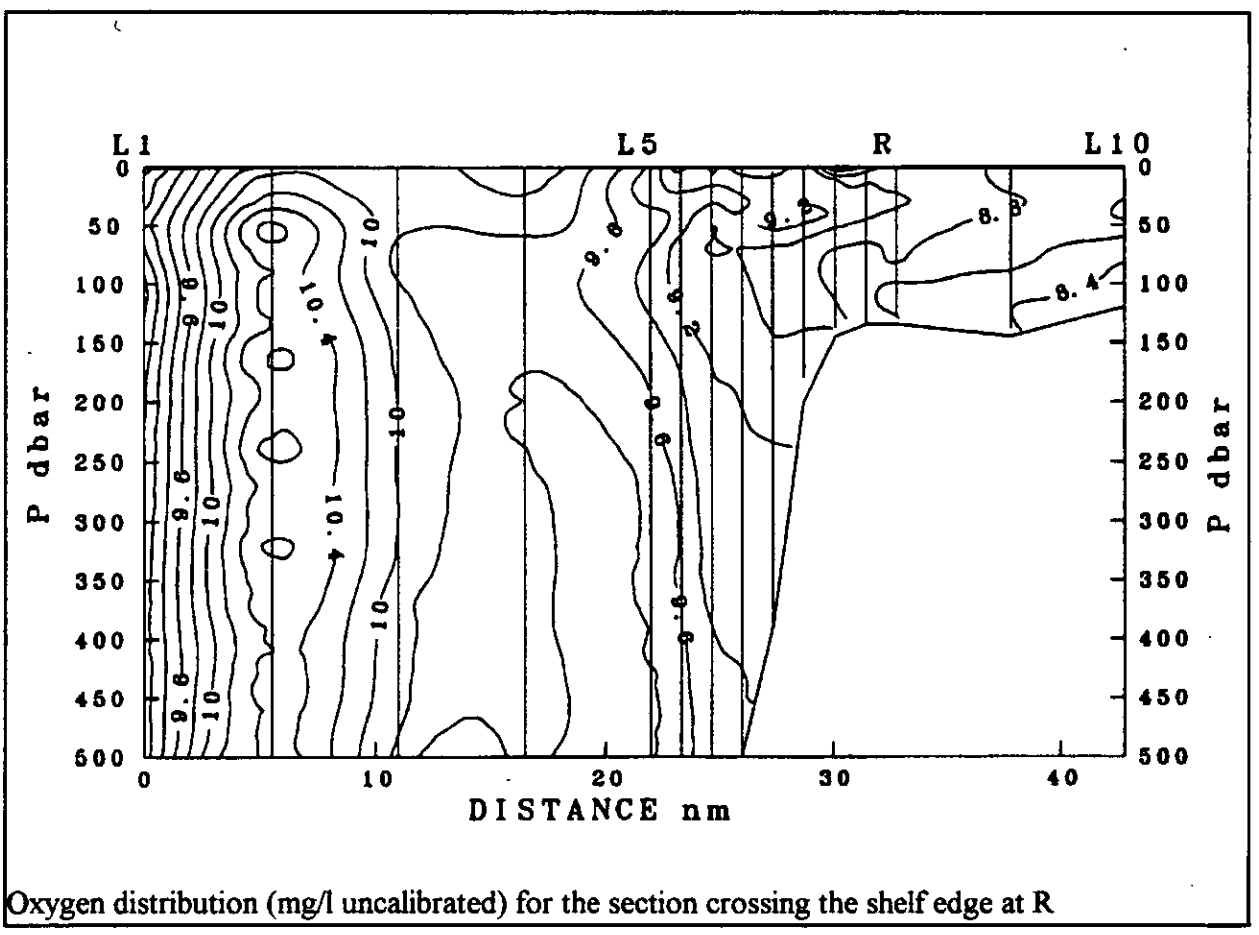
Salinity distribution(psu uncalibrated) for the section crossing the shelf edge at R



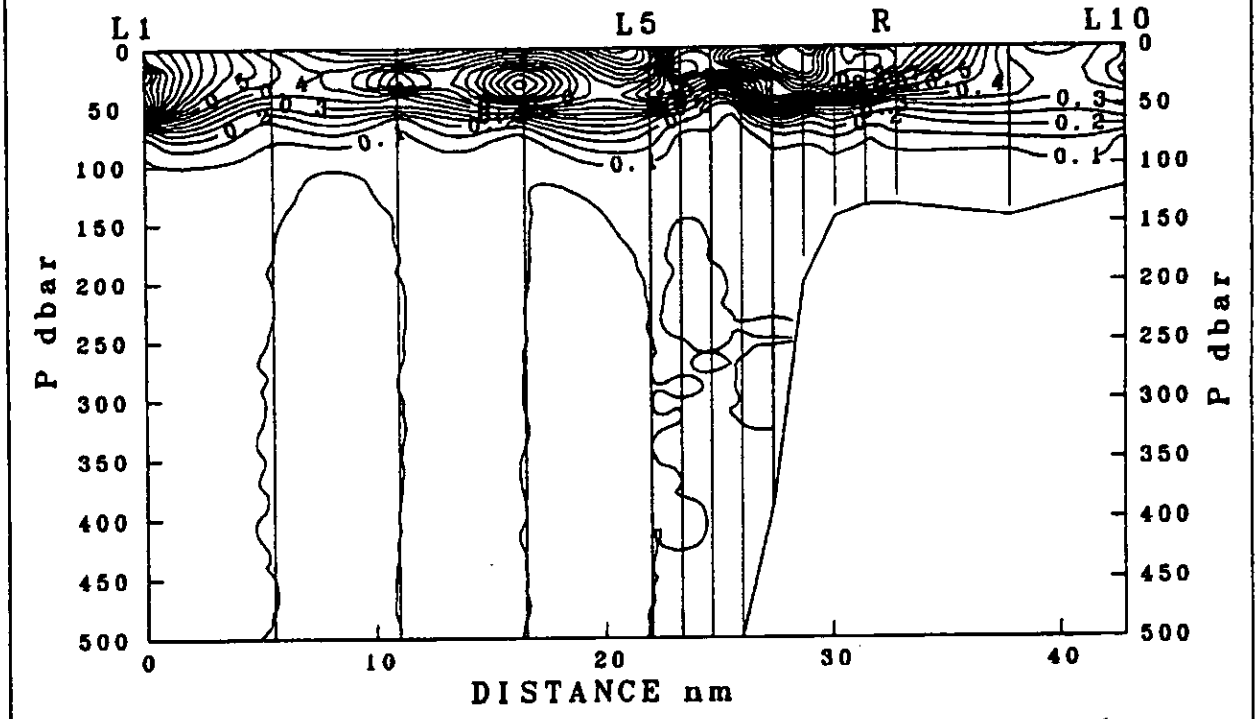
Temperature distribution (°C uncalibrated) for the section crossing the shelf edge at R



