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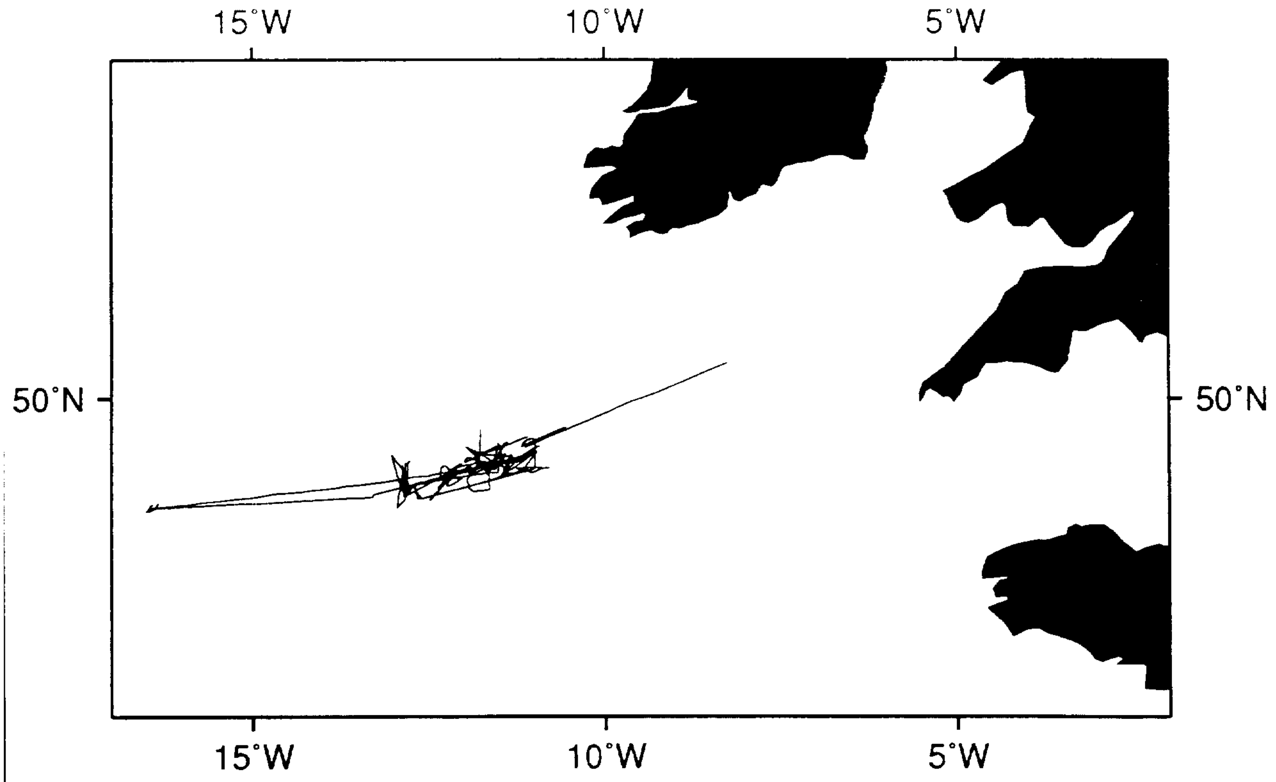
Oceanographic Sciences
Deacon Laboratory

RRS *Charles Darwin* Cruise 85

11 Apr - 07 May 1994

Pelagic ecology of the Goban Spur shelf break

Cruise Report No 245 1995



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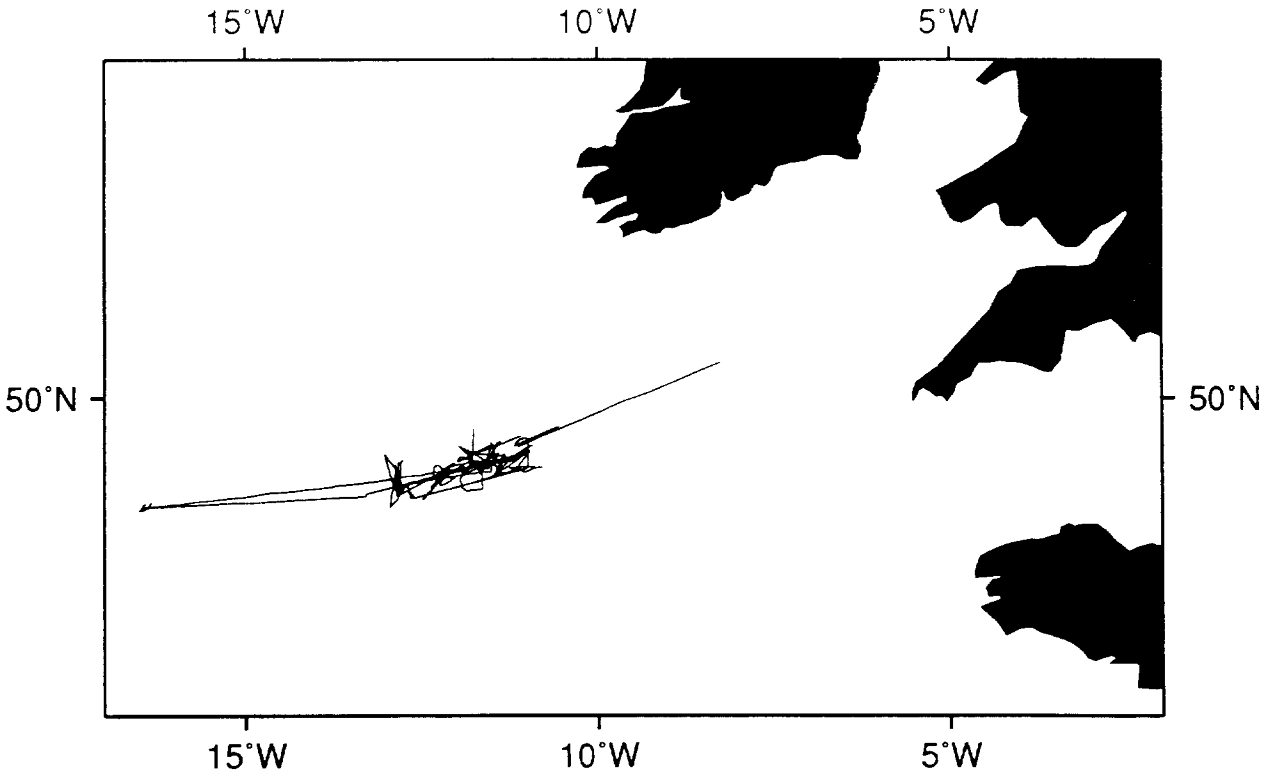

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INSTITUTE OF OCEANOGRAPHIC SCIENCES

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CRUISE REPORT NO. 245

RRS *CHARLES DARWIN* CRUISE 85
11 APR-07 MAY 1994

Pelagic ecology of the Goban Spur shelf break

Principal Scientist
P R Pugh

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ABSTRACT

Charles Darwin cruise 85 represented a UK contribution to the EEC MAST II Ocean Margin EXchange (OMEX) project to quantify the biologically mediated cross-slope exchanges and vertical fluxes of biogenic material in the region of the Goban Spur (c. 49-50°N, 11-13°W).

The sampling programme consisted of: 1) SeaSoar surveys, at the beginning and end of the cruise to investigate the changes in the hydrographic structure of the region. Unfortunately, unforeseen circumstances and bad weather prevented the completion of both surveys; 2) Observe the day and night depth distribution, throughout the water column, of macroplankton and micronekton by means of a vertically stratified series of RMT1+8M net deployments at six stations along the OMEX line, where the water depth ranged from c 200m to c 1400m. This was largely successful, but gear failures and bad weather prevented the collection of a complete set of samples; 3) Observe patterns of acoustic back-scatter, using the shipborne ADCP, throughout the cruise and relate these with the data from the biological sampling; with additional "sea truthing" from Longhurst-Hardy Plankton Recorder deployments. In addition a short-term ADCP mooring was deployed to allow intercomparisons with the shipborne ADCP; 4) Assess changes in marine snow abundances with slope hydrography. Attempts were made to recover and deploy three sediment trap moorings, and the vertical distribution of particles was investigated using a marine snow camera, attached to a CTD, and large volume water bottles; 5) Evaluate cross-slope changes in phytoplankton and microzooplankton communities, from continuous surface fluorescence and nutrient measurements, and from water bottle and vertical net collections for biomass, primary productivity and grazing studies.

In addition physiological and experimental studies on the bioluminescent characteristics of the pelagic slope fauna were carried out.

KEYWORDS

ADCP
ATLANTIC OCEAN(NE)
BIOGENIC MATERIAL
BIOLUMINESCENCE
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GOBAN SPUR
HYDROLOGY
LONGHURST HARDY PLANKTON RECORDER
MARINE SNOW
MAST
MICRONEKTON
NUTRIENTS
OMEX
PARTICULATE FLUX
PHYTOPLANKTON
PRIMARY PRODUCTION
RMT
SEASOAR
SEDIMENT TRAPS
SHELF EDGE
VERTICAL MIGRATIONS

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ITINERARY

Depart Barry 11th April - Arrive Barry 7th May 1994.

OBJECTIVES

1. To carry out biological, chemical and physical investigations in the region of the Goban Spur shelf break region (40-50°N 11-14°W), as part of a community research programme (OMEX) to quantify the biologically mediated cross-slope exchanges and vertical fluxes of biogenic material. These investigations to include:-

a) Two SeaSoar surveys of the area to assess the physical structure of the water column; in association with shipborne ADCP measurements.

b) Deployments of the Longhurst-Hardy Plankton Recorder in an attempt to correlate the vertical distribution of plankton with shipborne ADCP results.

c) Sediment trap moorings to assess the sedimentation rate of particles, and to provide material for biological and chemical analyses.

d) Net collection of plankton and micronekton to assess their vertical distribution, diel migrations, and role in trophic transformations and vertical transport of particulate carbon.

e) Estimation of the rates of phytoplankton primary productivity, new and regenerated production and phosphate uptake.

f) Assessment of microzooplankton biomass in the euphotic zone and its grazing potential

g) Deployment and retrieval of an upward-looking ADCP mooring.

h) Studies on marine snow, and the impact of zooplankton feeding.