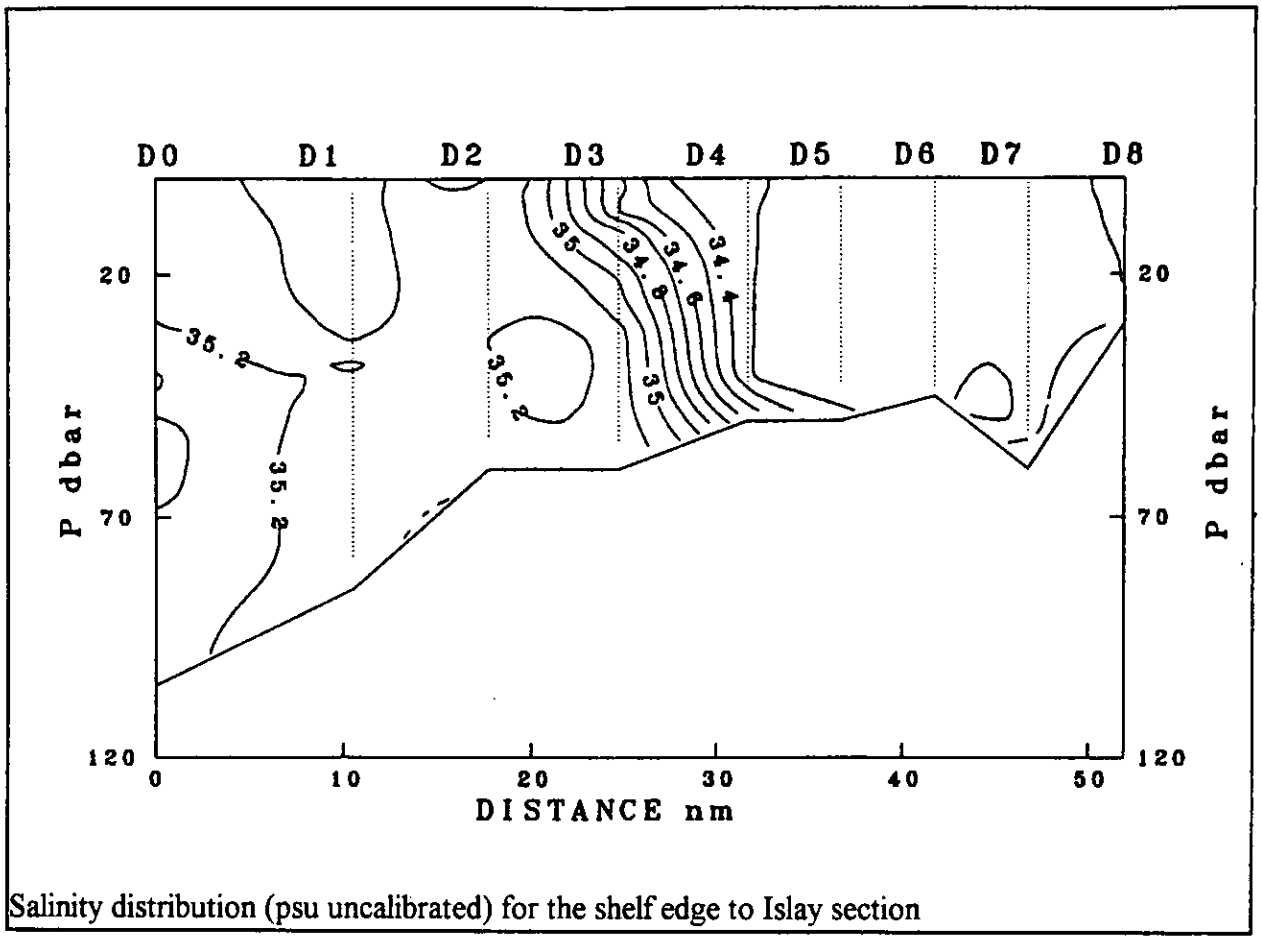
Sigma-t distribution (kgm^{-3} uncalibrated) for the section crossing the shelf edge at R



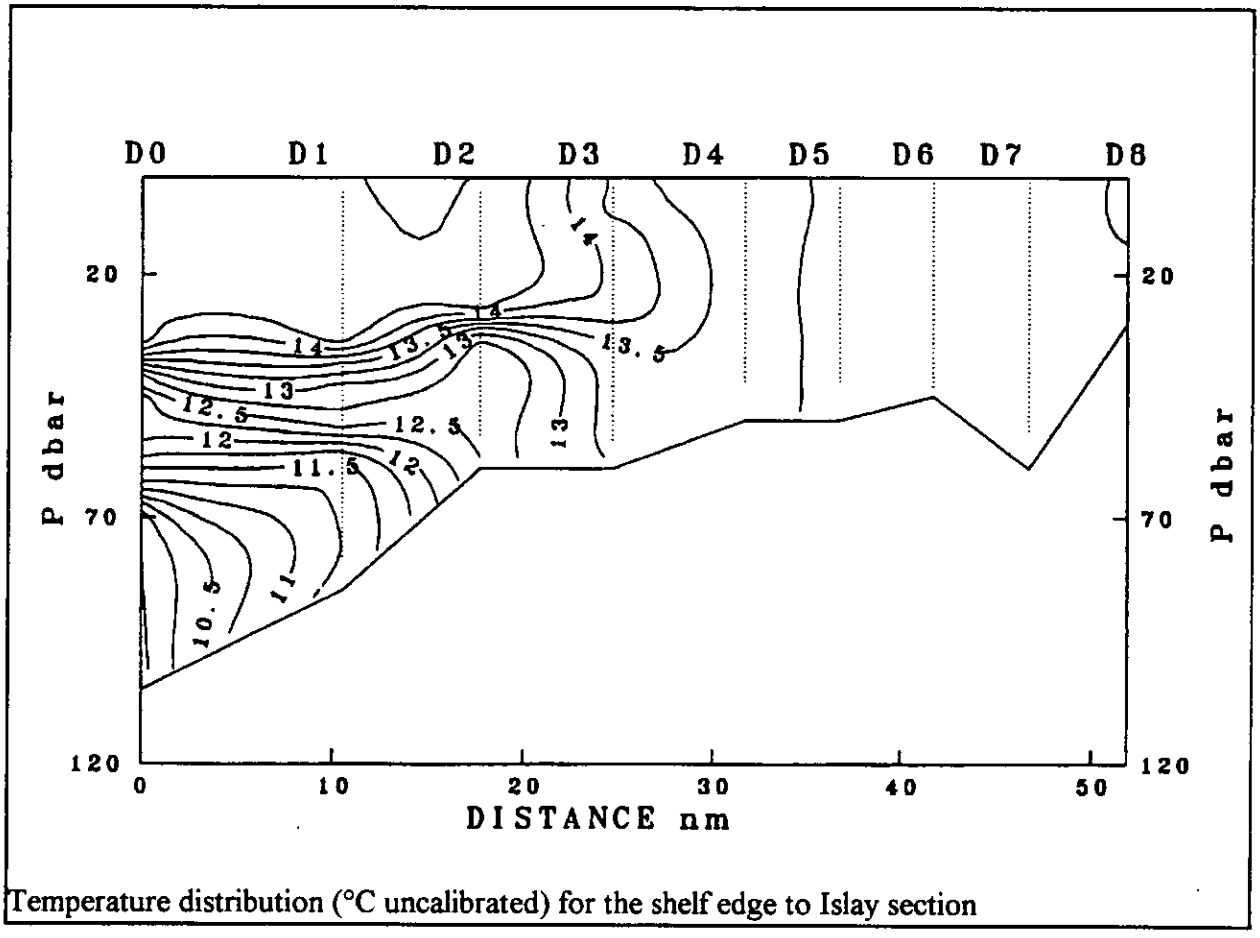
Oxygen distribution (mg/l uncalibrated) for the section crossing the shelf edge at R