2. To recover and deploy sediment trap moorings at ca. 48°55'N 16°23'W.

NARRATIVE (Figures 1 & 2)

RRS *Charles Darwin* sailed from Barry at 0800 BST on 12th April 1994 and course was set for the Goban Spur (ca. 49°25'N 12°00'W), with a passage time of approximately 36 hours. During the day the opportunity was taken to calibrate the shipborne ADCP, albeit in rather shallow water.

An attempt to deploy the PES fish at 1100Z on 13th April was delayed until 1330Z because of problems with the ship's gyros. Site **A**, the proposed deployment position for the ADCP mooring, was reached at 1700Z and wire test for the release gears and a trial CTD were carried out. A bathymetric survey was carried out overnight to find a suitable site for the ADCP mooring. Deployment of the sub-surface ADCP mooring was commenced at 0843Z on the 13th April (St. 53301). It was finally slipped at 0951Z at position 49°25.39'N 11°47.51'W where the water depth was 999 corrected metres; with the ADCP approximately 350 m below the surface.

Course was then set for the nearby OMEX1 (Site **D**, ca. 49°25'N, 11°32'W) site, where it was hoped to recover and redeploy a German sediment trap array. The mooring had been deployed during a *Poseidon* cruise in June 1993 and *Meteor* had attempted to recover it earlier this year. They had ranged on it and fired the release code, but then had then been unable to range on it again and failed to find the mooring. We were unable to make any contact with the mooring and so were unable to recover or redeploy it.

After a float test for a package containing a replacement water pump destined for RRS *Challenger*, the SeaSoar was deployed (St. 53302) at 49°25.1'N 11°30.2'W. The original plan had been to do a 100 x 50 km box survey, with six main legs, running in an easterly or westerly direction, at 10 km intervals. At the start of the cruise it was decided to realign this box in order that the OMEX line (Figure 2), that connected the sites of the OMEX1, 2 and 3 sediment trap moorings, could be followed. In addition, it was decided to increase the length of the main legs of the survey to 130 km; to reduce the number of long legs to four; and to increase the distance between them to 15 km. The series of sampling stations (Sites **B** to **G**) also were realigned to be positioned along the OMEX line, which was extended inshore to the 200 m depth contour.

As the present position of the ship was close to the OMEX1 site, it was decided that time allowed for the duplication of most of the actual OMEX line and so a course of 252° was set at a speed of 8 kt. After about three hours in the water, the SeaSoar suffered a signal failure and was recovered with a suspected cable fault. The termination was remade and SeaSoar redeployed at c. 2200Z. The first and second legs of the survey were then completed successfully, with the length of cable being reduced to 200 m as the continental shelf was approached. During the third leg (a repeat of the first) the SeaSoar began to respond poorly to the command waveform and the vehicle was recovered with a suspected hydraulic leak. The hydraulic unit was replaced and the vehicle redeployed. Because the Admiralty had requested that we be west of 12°30'W by 1200Z on the 15th April, the loss of time due to recovery and redeployment of the SeaSoar meant that the third leg would have to be curtailed at ca. 12°20'W. However, prior to this turn a drifting buoy was sighted in close vicinity to where the ADCP mooring had been deployed. The course change was completed and the fourth leg begun, but it was considered expedient to remain in close contact with the buoy in case the ADCP mooring had broken free, and so the SeaSoar was recovered and the first survey terminated early at 2223Z on the 14th April.

As the buoy could not be approached in the dark, the time was filled with a CTD and Marine Snow Profiler (MSP) cast to 1003 m (St. 53303). At first light the buoy was approached, and was found to be a dhan buoy attached to the end of a "long line". It transpired that the previous night the SeaSoar had been towed through the area between the buoy and the mother ship. This could account for some damage to the fairing of the cable; and it was fortunate that more serious damage or loss was not sustained.

Course was now set for the OMEX2 site (Site **G**, St. 53304, water depth c. 1400 m) at 49°11.2'N 12°49.2'W, and this was reached at 0700z on 15th April. The OMEX2 sediment trap mooring was located, and released at 0800Z. It proved to be troublesome to recover due to entanglement, but was inboard by 1045Z.

Then commenced the intensive site sampling programme, also scheduled to take place at Sites **B** to **F**, consisting of total water column vertical series of day and night RMT1+8M nets, interspersed with water bottle sampling and primary production experiments; CTDs with the marine snow profiling camera (MSP); and other nets. During the first RMT deployment the nets proved difficult to close, but this was put down to the narrow frequency band to which the monitor was responding. However, further problems with a battery pack began to become apparent, as well as damage to the aged nets during launch and recovery. A request was sent to *Challenger* asking for one of their new battery packs to be sent over during the rendezvous scheduled for the 17th April.

Overnight, whilst water bottle sampling for a primary production experiment, the kevlar rope to which the bottle were being clamped parted and one water bottle was lost. The usual hydrographic wire was used henceforth. A shallow CTD dip was carried out to collect further water, and then a deep CTD + MSP cast was made. Two sets of daytime RMT nets were then completed successfully but, after a change of batteries, the third net of the next nighttime deployment failed to close. It was clear that this battery pack was "duff". The other battery pack was re-instated for the next nighttime deployment, and worked successfully. It was then necessary to resort to a third, very old, battery pack for the next deployment, but fortunately they worked adequately.

The rendezvous with *Challenger* occurred during the mid-morning of the 17th, and a boat transfer of the replacement water pump and a new battery pack successfully completed. However, with the problem of batteries solved, the first signs of another problem, with the release gear, appeared during the next deployment of the RMT nets when the second net proved difficult to close. None the less, a series of RMT nets down to 1300 m by day, and 1100 m by night was now completed. Overnight there was much midships activity, and a free-floating primary productivity rig was launched around sunrise. A series of near-bottom RMT nets was then attempted, but had to be abandoned when the first net refused to close, again caused by a malfunction of the release gear.

The OMEX2 sediment trap mooring site then was successfully relayed on its original site; and the primary productivity rig was relocated and recovered around sunset. Although the RMT net release gear appeared to be working correctly, it was decided not to attempt another near-bottom series of hauls. Instead, further water bottle sampling, etc., was carried out in preparation for a deck incubation experiment, and sampling at Site **G** was terminated. The remainder of the night of the 18th/19th April was given over to recalibrating the ship's logs, which previously had found to be wildly inaccurate, and then course was set for Site **F** (St. 53305, c. 49°16'N, 12°20'W, water depth c. 1100 m).

A Longhurst-Hardy Plankton recorder (LHPR) was towed successfully, down to a depth of 320 m. However, there were further release gear problems during the next RMT tow, when the second net refused to close and had to be hauled back to the surface. It was thought that the spare release gear was working correctly and so the releases were exchanged and a test dip of the nets carried out. Electronically, the system appeared to work properly, but after the next deployment it was found that the catch in the first pair of nets was very small. A similar thing happened on the next deployment and so it was concluded that Net 1 had opened and closed on the first release signal, and consequently that Net 2 had been fished for 2 h. The original release gear was then re-installed, but failed completely on the subsequent deployment. Thus both 4-jaw releases were faulty.

Various other activities were carried out while the original release gear was stripped down and re-built. A test dip then showed that it had been wired up 90° out of alignment. This was corrected and a test deployment of the whole rig, to 500 m, appeared to work perfectly. However, the damage to the third RMT8 net, due to abrasion by the cod-ends of the RMT1s, was becoming severe. An abbreviated set of near-surface RMT hauls was then carried out, and the correct opening of the first net was checked by hauling the rig back to the surface. This release gear then worked perfectly for the remainder of the cruise. Emergency repairs to the nets were begun.

A successful series of RMT hauls was completed overnight (20/21 April); interspersed with water bottle collections for a primary productivity experiment. The free-floating productivity rig was but then launched around sunrise. Two daytime deployments of the RMT nets were completed successfully; followed by two marine snow catchers and an Apstein net. The productivity rig was then recovered. After a brief vertical NII3 net the RMT nets were launched again in order to do some nighttime bottom sampling. After a deep CTD + marine snow sampler and some water bottles, a single depth horizon was fished with the RMT nets in order to complete the day/night vertical series to 1000 m.

It was hoped to fish some daytime near bottom RMT nets, but rapidly deteriorating weather prevented this, and the decision was made to steam back to the ADCP mooring (Site **A**). It was, however, too rough to recover the mooring and so the ship stationed itself above the mooring, and an experiment carried out to see if the shipborne ADCP would interfere with it. Two CTD deployments were carried out (St. 53306), and the vessel steamed to Site **E** (St. 53307, c. 49°21'N, 11°50'W, water depth c. 1050 m.) where water bottle and CTD + MSP casts were made. As it was too rough to deploy the RMT nets, the vessel steamed to the OMEX1 Site (**D**, c. 49°25'N, 11°40'W, water depth c. 750-800 m.) and further midships activities carried out overnight (St. 53308). The weather conditions were now such that the scientific programme had to be suspended for the next 48 h. However, this did not prevent an enjoyable mid-cruise "Bergfest"! The only work carried out during this period were two marine snow catchers (St. 53309) and a series of water bottle casts (St. 53310).

On the morning of 25th April the weather conditions had improved, but it was still too rough to recovery the ADCP mooring. The vessel then steamed to north of Site **E**, and a LHPR was launched (St.

53311). There was much slack wire during the pay out; and excessive surge during recovery caused the net to be ripped to pieces, and some welds on the frame came apart. As RMT netting was still out of the question the vessel returned to the OMEX1 Site (**D**), and various midships activities took place overnight (St. 53312). A further improvement in the weather meant an attempt could now be made to recover the ADCP mooring. It proved difficult to release, but eventually appeared at the surface. Because the mooring could not have a stray line, it was difficult to grapple - and five attempts were made before it was successfully brought aboard. RMT netting was still impossible, so further midships activities were then carried out at Sites **C** (St. 53313, c. 49°28'N, 11°11'W, water depth c. 225 m), **B** (St. 53314, c. 49°30'N, 11°00'W, water depth c. 200 m), and again at **C** (St. 53315).