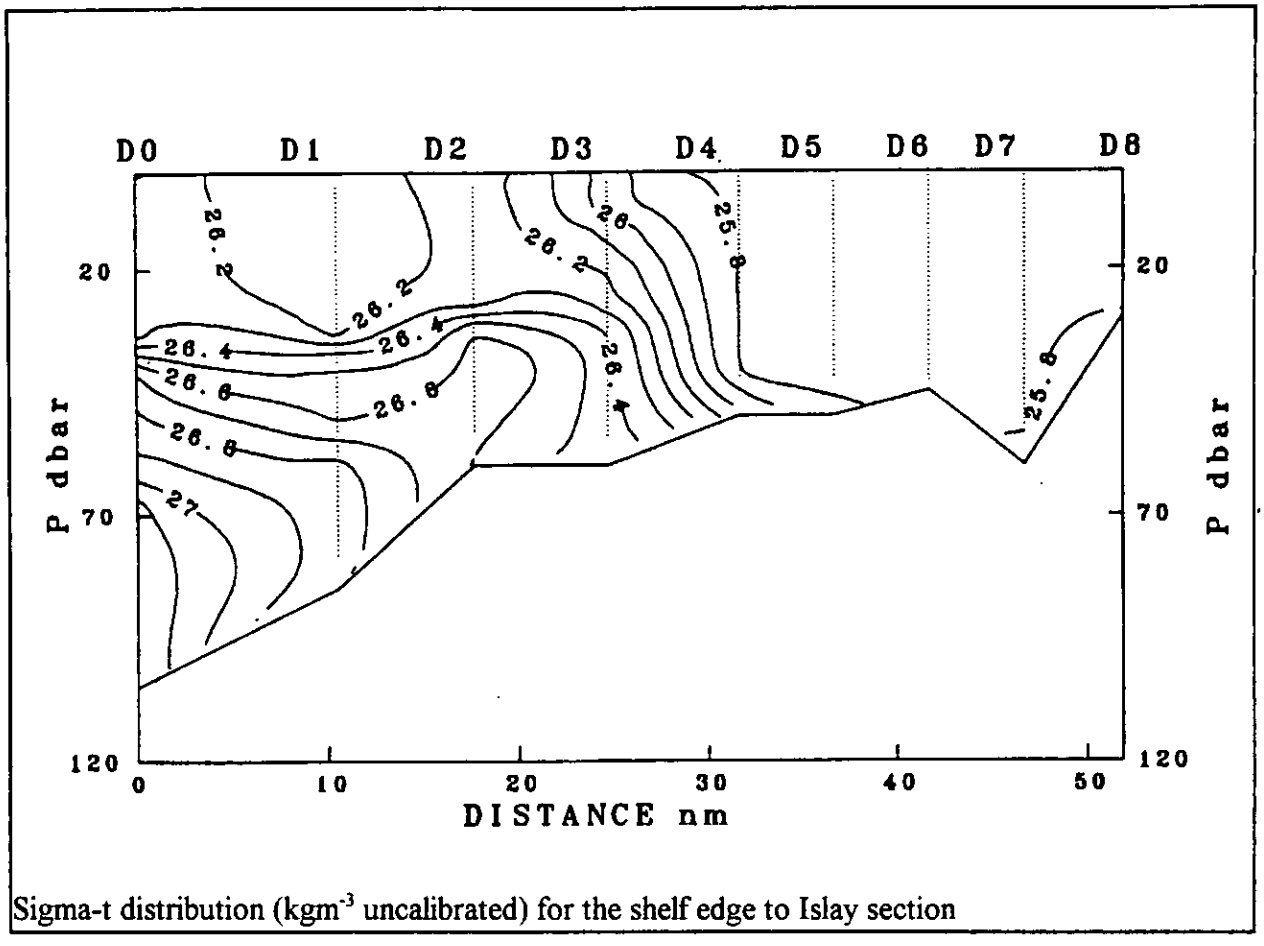
Fluorescence voltage distribution (uncalibrated) for the section crossing the shelf edge at R