As the forecasts predicted an improvement in the weather conditions within 24+ hours, course was set for Site **H** (c. 48°55'N 16°23'W) were a moored sediment trap array was due to be recovered and a new one laid. During the transit, XBTs were launched at hourly intervals (Table 1). Site **H** (St. 53316) was reached at c. 0130Z on 29th April, and an acoustic box survey of the area was carried out. A necessary wire test for the new releases was delayed due to a fault with the midships winch, but eventually took place successfully. At 0800Z, on a sunny and calm day, an attempt to recover the mooring was commenced. It was emitting a weak signal, but gave positive signs of having released. However, it did not begin to rise, and finally it was concluded that the mooring rope had parted above the releases and that the latter were lying on their sides. The site was then abandoned and deployment of the new mooring commenced at a site about 3 nm away from it. This was completed successfully and passage back to Site **D** commenced. Further, XBTs were launched, hourly, during the passage (Table 1) and a brief stop was made at the OMEX3 Site (St. 53317, c. 49°05'N, 13°18'W, water depth c. 3600 m) for some midships activities.

As Site **D** (St. 53318) was approached the repaired LHPR was launched and fished successfully. A series of day and night RMT net deployments was then commenced, including some near bottom day tows; followed by some midships activities primarily for a primary productivity experiment and the free-floating rig was launched around sunrise. Unfortunately during the next deployment of the RMT nets the monitor "cross" was wound up tight into the block, and the warp parted from it. The cross plummeted to the deck and bounced over the stern of the ship; fortunately without injury to any person. It proved possible to drag the cross aboard, but the "monitor" and near bottom each-sounder were no longer working, and the release gear had been dented. While these parts of the RMT system were being replaced, the vessel steamed into deeper water (c. 1000 m) and a vertical wire test of an ADCP was carried out (St. 53319). On returning to Site **D**, an attempt was made to deploy the RMT nets, with a new monitor and the second release gear, but unfortunately the RMT1 nets became trapped under the weight bar and one was torn. This was quickly replaced and time allowed an abbreviated series of day hauls to be carried out (St. 53320). As near bottom fishing was now not feasible, a single night RMT haul (St. 53321) was made to complete the day/night series of hauls down to 600 m. The vessel then steamed to Site **C**.

A night series of RMTs (St. 53322) was followed by various midships activities (St. 53323), and a day series of RMTs in waters somewhat shallower than expected. Unfortunately, an intermittent fault in the release gear prevented closure of the third net, which was hauled back open to the surface. None the less, the three catches were very different. A LHPR tow was successfully completed, and then course was set for Site **B**. The weather was deteriorating again and activities were restricted to midships (St. 53324-5). However, a brief amelioration allowed a nighttime RMT deployment, although the third net had to be abbreviated as the weather worsened again. It was now too rough for netting and also, in the Master's opinion, too rough to launch the SeaSoar. Scientific activities were suspended for the remainder of the day (3rd May).

The SeaSoar (St. 53326) was eventually launched at c. 0800Z on the 4th May, and worked well for the remainder of the day. However, a further deterioration in the weather caused the Master to order its retrieval at c. 0130Z the following morning. Some further midships activities (St. 53327-8) eventually were possible, and then, as time had run out, course was set for Barry. During the transit the PES fish was retrieved and a further ADCP calibration was carried out. RRS *Charles Darwin* docked in Barry at 0448 BST on Saturday 7th May 1994.

The success of a research cruise, particularly a multidisciplinary one, depends on a great deal of collaboration and co-operation not only between the participating scientists, but also with the ship's personnel. The latter were outstanding and it is a pleasure to express my thanks to the Master, the Officers, P.O.'s and crew of *Charles Darwin* for their considerable contribution to the success of the cruise.

PRP

SAMPLING EQUIPMENT AND INSTRUMENTATION

Multiple Rectangular Midwater Trawl. RMT(1+8)M

This normally very reliable gear provided more headaches during this trip than in all my previous cruises put together. These problems were all minor in their own right, but cumulatively proved to be most troublesome. The great age of the netting caused the most annoying and continuous problems, with every recovery revealing new tears and snags. These were either sewn up or patched on deck, or if they were more serious the whole net had to be replaced. Some of the tears were the result of the new handling method, involving the collapsing of the nets, that has had to be adopted in order to launch and recover the nets through the stern A-frame. In the light of this further modifications are planned in order to reduce the wear on the nets.

The most worrying problem was caused by the two 4-jaw release gears. The first unit had a broken gear box at the start of the cruise and so the back-up was fitted. This worked well in the laboratory and during the initial net deployments, although occasional problems were experienced with closing the nets most probably caused by a bad battery pack. After the gear's first failure the unit was examined in the laboratory but no fault could be found. The release gear was then used again successfully before another failure occurred, this time on a different jaw. Again the unit worked perfectly in the laboratory, but some evidence of water entry was discovered and it was decided to replace it with the other unit, once its gear box had been repaired.

The repairs went well and this unit also worked perfectly in the laboratory. It was used for the next two net deployments during that night. However, on both occasions there was evidence of premature closing of net 1. A further attempt with the other unit also failed. Examination of the first unit revealed a slight misalignment of the drive cam that, although it operated correctly on the bench, proved to be enough to strip away a second release bridle when under load. With this problem solved the net was used successfully for several deployments, and allowed time for work to be carried out on the second unit. As there were no obvious faults with this unit, a programme of replacement was started, including the O-rings, Marsh Marine plug, all the wiring and one of the micro-switches. Everything appeared fine.

As the end of the cruise neared an accident occurred during the deployment of the nets, which resulted in the monitor cross and release gear being dropped on to the deck. The flowmeter and the monitor cross were written off, and all parts were replaced with spares, including the second release. This worked for the next four deployments, but then unfortunately failed again. The first unit was inspected and proved to have suffered only minor damage, which was quickly overcome. Bad weather almost prevented the unit being sea-trialled, but one final deployment was achieved. To round off this saga the second unit again worked perfectly in the laboratory!

BB

Longhurst-Hardy Plankton Recorder. LHPR

Once again the age of the equipment proved to be a problem. Although the once troublesome wind-on mechanism now seems to have been remedied, there were still problems with this gear. The metal framework is on its last legs and, even though it was rewelded prior to the cruise, we were fortunate to recover it all, though badly damaged, on one occasion.

The lightness of this gear means that it suffers badly due to surging if there is a swell running. One deployment ended with a shredded net and the fin hanging on by three rapidly shearing bolts. Records and catch quantity indicate that this damage occurred during recovery. The net was replaced and an "at sea" mend was effected to the fin support brackets to allow further netting. However, these temporary repairs meant that a more cautious approach to inclement weather deployment had to be adopted. Unless new nets are purchased this will become a more and more regular occurrence.

BB

Electronics and Acoustics

RMT monitors

Some problems wee encountered with trying to open the nets. It was thought that the battery packs may have been the cause, and a sledge battery pack was transferred from the *Challenger* when we rendezvoused with her. It was later found that the release gear mechanism was not working properly. This gives the same symptom (net refuses to open after transmitting the FM signal) as when the monitor is misbehaving. Nevertheless, of the three battery packs originally available, one contains several badly leaking cells (#7), one will not charge up beyond 33V (#1), and may be in a similar condition, but the third can be considered reliable for long hauls (#15). The Light Monitor was used for the LHPR and the White Lead monitor for the RMT. After an accident, where the warp parted with the monitor and cross at the top of the A-frame, the White Lead monitor developed several faults and was replaced with the Light monitor for the remaining RMT tows. The Black Lead monitor was not used. Two Mk3 deck units and a waterfall display were used to monitor the RMT. The tows were recorded on an RVS Waverley recorder. The input channel of the latter went on one card, and so the spare was used. However, the paper advance on this card failed after a short time. An IOSDL Mk4 PES Beam Steering unit had been installed, together with the new RVS interconnection panel, which makes using the various options extremely user-friendly.

DW

Moorings

Four mooring recoveries/deployments were scheduled to take place during the cruise. All were to be carried out using the RVS double barrel capstan with the line leading over a wide throated sheave attached to the starboard aft Effer crane.

ADCP Mooring

The new RDI Broadband Acoustic Doppler Current Profiler (Figure 3) was deployed on the Goban Spur in a water depth of 999 m corrected, after an overnight site survey. The deployment position was 49°25.39'N 11°47.51'W. The instruments primary role was to be as a bioacoustic sensor but it also presented an opportunity to determine both instrument and mooring performance as a preliminary to its deployment in the Agulhas current in early 1995.

Deployment commenced at 0843Z 13-04-1994 when the ADCP was lifted overboard on the port rexroth, cut away and allowed to drift astern as the ship increased speed to 1 knot. The mooring line was payed out and stopped off, as required, to insert the back-up buoyancy spheres. Two IOSDL CR200 releases, after having been successfully wire tested, were deployed on a stainless steel rig and the anchor cut away at 0951Z, finally reaching the seabed at 0956Z.

During its deployment period the mooring was monitored by the Argos CLS subsurface mooring monitoring surface to alert the Ship and IOSDL by fax if the mooring inadvertently released prematurely. Onboard monitoring of Argos beacon signals was carried out prior to deployment using a GONIO direction finding system.

The mooring was recovered on the 26th April. Although the acoustics conditions were not perfect, the releases were activated after about twenty minutes of transmission. A combination of 20 knot winds and a large swell 30 degrees off the wind caused difficulties in positioning the ship to grapple the mooring, but on the fourth attempt a slipping hook was clipped into the upper frame of the ADCP and recovery was completed successfully by 1336Z.

OMEX 1 and 2 moorings. (Kiel University)

The OMEX 1 mooring, with a single Benthos release, was interrogated at position 49°24.72'N 11°31.86'W on the 13th April. The German ship *Meteor* had attempted to recover this mooring earlier in the year. They had ranged on it, fired the release code and had then been unable to range on the release again. After waiting 30 minutes they had departed the site. We could not get any reply at all, despite ideal acoustic conditions. As a result of this we were unable to relay the mooring.

The OMEX 2 mooring, with an RT661 and a Benthos release, was recovered on the morning of 15th April at position 49°11.20'N 12°49.18'W. The mooring components and instruments were overhauled and relayed on the 18th April at the same site.