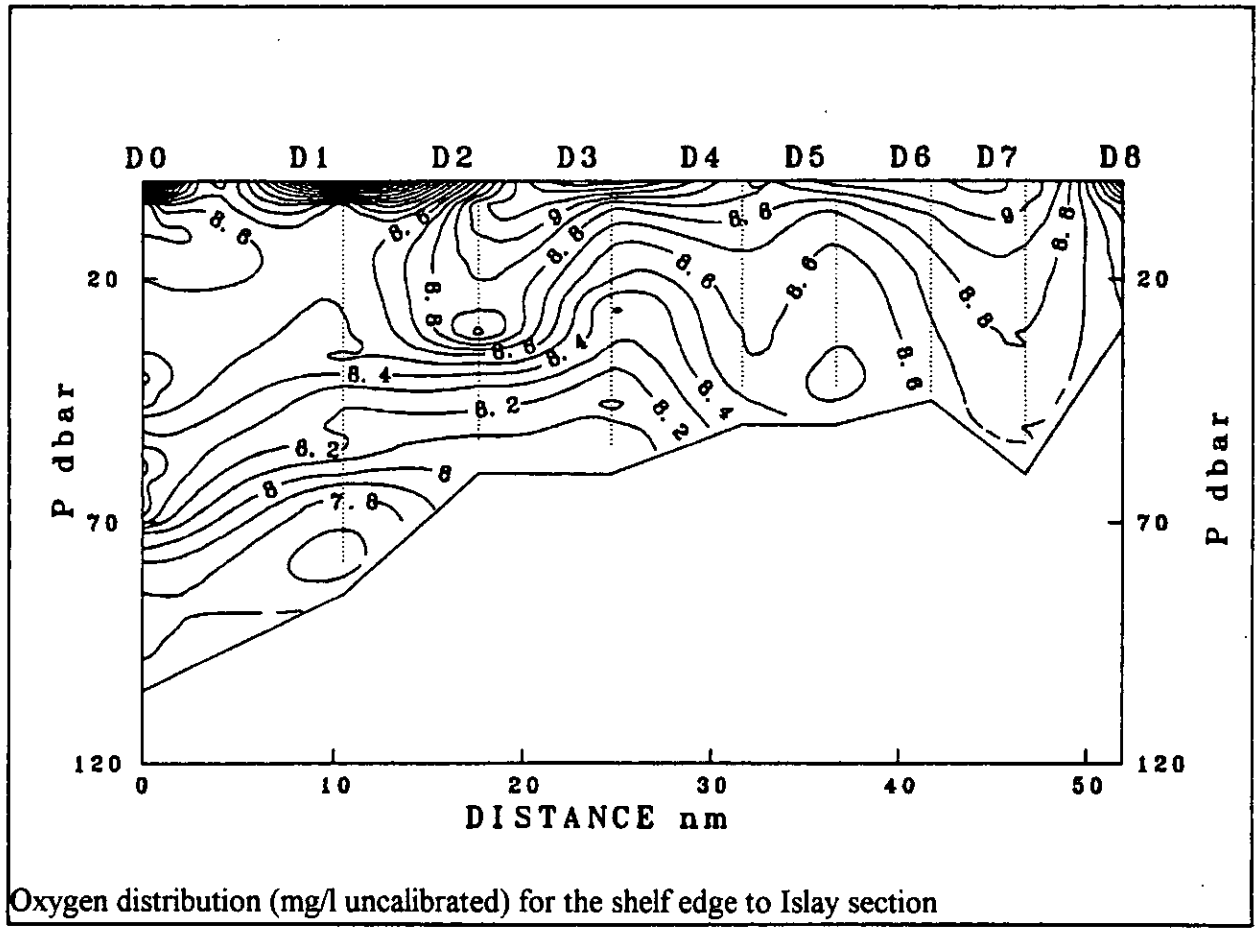
Salinity distribution (psu uncalibrated) for the shelf edge to Islay section



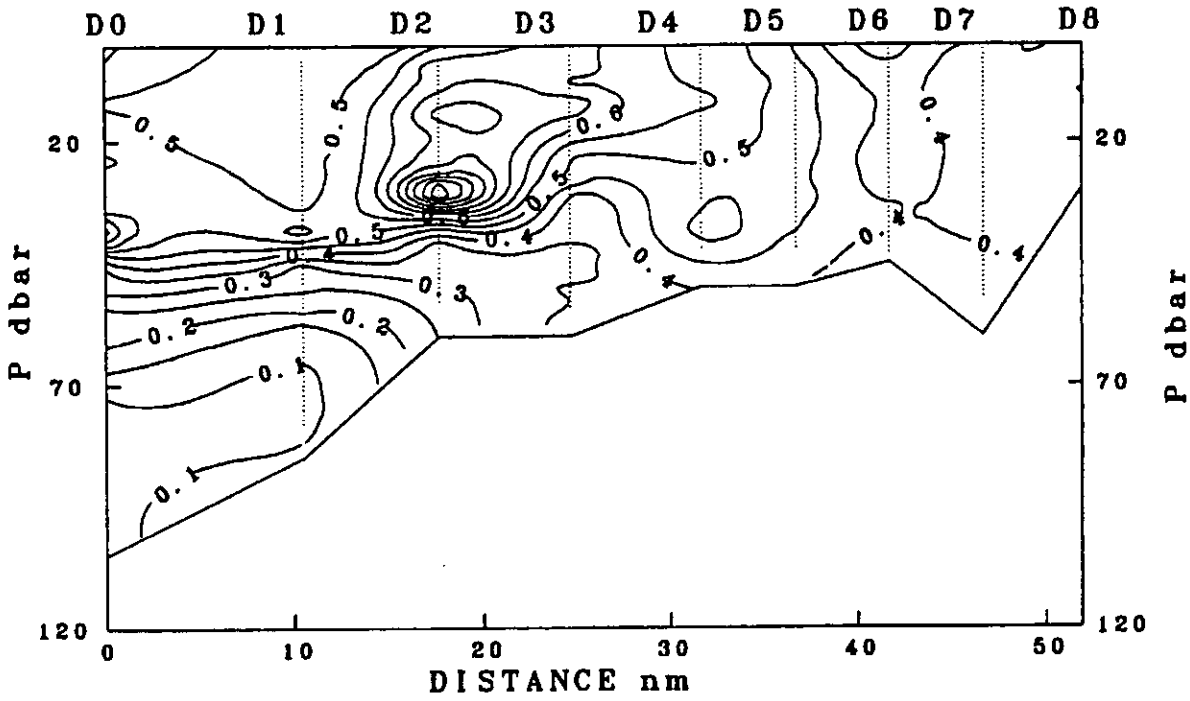
Temperature distribution (°C uncalibrated) for the shelf edge to Islay section



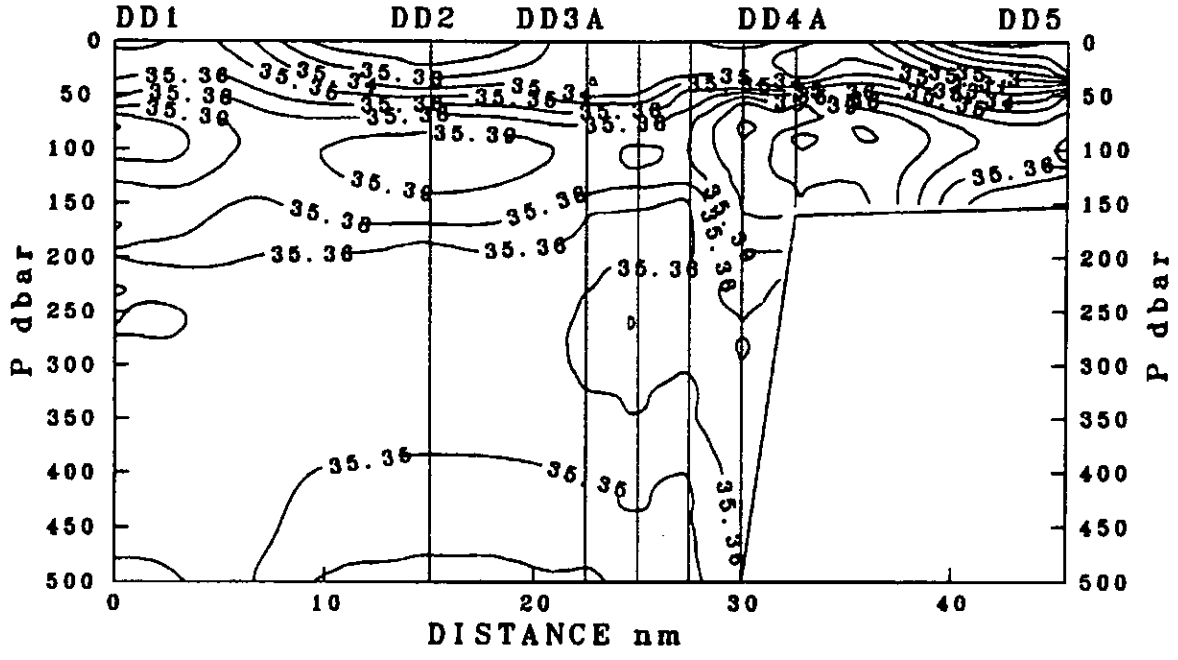
Sigma-t distribution (kgm^{-3} uncalibrated) for the shelf edge to Islay section



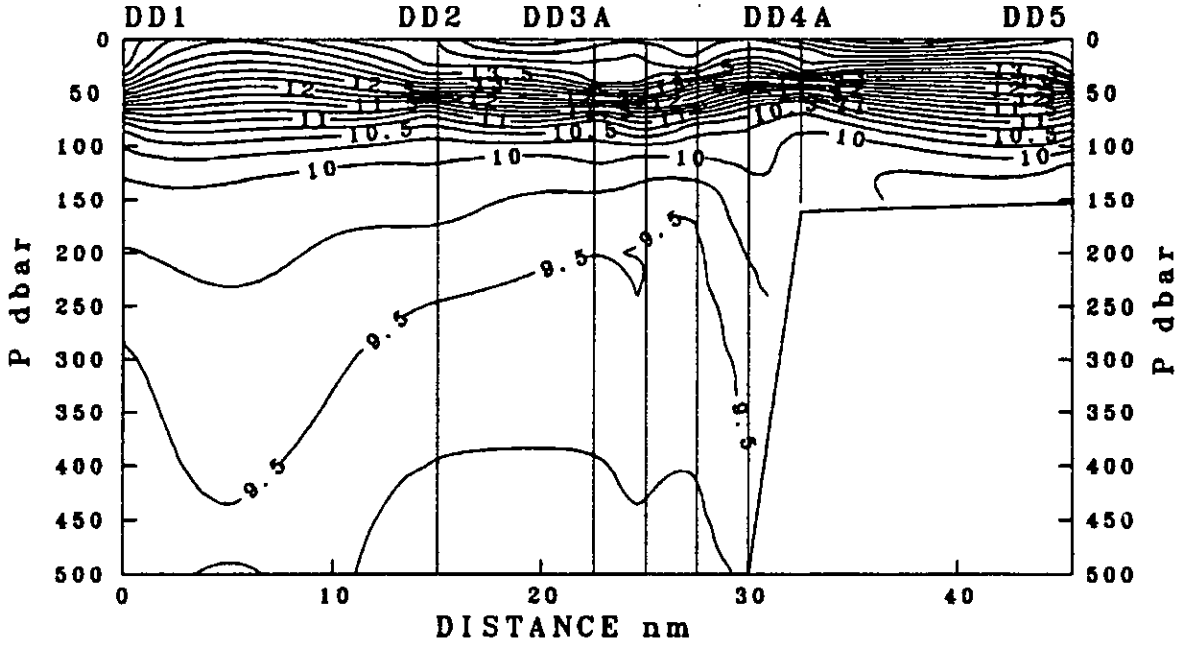
Oxygen distribution (mg/l uncalibrated) for the shelf edge to Islay section



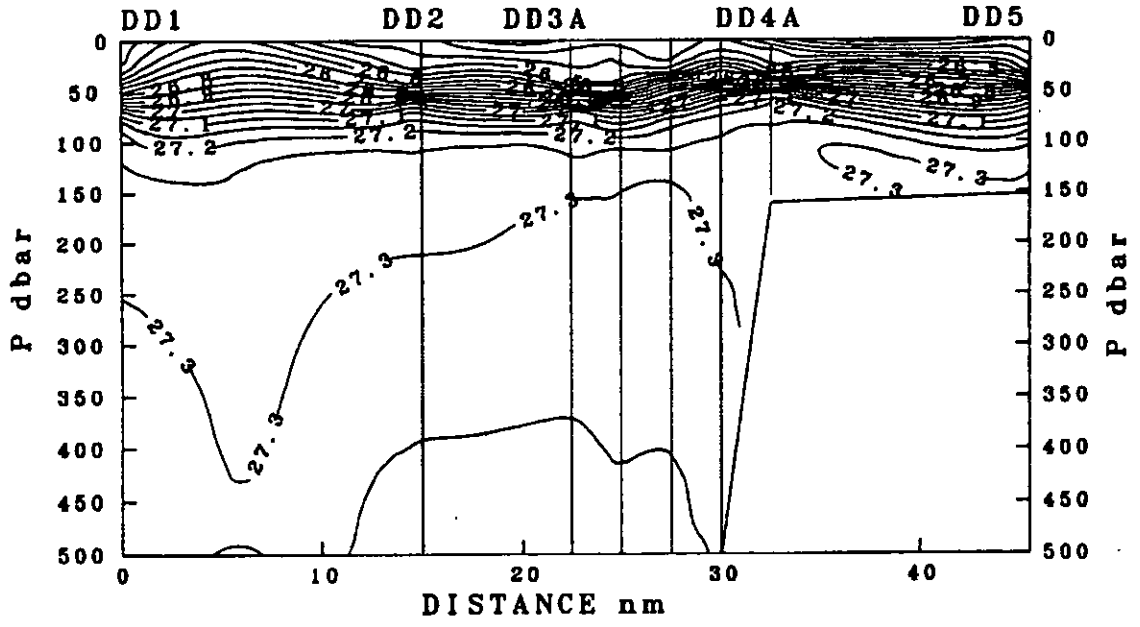
Fluorescence voltage distribution (uncalibrated) for the shelf edge to Islay section