Sediment trap mooring at 48°59'N 16°22'W

The mooring (Figure 4), in 4818 m (u/c) of water, was interrogated at 0812Z on 29-04-1994 and both releases replied with weak signals. The first release was fired but the mooring did not appear to rise. The process was repeated with the second release unit and when this also fired without releasing the mooring there was concern that the releases (2 RVS CR200s) were possibly on their sides. This was confirmed when the ship drifted over the mooring position and the signals suddenly increased in strength, but no bottom separation was observed. Repeated attempts were made to release the mooring before the site was abandoned. The cause of the mooring failure is not known but it must have failed below the buoyancy units. Both releases were switched off prior to departure from the site.

A site was selected 3 nm to the west of the lost mooring to deploy a replacement sediment trap rig (Figure 5), with recovery planned for September 1994 on *Meteor*. The deployment commenced 2 nm downwind of the site at 1055Z with the ship steaming at 1 knot. The upper buoyancy and the current meter were slipped over by hand and allowed to drift astern. Line tension was taken up and the top sediment trap lifted to the block and deployed from the double barrel capstan (DBC). The line was payed out from the DBC and stopped off as required to insert instrumentation. Releases RVS CR2361 and DRA RT661 were clamped to an IOSDL release bar. The RT661 was removed from its case and housed in an IOSDL 20" case, using the motor drive voltage to fire a pyro. (The same configuration as the 1993 SWINDEX moorings). The new batteries supplied by DRA were flat in the unit prepared for use, and the batteries in the second unit were marked "old" so LiSO2 D cells were used. The anchor was lowered and cut away at 1332Z, touching down on the seabed at 1421Z, the CR2361 showing a bottom separation of 42 m on impact. Descent rate was initially 150 $m.min^{-1}$ slowing finally to 60 $m.min^{-1}$ just prior to anchor touch down. CR 2361 timed out at 1452Z, and RT661 was interrogated through the single element of the PES fish by a TT301 to show a range of 5117 metres. The deployed position was 48°58.13'N 16°29.03'W. Water Depth 4808 uncorrected metres.

KG, DW

Conductivity-Temperature-Depth Probe (CTD)

The DRA CTD system deployed during the cruise comprised a Neil Brown MkIIIb CTD (serial number 0028-G2-13044) fitted with an interface to a Chelsea Instruments Mark II chlorophyll fluorometer (serial number SSUF022). Water samples were collected via a 12 pin General Oceanics rosette sampler mounted with six 2.4 l and six 1.7 l Go-Flo water bottles. Six firing positions were used and the bottles were fired in pairs to provide 4.1 l water samples. Each 1.7 l bottle was fitted with a reversing cage containing a digital SIS pressure and temperature device. The IOS Marine Snow Profiler (MSP) was attached to the CTD cage and powered independently. During the cruise, a 10 kHz acoustic pinger was attached to the CTD cage, allowing the CTD and MSP to be lowered to within a few metres of the seabed.

The deck unit was an EG&G Ocean Products Model 1401 deck unit, with the bottle handled through a General Oceanics RMS MkVI deck unit. CTD data were logged by DRA on an IBM-compatible PC using the EG&G Oceansoft package. Raw data were independently logged by the RVS computer system.

On the day of departure RVS supplied a SEATECH 25 cm transmissometer, which was hoped could be used in place of the chlorophyll fluorometer. Initial trials to interface the CTD and the transmissometer were unsuccessful, and a fault was traced to the moulded cable that had been specially constructed to interface with the CTD. Further problems were encountered when trying to match the power requirements of the transmissometer to the power supplied from the CTD. A voltage regulator was constructed by IOS and fitted inside the transmissometer pressure housing. Although this reduced the voltage supplied to acceptable levels, the data stream was not compatible with the interface card and the transmissometer was abandoned in favour of the chlorophyll fluorometer.

AMcD, RR

DRA SeaSoar Surveys

Two surveys of the Goban Spur region (Figures 6 & 7) were carried out using the DRA SeaSoar vehicle fitted with a Chelsea Instruments Aqualink CTD (serial number AQL006) and a Chelsea Instruments Aquatracka chlorophyll fluorometer (serial number 88/699/013).

Data were gathered using the Chelsea Instruments HP data logger and passed to the DRA logging system for calibration and display of real time CTD data. Calibrated values of chlorophyll fluorescence were not available in real time. Raw data were also logged by the RVS computer system. Water samples for salinity analysis were drawn from the non-toxic water supply at times and locations that coincided with the vehicle sampling close to the surface. Samples for chlorophyll analysis were obtained by PML.

The vehicle was first deployed on April 13th at 1336Z at position 49°24.4'N 11°31.6'W. Deployment was completed by 1314Z with 55 m of faired cable paid out. The vehicle was towed along a heading of 252° at a speed of 8 knots. Undulations between the surface and 300 m were achieved. At 131645Z the SeaSoar suffered a signal failure and was recovered with a suspected cable fault. On recovery, the cable termination was checked and found to contain water. The termination was remade and SeaSoar redeployed at 132224Z at position 49°19.2'N 11°55.0'W. The first leg of the survey was completed and course changes made at 140250Z and 140347Z in order to bring the ship onto a heading of 075°.

The ship was stopped at 140938Z to reduce the cable length to 200 m before approaching the continental shelf. This produced short undulations to a depth of 140 m. Water depths remained in excess of 170 m at all times. Turns were made at 141126Z and 141226Z bringing the ship onto a new heading of 255° on the third leg of the survey. At 141420Z the remaining 350 m of cable was deployed.

At 141600Z the vehicle began to respond poorly to the command waveform. Different tow speeds were tried but with no improvement in performance. At 141633Z the vehicle was recovered with a suspected hydraulic leak. The hydraulic unit was inspected and no major leak detected although the bellows were severely compressed suggesting a shortage of oil in the unit. The hydraulic unit was replaced with the new design IOS unit and the vehicle redeployed.

With the same command waveform, the vehicle exhibited a marked change in performance. Climb and dive rates both in excess of 2.4 ms^{-1} were noted. Previous dive rates of 0.5 ms^{-1} had been observed with the original hydraulic unit. This increased speed gave rise to maximum cable tensions in the region of

2500 Kg which were well above the acceptable safety limits. The system gain and waveform were modified in an attempt to reduce cable tensions.

At 142130Z a drifting buoy was sighted in close vicinity to where the ADCP mooring had been deployed. It was, therefore, necessary to remain in close contact with the buoy in case the ADCP mooring had broken free, and so the SeaSoar was recovered and the first survey terminated early.

Between surveys, both the hydraulic units were stripped and checked, The Chelsea Instrument unit was found to have a leak in the inner hydraulic circuit which, although not critical, could impair the performance of the vehicle. The IOS unit was found to contain a high proportion of salt water. Both units were repaired and filled with oil. The Chelsea Instruments units was fitted into the vehicle in readiness for the second survey. A new cable termination was made to replace the emergency termination made during the first survey.

SeaSoar was deployed for the second survey on 4th May at 0805Z in position 49°16.53'N 11°30.05'W. The vehicle was towed on a heading of 254° at a speed of 8 knots. Because of high sea states, the course alteration onto the second survey leg consisted of a series of wide turns through the swell. These were completed at 041513Z when a new heading of 075° was achieved. At 042120Z the cable length was shortened to 200 m approaching the continental shelf. Course changes were made to 000° at 042336Z and to 255° at 050048Z.

At 050124Z the Master of the vessel requested that SeaSoar be recovered due to worsening weather conditions. SeaSoar was finally recovered in working condition at 050142Z.

AMcD, RR

Computing

Data from both scientific and navigation sources were logged throughout the cruise, using the RVS ABC data logging system. In excess of 400 megabytes of raw data were collected, some 250 megabytes being generated by the hull mounted ADCP.

Some data editing and processing was carried out during the cruise. Data from the DRA CTD unit were processed using calibration constants provided by the DRA staff. A logarithmic scale fluorometer was used for the majority of the CTD profiles; but as this instrument normally is used in conjunction with the DRA SeaSoar, there is some uncertainty as to the applicability of the antilog coefficients provided. Raw surface sampling data (thermosalinograph, fluorometer, transmissometer, bridge mounted PAR light meters) were kept under review, and despiked when necessary. The thermosalinograph data were processed on board using old calibration values to provide 'rough' salinity data. Recalibration using seawater samples taken during the course of the cruise will be required to give accurate salinity data.

A processed navigation file was generated using the Trimble GPS receiver as primary position fix source, with relative motion data from the ship's gyro and the Chernikeeff ship's log. The Trimble GPS receiver was configured to provide 3 vehicle fixes only, with masks for PDOP and elevation set to 7 and 15 degrees, respectively. GPS coverage throughout the cruise was in excess of 98%. It was necessary to recalibrate the Chernikeeff ship's log during the cruise to compensate for modifications made to the system whilst at RVS Barry. The recalibration was carried out in the open ocean using position data from the Trimble GPS receiver. It is estimated that the new calibration is accurate to within 0.5 knots for the full range of fore-aft water velocities.

Depth data from the SIMRAD EA-500 (10 kHz) echo sounder were logged, despiked and processed. A sub-sampled version of the processed data set will be forwarded to GEBCO.

RP

SCIENTIFIC INVESTIGATIONS

Acoustic Doppler Current Profilers

Shipboard ADCP

The R.D. Instruments 150 kHz shipboard ADCP was set up to profile over 64 bins of length 8 metres giving a total maximum depth range of 512 metres (the standard deep-water set-up for IOSDL cruises). The sampling period was 2 minutes which, with bottom tracking mode off, allowed for approximately 84 pings per ensemble giving a standard deviation of 1.4 $cm.sec^{-1}$ (RDI 1989).

The ADCP hardware and PC located in the plot gave no problems throughout the cruise although some video software installed prior to the cruise, to allow the data acquisition software (DAS) display to be viewed on a TV screen in the main laboratory, caused the software clock on the PC to lose nearly 3 minutes per day. Fortunately, however, this drift was linear and so corrections to the ADCP time were applied to the data with confidence. The quality of data throughout the cruise was extremely good, sometimes even at speeds of 10 knots, with profiling extending to over 350 metres most of the time.

Calibrations for misalignment angle (phi) and amplitude scaling factor (A) were calculated after making a zigzag course of 6 legs each of 20 minutes duration as described by Pollard and Read (1989). However, this course, being in only 70 metres of water, necessitated a change in the ADCP sampling parameters in order to obtain a reasonable amount of data for the calibration. Bottom tracking mode was used so that ship's speed derived from GPS could be compared to that measured by the instrument, and the bin length was set to 4 m enabling 20 bins of data to be utilised. Calibration values obtained from these data were 0.993 for A and 0.3 for phi.

Processing of the ADCP data was achieved using the IOSDL PEXEC processing software. A set of command files which have been developed and streamlined over the last few years were used to carry out batch processing of the data in 4 major steps. These are:-

1. Conversion of the data from RVS data format to Pstar format.

2. Correction for the time drift of the ADCP clock against GMT.

3. Application of the calibration constants to the velocity data.

4. Merging of smoothed navigation data and calculation of absolute current velocity by subtracting ship's velocity.

Returned echo amplitude from the ADCP is related to the volume of scatterers (primarily zooplankton due to the 1 cm wavelength of 150 kHz sound in water) illuminated by the ADCP in a particular depth cell, as well as being inversely proportional to the range from the ADCP. A crude way of compensating for the range is to take the mean echo intensity for a depth cell and calculate the deviations from the mean over the period of, for example, one day. Contour plots of this relative backscatter were generated throughout the cruise and these were clearly dominated by diel vertical migration patterns.

BroadBand ADCPs

Two BroadBand ADCPs recently acquired by IOSDL were used during the cruise. The two units are self-contained ADCPs with 1000 m pressure cases and beam angles of 20 degrees. These state of the art Doppler Profilers from R.D. Instruments utilise a much more advanced technique for measuring the Doppler shift, which has resulted in a marked improvement in the standard deviation of a single ping measurement (RDI 1993). A major advantage of this is the saving of battery power enabling longer duration deployments or, in other situations, greater time resolution.

One instrument undertook its maiden deployment in the form of a profiling experiment where it was lowered on a hydrographic wire to 900 m and back to the surface at a rate of 30 metres per minute. The set-up of the instrument comprised eight 8-metre bins and 8-second ensembles consisting of 7 pings (giving a standard deviation of 0.75 $cm.sec^{-1}$). The lowing rate of 0.5 $m.sec^{-1}$ effectively allowed two ensembles to be taken whilst passing through 8 metres of water (1 bin length). Self-contained ADCPs have been used in this manner to profile over the full ocean depth (6000 m) by Fischer and Visbeck (1993) with encouraging results and with the improved accuracy of measurement of the BroadBand instrument it is hoped that full ocean depth profiling will become a reliable source of valuable current data.

The second unit was used in a upward looking configuration on a mooring which incorporated an Aanderaa current meter 2 metres below the ADCP for comparison current data and for pressure. The ADCP (at 350 m depth) was set up with 45 bins of 8 metre length, that is to profile over the entire water column above the ADCP, and 5 minute ensembles of 25 ping (S.D. 0.4 $cm.sec^{-1}$). With 20 degree beam angles the closest to the surface that the instrument can theoretically profile is the distance to the surface * cos(20) or 329 m. However, on examination of the data after recovery, the top 7 bins of data were discarded because of bad data caused by surface reflections leaving the last bin of good data centred at 40 m depth. The remaining data were of very high quality with 'percent good' at 100% for all but the last bin where it dropped into the nineties. Relative amplitude data clearly indicating diel vertical migration correlated well with the vertical velocity information, which indicated downward motion of up to 2.5 $cm.sec^{-1}$ compared to upwards motion of only up to 1.5 $cm.sec^{-1}$.

FISCHER, J. & VISBECK, M. 1993. Deep velocity profiling with self-contained ADCPs. *Journal of Atmospheric and Oceanic Technology*, **10**, 764-773.

POLLARD, R.T. & READ, J. 1989. A method of calibrating shipmounted acoustic doppler profilers and the limitations of gyro compasses. *Journal of Atmospheric and Oceanic Technology*, **6**, 859-865.

RDI. 1989. Acoustic Doppler Current Profilers Principles of Operation: A Practical Primer. RD Instruments San Diego, CA. 36pp

RDI. 1993. Direct-Reading Broadband Acoustic Doppler Current Profiler. Technical Manual. RD Instruments, San Diego, CA.

NC

CTD profiles

The first cast was scheduled for 12th April at 1900Z, when both the CTD and MSP would be tested. During the cast it was noted that the pressure readings on the CTD exceeded the wire out by a factor of two. This was traced to an incorrect calibration file, which was subsequently replaced. All water bottles were fired at a single depth to cross calibrate the pressure and temperature devices; with one faulty pressure device being replaced. The chlorophyll fluorometer did not operate during this cast, or on several subsequent casts. The fault was traced to the high start-up current required by the unit; insufficient power being supplied from the CTD interface. The problem was solved by replacing the fluorometer with a Chelsea Instruments MkIII chlorophyll fluorometer (serial number 88/699/010) designed for use on the SeaSoar.

A total of 33 CTD casts were carried out during the cruise. Only one cast had to be abandoned when the winch cable caught on the rosette sampler, pulling a signal cable connector apart. Water samples were obtained on 24 of the casts. These were required for PML pigment analyses. The Marine Snow Profiler (MSP) operated during 16 of the casts, most of which extended close to the seabed.

Water samples were obtained by DRA for post-cruise salinity calibrations and additional samples were taken from the non-toxic water supply for cross calibration with the thermosalinograph. Further samples were taken by PML in order to calibrate the chlorophyll fluorometer. Absolute values of chlorophyll concentration were not available from the fluorometer on board as this instrument had not been calibrated with the deck unit and Oceansoft package. This will be done post-cruise.

AMcD, RR

SeaSoar Surveys

For the reasons explained above, neither of the SeaSoar surveys were completed according to plan. However, the area covered by first survey (Figure 6) was approximately the same as that of the second (Figure 7).

The two surveys indicated that a significant change in water structure occurred during the intervening period between them. During the first survey temperatures and salinities were generally well mixed, with very low chlorophyll levels. The second survey indicated an increase in water temperature of 0.5°C in the upper 50 m of the water column, and a corresponding increase in chlorophyll concentration. Calibrated chlorophyll concentrations were not available from the second survey prior to the completion of the cruise.

AMcD, RR

Midwater Trawling : RMT1+8M Programme

A total of 68 successful multinet (RMT1+8M) tows were made at or near sites **B**, **C**, **D**, **F** and **G**. These sites ranged from the shelf to the slope and had water depths of approximately 170 m (**B**), 350 m (**C**), 650 m (**D**), 1100 m (**F**) and 1700 m (**G**). Paired day and night tows were made at all sites except **B**, where only night tows were possible. 100 m depth horizons were routinely fished (50 m bands at **B**) with the addition of some near-bottom hauls at **D** and **F**.

The catches at the deep station (**G**) were notable particularly for the very large numbers of 2 species of pteropod taken by day between 100 m and 300 m and from the surface to 200 m by night. There were relatively few fish other than *Cyclothone*, and *Xenodermichthys* was most regularly taken. This latter species also occurred at **D** and **F** where the individuals were much smaller than at the deepest position. At **B**, **C** and **D** *Maurolicus* was taken, but this species was not present at the two deeper sites. Hatchet fish, especially *Argyropelecus aculeatus* and *A. hemigymnus*, were present at all sites except **B**. Myctophids were similarly present at all sites except **B** and *Benthosema* was particularly abundant in the surface layer at night at position **D**.

Gelatinous organisms were abundant in many of the samples. In addition to the pteropods, salps and siphonophores dominated particular hauls and chaetognaths were a major component of some samples. The pseudo-thecosome *Cymbulia* was also frequently present, albeit in small numbers. Squid were relatively uncommon and represented only by *Teuthowenia megalops, Gonatus* and a few *Histioteuthis.* Two large *T. megalops* were taken at the deep water positions and a mass of squid eggs, perhaps of the same species, in one RMT1 sample.

Decapod crustaceans were not major components of most catches. Some large *Acanthephyra* and *Sergia* were present at the deeper stations, but only a very few *Gennadas* and *Systellaspis* were taken. Pasiphaeids were the commonest group of decapods in many of the samples. Euphausiids were not common, except in one or two of the upper slope samples. Mysids, especially *Lophogaster* sp., were dominant at sites **B** and **C** and *Eucopia* in the deep samples at sites **G**.

A feature of the shallow sites (**B** and **C**) was that the RMT1 samples contained very large numbers of copepods and larvaceans; at **B** the RMT1 samples were much greater in volume than were the equivalent RMT8 samples.

Problems experienced with the RMT system included poor battery packs (improved after obtaining an additional good pack from *Challenger*) and release gear problems. The latter were repaired on board and the sampling continued relatively uninterrupted. The nets were very vulnerable to chafing, particularly the top RMT8 (net 3) by the RMT1 buckets. Almost continuous running repairs were necessary to keep the damage in check. The near-bottom echo-sounder worked well and gave a bottom echo first visible at about 100 m off the bottom. The near-bottom catches showed some indication of increased biomass, particularly of *Eucopia* at site **F**.

PJH

Vision and Bioluminescence

The eyes of a number of decapod and mysid crustaceans were fixed for subsequent structural studies. Mysid eyes have a refractive optical system similar to that of euphausiids. They differ from the latter in that many species have elaborate reflective tapeta, but their respective ecological niches have substantial overlap, particularly in the upper layers of the ocean.

The ocular light organs of the squid *Teuthowenia megalops* were fixed for electron microscopy. The presence of specimens from 10-180 mm dorsal mantle length in the catches has provided material to investigate the development of these structures.