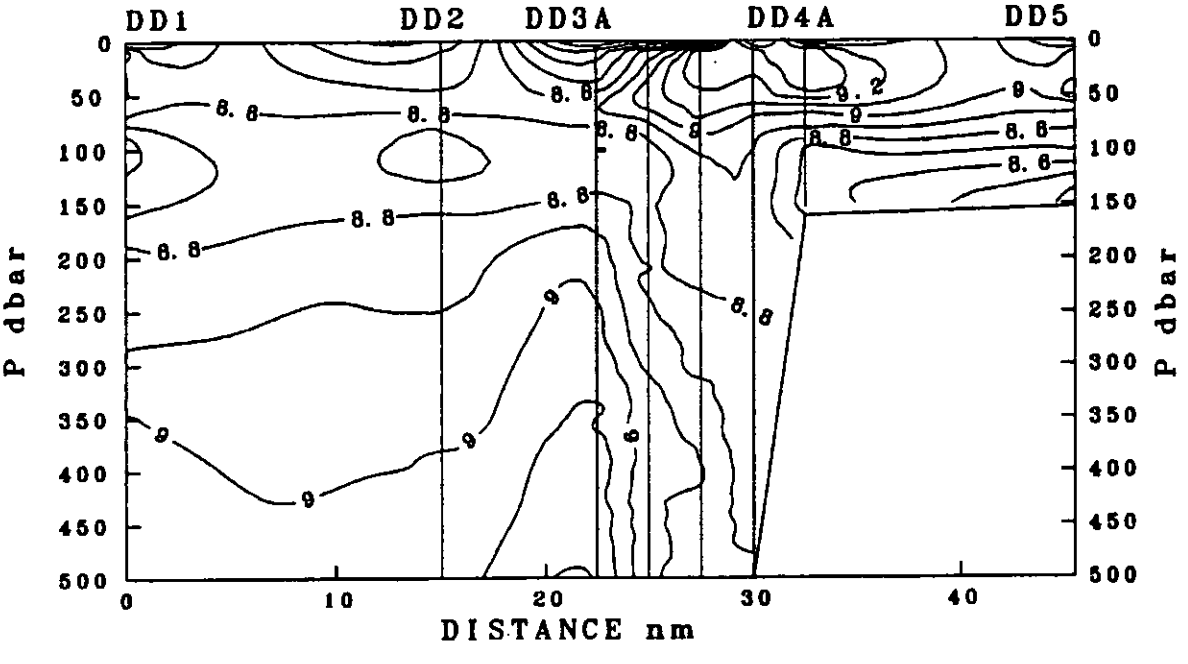
Salinity distribution (psu uncalibrated) for a section across the "LOIS Box"



Temperature section (psu uncalibrated) for a section across the "LOIS Box"

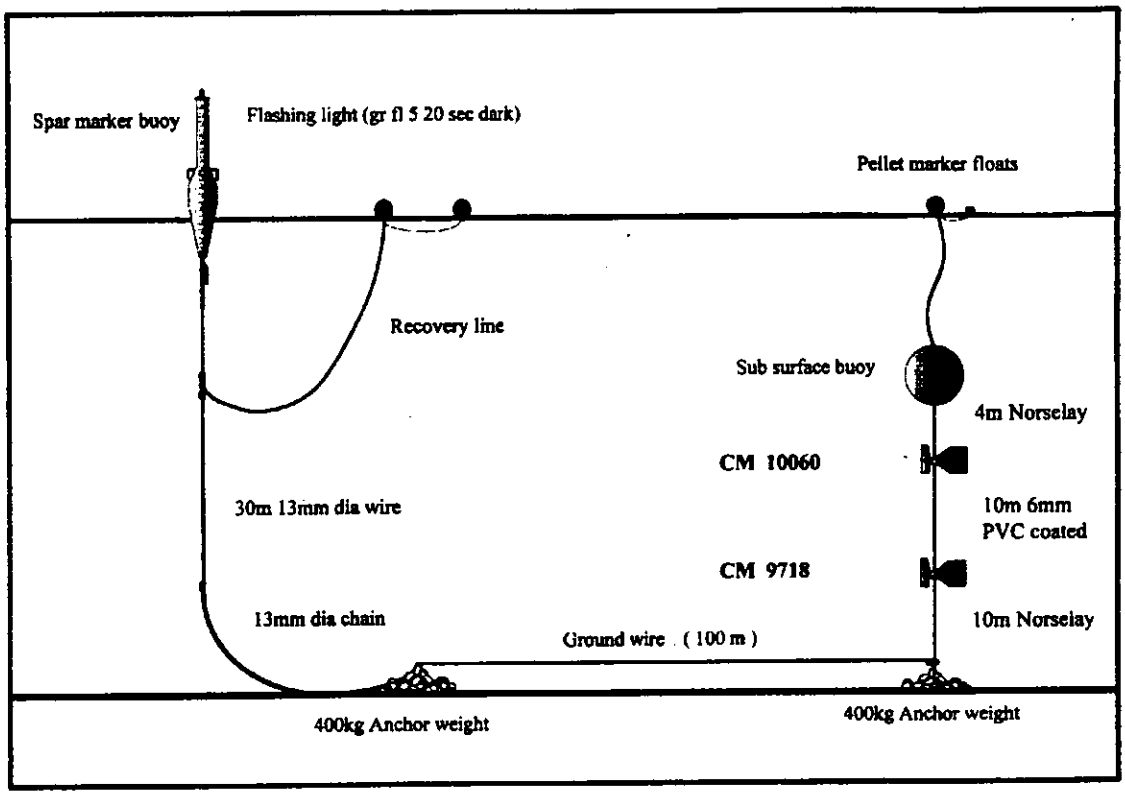


Density (uncalibrated) for section across the "LOIS Box"



Oxygen distribution (mg/l uncalibrated) for a section across the "LOIS Box"