The cruise provided the first opportunity for sea trials of an ISIT video camera to record the bioluminescent responses of zooplankton and micronekton, but were restricted by the condition and variety of the multinet catches. Few animals were alive and active on recovery of the nets and trials had to be limited to the copepod *Euaugaptilus magnus*. Nevertheless recordings of the responses of more than 20 animals were obtained, allowing the use of different combinations of lighting and lenses. The system gives the best results for these small animals at full aperture with a 50 mm lens and diffuse incident lighting. Their secretory luminescence persists in the water as discrete spots of light for several seconds. The recordings demonstrate how the secretions are rapidly propelled away by the escape swimming of the animal and indicate the potential of the system for other species.

PJH

Phytoplankton productivity and nutrient concentrations

Experiments to estimate the rates of phytoplankton primary productivity, new and regenerated production (relative assimilation rates of nitrate and ammonium), and phosphate uptake were undertaken at

12 stations (Table 2). Rates of primary production and phosphate uptake were determined through the incorporation of radioisotopes ^{14}C and ^{33}P, nitrogen assimilation was estimated using the stable isotope ^{15}N.

Water was collected pre-dawn from a series of depths between 0 and 50 m using 30 l 'Go-Flo' bottles. Water from each depth was then distributed into:-

^{14}C - 3 x 125 ml polycarbonate bottles + 1 x dark 125 ml polycarbonate bottle,

^{33}P - 3 x 125 ml polycarbonate bottles + 1 x dark 125 ml polycarbonate bottle,

$^{15}NO3$ - 2 x 2.4 l polycarbonate bottles,

$^{15}NH4$ - 2 x 2.4 l polycarbonate bottles,

prior to inoculation with 1 μCi [^{14}C] sodium bicarbonate, 1 μCi [^{33}P] sodium orthophosphate, 0.08 μmol/l [^{15}N] sodium nitrate and 0.08 μmol/l [^{15}N] ammonium chloride respectively. All bottles were then incubated during the dawn to dusk period using either an *in situ* free floating rig or an on deck incubator which consisted of a series of six plastic boxes with neutral density filters to give 100, 60, 30, 16, 3 and 0.3% of ambient irradiance, and maintained at surface temperatures by flow through of the ships 'non-toxic' seawater supply. At dusk all bottles were transferred to a dark incubator overnight. Incubations were terminated the following morning by filtration. Primary production and phosphate uptake rates were size fractionated into greater and less than 2.0 μm classes.

In support of these data samples from each depth were also collected for the determination of total chlorophyll *a* concentration (spectrophotometer), size-fractionated chlorophyll *a* concentration (fluorometer), on board nutrient analysis (nitrate, nitrite, ammonium, silicate and phosphate). From each station 50 ml of seawater was collected at 10 m and 20 m depths and preserved in Lugol's iodine solution for phytoplankton species identification.

In parallel with SeaSoar surveys of the study area, at the beginning and the end of the cruise, the autoanalyser was used in continuous mode for determination of surface nutrient concentrations from the non-toxic supply. Samples were collected on a regular basis for chlorophyll *a* analysis, in order to calibrate the ships flow-through fluorometer, CTD and SeaSoar sensors.

Underway surface nutrient analysis:

13/04/94, 2030 to 15/04/94, 0600.

04/05/94, 1330 to 05/05/94, 0500.

Sample and data analysis is expected to be complete within four months, and will be transferred to the NERC, B.O.D.C.

AR, KD

Microzooplankton Herbivory and Community Structure

The overall objective of this research is to test the hypothesis that microheterotrophic activity is greater at the ocean margin (due to locally enhanced primary production from nutrient input) than in adjacent ocean and shelf waters.

Specifically the aims were to:

1) Quantify the concentration and species composition of microzooplankton (phagotrophic organisms <200 μm in length) in the surface mixed layer of the ocean margin.

2) Determine microzooplankton standing stocks.

3) Quantify herbivorous interactions between microzooplankton and phytoplankton in the ocean margin surface waters.

Microzooplankton Biomass Studies

Water samples were collected using 4.1 litre bottles from CTD casts (Table 3) and fixed as follows:

i) 1% acid Lugol's iodine for the determination of species composition and total microzooplankton biomass.

ii) 2% hexamine buffered formaldehyde for identification and enumeration of autotrophic microzooplankton.

iii) 5% Bouin's solution for the subsequent determination of ciliate taxonomy by silver protargol staining.

iv) 0.3% glutaraldehyde for enumeration of autotrophic and heterotrophic nanoflagellates (2-20 μm). Cells were stained using 5mg/ml of DAPI and Proflavin, concentrated onto 0.4 μm polycarbonate filters, mounted on glass slides and frozen.

The above samples will be analysed by inverted/fluorescent microscopy and image analysis.

For the qualitative assessment of the larger and less delicate of the microzooplankton species vertical Apstein net hauls were carried out in the upper 50 m or 75 m of the water column (Table 3). The Apstein was fitted with a 20 μm mesh net. For each sample approximately 200 ml was fixed in 1% acid Lugol's and 50 ml was used for immediate live observation using an inverted microscope fitted with Nomarski Interference Contrast and fluorescence. Photographic and video images were taken of the live cells, which included tintinnids, ciliates, dinoflagellates and other phytoplankton cells, and will be used in future identification work. Phytoplankton cells dominated the net hauls throughout and included several species of diatoms such as *Rhizosolenia, Pterosperma, Chaetoceros, Navicula, Phaeocystis* and *Thalassiosiracea.* Autotrophic dinoflagellates were also abundant including *Ceratium furca, C. tripos, C. longipes, C. pentagonum, C. fusus, Gymnodinium heterostriatum, G. abbreviatum, Dinophysis acuminata, D. micronata, D. ovum, Oxytoxum* *scolopax, O. milneri, Gyrodinium aureolum, Gonyaulax sp., Amphidoma caudata, Prorocentrum* and *Ptychodiscus noctiluca.* Heterotrophic protozoa were less common, but those identified include the less fragile tintinnids *Codonellopsis contracta, Eutintinnus tubulosus, Salpingella gracilis, Dictyocysta speciosa* and *D. reticulata.* Aloricate ciliates are very fragile and few species survive the meshes of the net, but *Peritromus sp.* and *Leegaardiella sp.* were identified. Heterotrophic dinoflagellates were not common and included *Protoperidinium spp., Cochlodinium sp., Corythodinium sp., Podolampas sp.* and *Pronoctiluca sp., Foraminifera sp.*. Radiolarian species were relatively common in the net hauls.

Additionally 2 litres of water was collected at intervals across the shelf break from the upper 300 m of the water column and filtered for subsequent analysis of pigment concentration by HPLC. This work will be carried out by Dr. R. Barlow at the Plymouth Marine Laboratory.

Microzooplankton Grazing Experiments

Microprotozoan grazing experiments were carried out using the dilution technique of Landry & Hassett (1982). A total of 11 experiments were conducted in conjunction with primary production experiments (Table 3). 60 litres of water were collected prior to dawn using 30 l 'Go-Flo' bottles from a depth of 10 m and pre-screened through a 200 µm mesh net. Dilutions were made up in 2 litre polycarbonate bottles and incubated in a Gallenkamp incubator for a 24 hour period. Samples were taken at the beginning and end of the experiment for chlorophyll concentration (stored in liquid nitrogen) and species composition and enumeration (1% Lugol's and 0.3% glutaraldehyde).

LANDRY, M.R. & HASSETT, R.P. 1982. Estimating the grazing impact of marine microzooplankton. *Marine Biology*, **67**, 283-288.

CS

Surface properties and Remote sensing

The SeaSoar surveys clearly provided the best characterisation of the spatial distribution of a number of physical and biological variables. As this can not be carried out while other overside activities are in progress, continuous monitoring of the surface water of these variables provides valuable insights. Underway measurements were made on a variety of variables to examine both spatial and temporal variability as the spring bloom developed (see Figure 8).

Satellite images were kindly provided in near real time by the NERC Computer Services, Image Analysis Unit, University of Plymouth (Steve Groom). It was hoped that these could guide our ship operations but in the event, although some five images were transmitted during the cruise of the general area, cloud cover was a serious impediment to their effective use. In only two of these were there good data at the ship's position.

RSL

Particle Flux Studies

Particle flux studies are being carried out at a variety of sites across the continental slope and onto the Porcupine Abyssal plain. The objective of these studies is to improve our understanding of the cross slope advective fluxes which are thought to dominate the slope environment and the vertical fluxes of the open ocean environment. Sediment trap moorings have been situated on the Goban Spur since June 1993 and in the vicinity of the Porcupine Abyssal Plain intermittently since the start of the JGOFS programme in 1989.

During CD85 it was hoped to recover and redeploy 2 moorings; and that a further one, which was not located in January, could be found and recovered.

Recoveries

Porcupine Abyssal Plain (Station **H**): This mooring had been in place since September 1992 with 3 $0.5m^2$ Parflux sediment traps, 2 current meters and one marine snow camera system. The acoustic command unit responded to surface signals but unfortunately the mooring would not lift off the seabed, as noted above. Either there had been a break in the mooring line below the bottom buoyancy, or a catastrophic failure of both buoyancy clusters, although the latter seems unlikely. This was a severe blow to the particle flux programme with the loss of a full year of data. Further the loss of capital equipment will severely impair future research in this field.

Goban Spur: The shallowest of the three moorings (OMEX 1) originally deployed in this area was once again not located and it was assumed to have been damaged or accidentally recovered by fishing activity in the region. The OMEX 2 mooring was successfully recovered giving indications of along slope particle transport. The current meter data record currents following the bottom contours. Material collected in the sediment traps shows clear seasonality in flux as well as a number of short sedimentation events during winter (<10 day resolution of the sample collection). These may be related to storm events leading to deeper mixing and particle export.

Deployments

Porcupine Abyssal Plain: A similar mooring to the one lost was deployed close to station **H** although without a marine snow camera system. The trap schedule is given in Table 4, and it is expected that it will be recovered in September 1994 during a cruise of the German research vessel *Meteor.*

Goban Spur: OMEX 2 mooring was successfully deployed with an expected recovery time of September 1994.