Tiree Passage Mooring 9th May 1994 to 15th August 1994

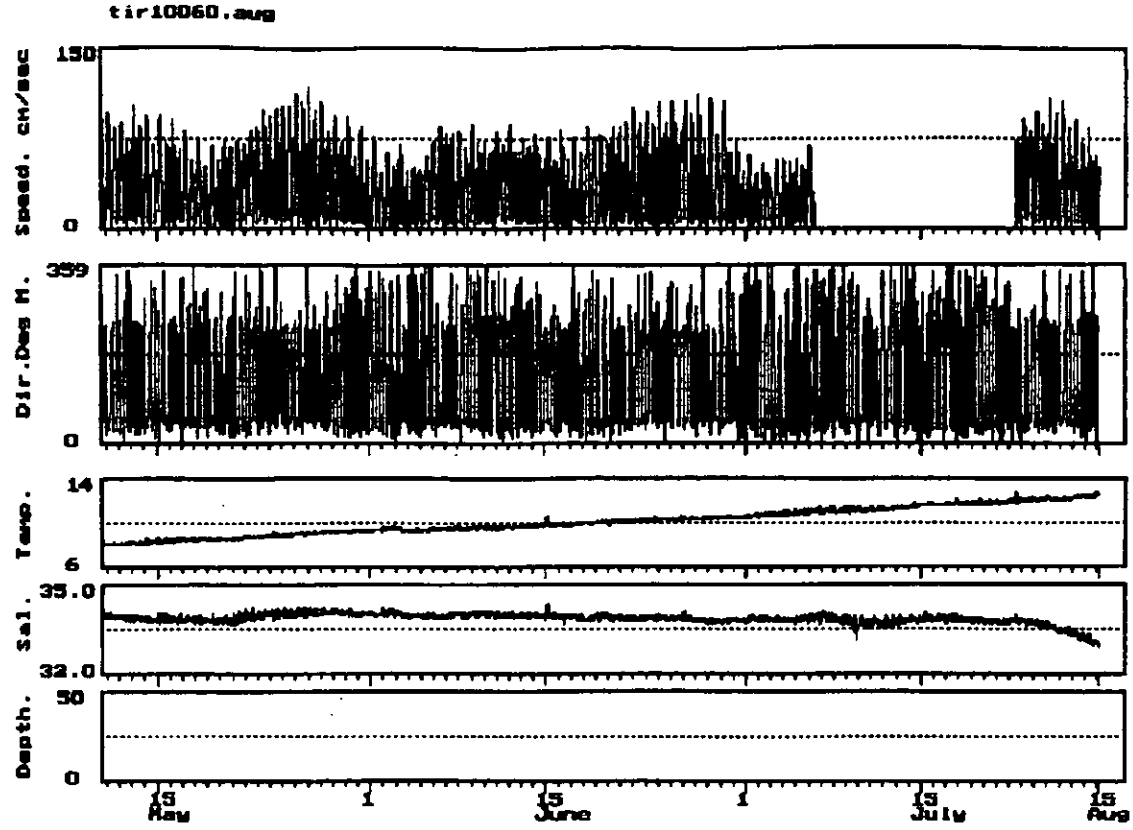


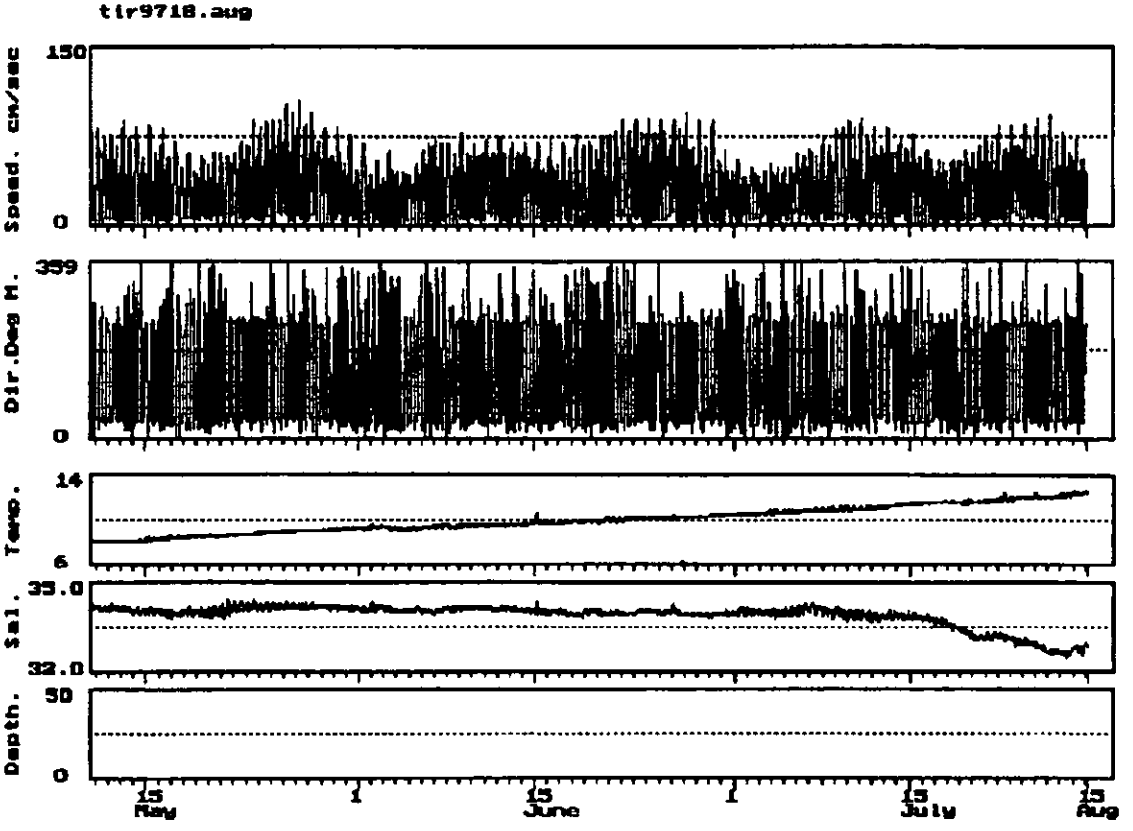
Mooring Position	**56 37'.20N**	**6 23'.90W**
Water Depth	45m	
Mooring Deployed	1234Z	09-05-1994
Mooring recovered	1426Z	15-08-1994

Meter	**10060**	(RCM7)
Distance from bottom (m)	22m	
Time of first cycle	1400.0Z	08-05-1994
Time of last cycle	1400 26secs	16-08-1994
Sample interval	30 mins	

Meter	**9718**	(RCM7)
Distance from bottom (m)	11m	
Time of first cycle	1400.0Z	08-05-1994
Time of last cycle	1400 58secs	16-08-1994
Sample interval	30 mins	

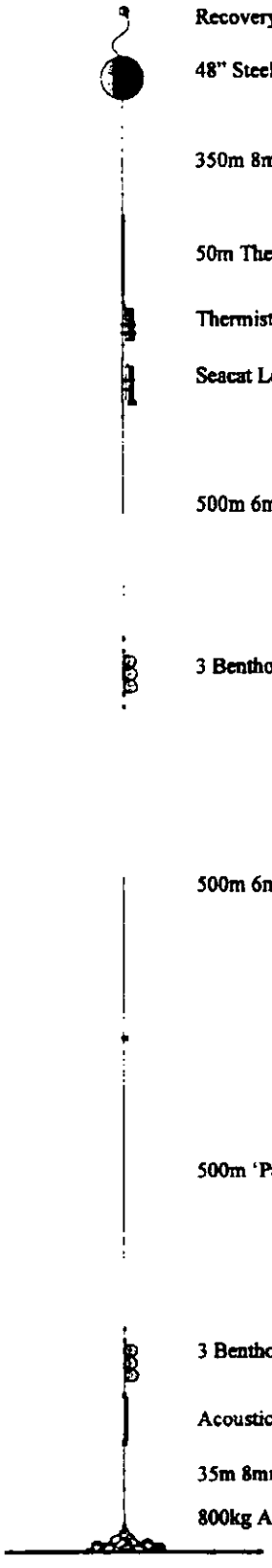
All recovered in good condition. All data OK but speed gone on meter 10060 for aprox 16 days from 7th july





Tiree Passage Mooring - Current meter results

Station M Mooring Deployment May 1994



Recovery Line

48" Steel Sphere

350m 8mm PVC Coated Wire

50m Thermistor Chain No. 1760

Thermistor Logger No. 1282

Seacat Logger No. 1004

500m 6mm PVC Coated Wire

3 Benthos Spheres

500m 6mm PVC Coated Wire

500m 'Paraline' Polyester Rope

3 Benthos Spheres

Acoustic Release No. 38

35m 8mm Dia Galvanised Wire

800kg Anchor Weight

Mooring Position: **57 17' 59 N 10 23' 51 W**

Water Depth: **2225m**

Thermistor Logger: **1282**

Time of first cycle: 1800.0Z 05-05-1994
Time of last cycle:
Sample interval: 60 mins.

Thermistor chain No: **1760**

Length: 50m
1st sensor: 1.5m above Seacat.

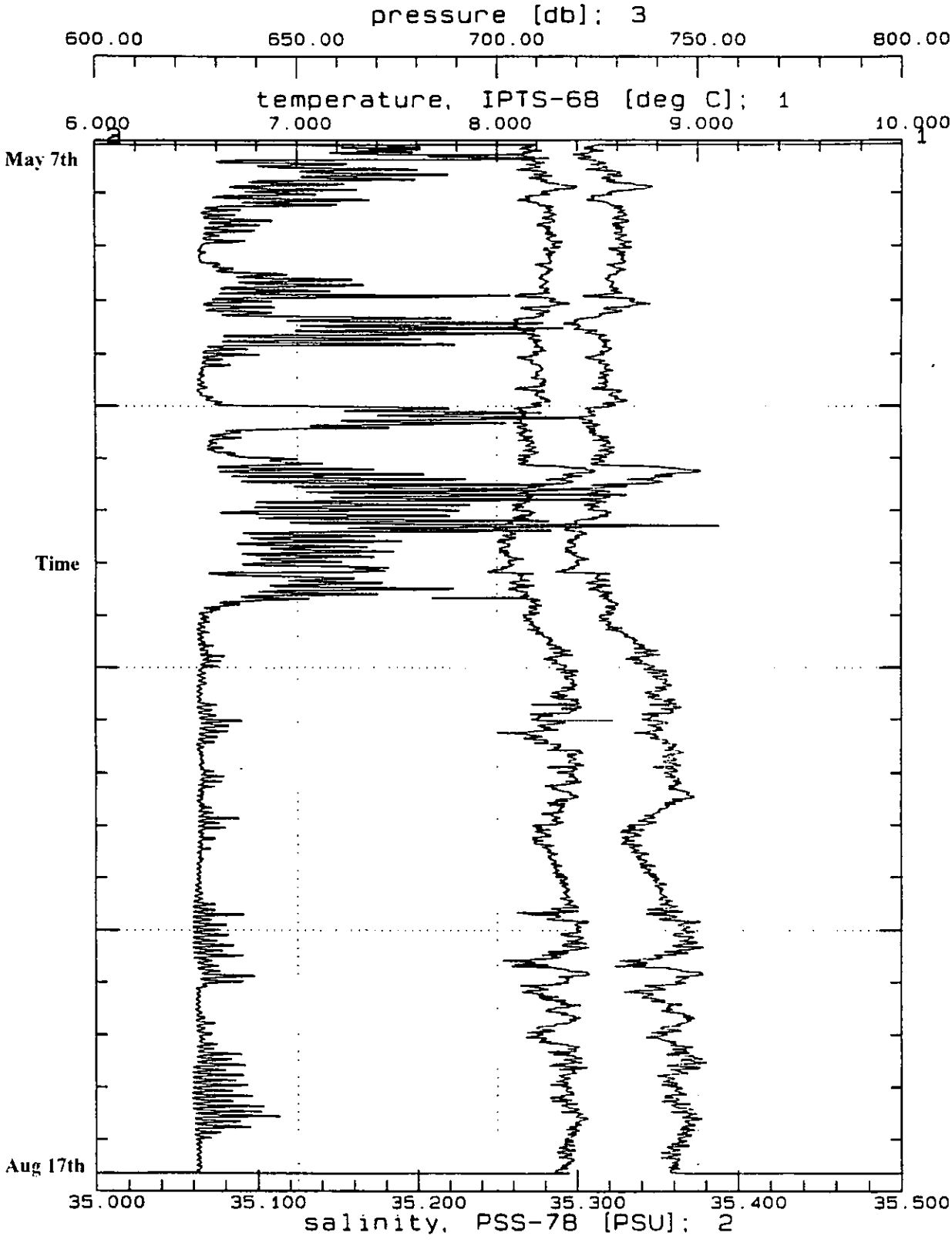
Sensors spaced at 5m intervals from 1st sensor.
total of 11 sensors in chain.

Seacat Logger: **1004**

Time of first cycle: 0530.0Z 07-05-1994
Time of last cycle:
Sample interval: 10 mins.

Acoustic release: **AR38**

Codes: **07 - 03 Spare = 11**
Release= 12



Mooring M May 7th to Aug 17th 1994