RSL, AA

Particulate samples

Samples were taken from the upper 150 to 400 m of the water column at a number of stations and filtered for the measurement of the following parameters: Dry weight, particulate organic carbon and nitrogen, chlorophyll *a* and particulate silicate. It was possible to sample the same positions repeatedly during the four week cruise, in order to follow progress of the spring bloom in the region. A list of stations sampled is included below:

Station:	Depth of sampling:
53304	0 - 400m
53305	0 - 400m
53307	0 - 400m
53308	0 - 400m
53309	0 - 200m
53312	0 - 400m
53314	0 - 150m
53315	0 - 200m
53317	0 - 200m
53318	0 - 400m
53323	0 - 200m
53325	0 - 150m
53328	0 - 200m

RSL, AA, PL

Marine snow particles

Distribution

Marine Snow aggregates are inanimate particles which are thought to be the principal vehicles by which material sinks through the water column. They are loosely defined as particles larger than 0.5 mm diameter. They are sometimes fragile and, as such, their distribution is best examined using *in situ* photographic techniques. The Marine Snow Profiler is one such instrument which is attached to the CTD which then provides the appropriate physical and biological profiles to merge with the marine snow distribution data. During CD85 the film (35mm XP2 or TMax) was developed on board using a continuous tank system (Brays film processor) providing images within only a few hours of the deployment. The images were subsequently examined using a Kontron image analyser to provide information on the size distribution, abundance and volume concentration of marine snow throughout the water column. During the cruise 17 deployments of the profiler were made (Table 5), all of which provided high quality information. However, as the phytoplankton bloom had not developed until right at the end of the cruise, the concentration of marine snow was at all times low. Preliminary results demonstrate that, in spite of the low abundance of marine snow the sub-surface peak, which has been a characteristic of periods of higher abundance, was once again in evidence.

Experimental work

It was hoped to collect marine snow particles at specific depths in the water column based on the distributions determined using the marine snow profiler. These would then be used for a variety of experimental and analytical purposes. In spite of 24 largely successful deployments of the Marine Snow Catcher (Table 6), the abundance of the aggregates was so low that there was only sufficient material for descriptive characterisation and some basic chemical and gravimetric analyses. The snow appeared to be dominated by the smaller size categories and displayed little or no autofluorescence. Artificial marine snow was produced on roll tanks to examine the dynamics of snow degradation but the aggregates thus produced were of a very loose structure and disintegrated in very slight turbulence.

A number of dominant mesozooplankton were collected in net tows and faecal material collected. These will be used to ascribe faecal pellets collected in the sediment traps to particular groups of organisms in the water column.

RSL, AA, PL

GEAR ABBREVIATIONS IN STATION LIST

ADCP(M)	Moored Acoustic Doppler Current Profiler.
ADCP(V)	Acoustic Doppler Current Profiler (Vertical Profile).
APSTEIN	40 cm diameter closing plankton net with 20 um mesh.
CM	Current Meter.
CTD	Conductivity-Temperature-Depth Probe.
LHPR	PML Longhurst-Hardy Sampler.
MS	Rossette Multisampler (Water Bottle).
MSC	Marine Snow Catcher (100 l Clear Water Bottle).
MSP	Marine Snow Profiler; Camera System With Fresnel Lens.
N113	1 m^2 Modified Indian Ocean Standard Ring Net (mesh size 0.33mm)
PROD	Primary Productivity Experiment.
RMT1+8M	Rectangular Midwater Trawl, having 3 pairs of nets with nominal mouth openings of 1 m^2 (RMT1, mesh size 0.33 mm) and 8 m^2 (RMT8, mesh size 4.5 mm).
SEASOAR	SeaSoar Towed Undulator.
SED TRAP	Sediment Trap Mooring
UFL	Underwater Fluorometer (Chelsea Instruments).
WB30	30 l Water Bottle.
WP2	Working Party 2 Net.

STN.	DATE 1994	POSITION LAT.	LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53301	13/ 4	49 25.4N	11 47.5W	ADCP(M)	350- 350	0950-	Moored ADCP	999
# 1								
53302	13/ 4	49 25.1N	11 30.2W	SEASOAR	0- 300	1400-1800	Signal failure; SeaSoar recovered	
# 1		49 20.5N	11 59.5W					
53302	13/ 4	49 19.1N	11 55.2W	SEASOAR	0- 300	2224-1633	Hydraulics failure; SeaSoar recovered	
# 2	14/ 4	49 20.7N	11 49.6W					
53302	14/ 4	49 20.5N	11 53.3W	SEASOAR	0- 300	1830-2223	Survey abandoned	
# 3		49 18.6N	12 11.0W					
53303	15/ 4	49 16.4N	12 14.1W	CTD	0-1003	0025-0130	Test dip for Marine Snow Profiler.	
# 1		49 16.1N	12 13.7W	MSC		Night		
53304	15/ 4	49 11.3N	12 48.2W	SED TRAP	0- 0	0915-1045	OMEX 2 mooring recovered. Station 'G'	
# 1		49 12.1N	12 48.7W	CM				
53304	15/ 4	49 8.7N	12 47.4W	RMT1M/1	600- 705	1343-1508	Flow est. Problems with closing nets	1400
# 2		49 12.2N	12 48.1W	RMT8M/1		Day	Flow Dist. 5.284 km.	
53304	15/ 4	49 12.2N	12 48.1W	RMT1M/2	700- 810	1508-1614	Flow est. Problems with closing nets	1450
# 3		49 15.1N	12 49.7W	RMT8M/2		Day	Flow Dist. 4.450 km.	
53304	15/ 4	49 15.1N	12 49.7W	RMT1M/3	810- 900	1614-1718	Flow est. Problems with closing nets	1450
# 4		49 17.8N	12 51.4W	RMT8M/3		Day	Flow Dist. 5.080 km.	
53304	15/ 4	49 6.9N	12 46.3W	APSTEIN	0- 75	2045-2055	Vertical haul.	1504
# 5		49 7.2N	12 46.0W			Dusk		
53304	15/ 4	49 14.3N	12 48.6W	RMT1M/1	10- 100	2342-0042		
# 6	16/ 4	49 16.8N	12 49.2W	RMT8M/1		Night	Flow Dist. 4.540 km.	

STN.	DATE 1994	POSITION LAT.	LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53304 # 7	16/ 4	49 16.8N 49 19.9N	12 49.2W 12 49.8W	RMT1M/2 RMT8M/2	100- 200	0042-0142 Night	Flow Dist. 5.080 km.	
53304 # 8	16/ 4	49 19.9N 49 22.8N	12 49.8W 12 50.2W	RMT1M/3 RMT8M/3	200- 297	0142-0242 Night	Flow Dist. 4.900 km.	
53304 # 9	16/ 4	49 23.9N 49 24.2N	12 49.3W 12 48.1W	WB30 PROD	0- 50	0415-0540	WB@50,40,30,20,15,10,5m.	
53304 #10	16/ 4	49 24.4N 49 24.5N	12 47.7W 12 47.6W	CTD MS	0- 50	0604-0610 Dawn	WB@0,10,20,30,40,50m.	
53304 #11	16/ 4	49 25.1N 49 25.5N	12 46.8W 12 46.5W	CTD MS MSP	0-1300	0650-0750 Day	WB@75,100m	
53304 #12	16/ 4	49 23.3N 49 20.6N	12 48.3W 12 47.8W	RMT1M/1 RMT8M/1	900-1000	0926-1026 Day	Flow Dist. 4.090 km.	1383
53304 #13	16/ 4	49 20.6N 49 14.7N	12 47.8W 12 49.0W	RMT1M/2 RMT8M/2	450-1100	1026-1238 Day	Failed to close. Catch discarded.	1358
53304 #14	16/ 4	49 12.5N 49 12.4N	12 49.3W 12 49.2W	WP2	0- 300	1402-1422 Day	Vertical haul.	
53304 #15	16/ 4	49 12.5N 49 12.4N	12 49.1W 12 49.1W	WP2	0- 300	1432-1528 Day	Vertical haul.	
53304 #16	16/ 4	49 12.9N 49 15.7N	12 49.1W 12 50.0W	RMT1M/1 RMT8M/1	10- 100	1554-1650 Day	Flow Dist. 4.810 km.	1406
53304 #17	16/ 4	49 15.7N 49 17.7N	12 50.0W 12 50.5W	RMT1M/2 RMT8M/2	100- 200	1650-1735 Day	3/4 hr tow. Flow Dist. 3.248 km.	1429

STN.	DATE 1994	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53304	16/ 4	49 17.7N	12 50.5W	RMT1M/3	200- 300	1735-1835		1460
#18		49 20.4N	12 51.1W	RMT8M/3		Day	Flow Dist. 4.225 km.	
53304	16/ 4	49 21.5N	12 51.3W	APSTEIN	0- 50	1908-1930	Vertical haul.	
#19		49 21.6N	12 51.4W			Dusk		
53304	16/ 4	49 20.8N	12 51.9W	RMT1M/1	295- 400	2044-2144		1542
#20		49 18.2N	12 52.5W	RMT8M/1		Night	Flow Dist. 3.865 km.	
53304	16/ 4	49 18.2N	12 52.5W	RMT1M/2	400- 500	2144-2244		1552
#21		49 15.8N	12 53.0W	RMT8M/2		Night	Flow Dist. 4.000 km.	
53304	16/ 4	49 15.8N	12 53.0W	RMT1M/3	0- 595	2244-0043	Net failed to close. Catch discarded.	1583
#22	17/ 4	49 11.2N	12 54.1W	RMT8M/3		Night		
53304	17/ 4	49 8.3N	12 55.3W	RMT1M/1	490- 600	0200-0300		
#23		49 5.8N	12 56.0W	RMT8M/1		Night	Flow Dist. 3.550 km.	
53304	17/ 4	49 5.8N	12 56.0W	RMT1M/2	600- 695	0300-0400		
#24		49 3.3N	12 56.5W	RMT8M/2		Night	Flow Dist. 3.550 km.	
53304	17/ 4	49 3.3N	12 56.5W	RMT1M/3	690- 800	0400-0500		2292
#25		49 1.1N	12 56.9W	RMT8M/3		Night	Flow Dist. 3.640 km.	
53304	17/ 4	49 5.7N	12 50.8W	RMT1M/1	300- 400	0700-0800		1760
#26		49 8.2N	12 52.0W	RMT8M/1		Day	Flow Dist. 4.135 km.	
53304	17/ 4	49 8.2N	12 52.0W	RMT1M/2	400- 500	0800-0900		1675
#27		49 10.7N	12 53.6W	RMT8M/2		Day	Flow Dist. 4.225 km.	
53304	17/ 4	49 10.7N	12 53.6W	RMT1M/3	500- 605	0900-1000		1720
#28		49 13.2N	12 55.1W	RMT8M/3		Day	Flow Dist. 4.405 km.	

STN.	DATE 1994	POSITION LAT.	LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53304	17/ 4	49 18.0N	12 57.4W	RMT1M/1	980-1110	1320-1420		1875
#29		49 20.5N	12 58.5W	RMT8M/1		Day	Flow Dist. 4.045 km.	
53304	17/ 4	49 20.5N	12 58.5W	RMT1M/2	1110-1200	1420-1532	Net difficult to close.	1700
#30		49 23.5N	12 59.8W	RMT8M/2		Day	Flow Dist. 5.385 km.	
53304	17/ 4	49 23.5N	12 59.8W	RMT1M/3	1200-1305	1532-1633		1625
#31		49 26.0N	13 0.8W	RMT8M/3		Day	Flow Dist. 3.775 km.	
53304	17/ 4	49 19.5N	12 50.6W	MSC	50- 50	1930-		
#32								
53304	17/ 4	49 19.6N	12 50.5W	MSC	50- 50	1942-		
#33								
53304	17/ 4	49 17.9N	12 49.5W	RMT1M/1	790- 900	2042-2142		1376
#34		49 15.4N	12 48.5W	RMT8M/1		Night	Flow Dist. 3.550 km.	
53304	17/ 4	49 15.4N	12 48.5W	RMT1M/2	890-1005	2142-2242		1358
#35		49 13.1N	12 47.8W	RMT8M/2		Night	Flow Dist. 3.550 km.	
53304	17/ 4	49 13.1N	12 47.8W	RMT1M/3	1005-1100	2242-2342		1382
#36		49 10.5N	12 47.4W	RMT8M/3		Night	Flow Dist. 3.910 km.	
53304	18/ 4	49 8.2N	12 46.8W	WP2	0- 50	0059-0108	Vertical haul.	
#37		49 8.2N	12 46.8W			Night		
53304	18/ 4	49 8.2N	12 46.8W	WP2	0- 50	0110-0120	Vertical haul.	
#38		49 8.2N	12 46.8W			Night		
53304	18/ 4	49 8.4N	12 47.0W	WB30	0- 50	0200-	WB@50,20,7.5m	
#39						Night		

STN.	DATE 1994	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53304 #40	18/ 4	49 8.5N	12 47.1W	WB30	0- 40	0215- Night	WB@40,15,5m	
53304 #41	18/ 4	49 8.5N	12 47.1W	WB30	0- 30	0230- Night	WB@30,10,2.5m	
53304 #42	18/ 4	49 8.5N	12 47.2W	WB30	10- 10	0240- Night	WB@10m	
53304 #43	18/ 4	49 8.5N	12 47.1W	WB30	10- 10	0245- Night	WB@10m	
53304 #44	18/ 4	49 8.5N	12 47.2W	MSC	50- 50	0300- Night		
53304 #45	18/ 4	49 8.6N	12 47.2W	MSC	50- 50	0330- Night		
53304 #46	18/ 4	49 8.7N 49 8.7N	12 47.2W 12 47.2W	CTD MS	0- 50	0334-0346 Night	WB@0,10,20,30,40,50m.	
53304 #47	18/ 4	49 10.4N 49 7.4N	12 45.8W 12 49.0W	PROD	0- 50	0530-1931	Times of deployment of in situ rig.	
53304 #48	18/ 4	49 9.9N 49 9.9N	12 46.0W 12 46.2W	CTD MS MSP	0- 200	0555-0612 Dawn	WB@200,175,150,120,100,75m.	
53304 #49	18/ 4	49 9.9N 49 10.4N	12 46.2W 12 46.5W	WB30	0- 400	0619-0721 Dawn	WB@5,10,30,50,80,100,200,400m (5 dips)	
53304 #50	18/ 4	49 11.2N	12 49.2W	SED TRAP CM	300-1450	1602-	OMEX2 mooring. Sed. traps @620 & 1070m.	1450

STN.	DATE 1994	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53304	18/ 4	49 5.7N	12 50.8W	N113	0- 500	1743-1830	Vertical haul.	
#51		49 5.9N	12 51.1W			Day		
53304	18/ 4	49 7.7N	12 49.5W	APSTEIN	0- 75	2012-2018	Vertical haul.	
#52		49 7.7N	12 49.5W			Dusk		
53304	18/ 4	49 7.9N	12 49.5W	CTD	0-1605	2120-2233	WB@1200,600,100,75m.	1630
#53		49 8.0N	12 49.2W	MS		Night		
				MSP				
53304	18/ 4	49 8.0N	12 49.2W	CTD	0- 100	2307-2316	WB@50,40,30,20,10,0m.	
#54		49 7.9N	12 49.2W	MS		Night		
53304	18/ 4	49 7.9N	12 49.2W	WB30	0- 50	2328-2355	WB@50,30,20,10,7.5,2.5m. (5 dips).	
#55		49 7.9N	12 49.2W			Night		
53305	19/ 4	49 16.1N	12 19.5W	LHPR	0- 320	0854-1205	Station 'F'	1160
# 1		49 23.9N	12 3.1W			Day		
53305	19/ 4	49 17.2N	12 17.7W	RMT1M/1	300- 410	1428-1528		1132
# 2		49 18.3N	12 14.7W	RMT8M/1		Day	Flow Dist. 3.550 km.	
53305	19/ 4	49 18.3N	12 14.7W	RMT1M/2	0- 500	1528-1730	Net failed to close; haul aborted.	1129
# 3		49 20.3N	12 8.0W	RMT8M/2		Day		
53305	19/ 4	49 20.5N	12 7.6W	WB30	300- 300	1747-1805		
# 4		49 20.4N	12 7.6W					
53305	19/ 4	49 20.4N	12 7.7W	N113	0- 500	1800-1845	Vertical haul	
# 5		49 20.1N	12 7.0W			Day		
53305	19/ 4	49 17.0N	12 11.0W	RMT1M/1	600- 700	2121-2221	Net did not fish.	1084
# 6		49 15.3N	12 13.5W	RMT8M/1		Night	Flow Dist. 4.000 km.	

STN.	DATE 1994	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53305	19/ 4	49 15.3N	12 13.5W	RMT1M/2	700- 800	2221-2322	Probably 2hr tow over 600-800m.	1088
# 7		49 13.7N	12 15.8W	RMT8M/2		Night	Flow Dist. 3.640 km.	
53305	19/ 4	49 13.7N	12 15.8W	RMT1M/3	800- 905	2322-0021		1096
# 8	20/ 4	49 12.1N	12 17.9W	RMT8M/3		Night	Flow Dist. 3.730 km.	
53305	20/ 4	49 11.0N	12 19.1W	N113	0- 50	0114-0121	Vertical haul.	
# 9		49 11.0N	12 19.1W			Night		
53305	20/ 4	49 10.3N	12 20.0W	RMT1M/1	385- 500	0155-0255	Net did not fish.	1111
#10		49 8.5N	12 22.5W	RMT8M/1		Night	Flow Dist. 3.820 km.	
53305	20/ 4	49 8.5N	12 22.5W	RMT1M/2	500- 605	0255-0359	Probably 2hr tow over 385-605m.	1130
#11		49 6.9N	12 24.9W	RMT8M/2		Night	Flow Dist. 3.280 km.	
53305	20/ 4	49 6.9N	12 24.9W	RMT1M/3	605- 700	0359-0457		1157
#12		49 5.3N	12 27.1W	RMT8M/3		Night	Flow Dist. 3.460 km.	
53305	20/ 4	49 7.1N	12 23.9W	CTD	0- 100	0959-1005	WB@75,1m.	
#13		49 7.1N	12 23.8W	MS		Day		
53305	20/ 4	49 7.0N	12 23.7W	CTD	0- 100	1021-1029	WB@100,50,40,30,20,10m.	
#14		49 7.0N	12 23.6W	MS		Day		
53305	20/ 4	49 7.1N	12 23.7W	WB30	100- 400	1200-	WB@100,200,400m.	
#15						Day		
53305	20/ 4	49 7.1N	12 23.5W	WB30	30- 80	1257-	WB@30,50,80m.	
#16						Day		
53305	20/ 4	49 7.1N	12 23.5W	WB30	5- 10	1300-	WB@5,10m.	
#17						Day		

STN.	DATE 1994	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53305	20/ 4	49 7.1N	12 23.5W	N113	0- 50	1304-1315	Vertical haul.	
#18		49 7.1N	12 23.4W			Day		
53305	20/ 4	49 7.2N	12 23.4W	MSC	40- 40	1330-		
#19						Day		
53305	20/ 4	49 7.1N	12 23.2W	MSC	40- 40	1350-		
#20						Day		
53305	20/ 4	49 10.4N	12 22.2W	RMT1M/1	0- 100	1548-1648		1089
#21		49 12.2N	12 19.7W	RMT8M/1		Day	Flow Dist. 4.045 km.	
53305	20/ 4	49 12.2N	12 19.7W	RMT1M/2	100- 200	1648-1748		1106
#22		49 13.9N	12 17.0W	RMT8M/2		Day	Flow Dist. 3.865 km.	
53305	20/ 4	49 13.9N	12 17.0W	RMT1M/3	200- 300	1748-1848		1096
#23		49 15.6N	12 14.0W	RMT8M/3		Day	Flow Dist. 4.090 km.	
53305	20/ 4	49 16.2N	12 12.6W	APSTEIN	0- 50	1926-1932	Vertical haul.	
#24		49 16.2N	12 12.5W			Dusk		
53305	20/ 4	49 15.6N	12 13.0W	RMT1M/1	300- 400	2056-2156		1089
#25		49 14.2N	12 15.3W	RMT8M/1		Night	Flow Dist. 3.550 km.	
53305	20/ 4	49 14.2N	12 15.3W	RMT1M/2	395- 495	2156-2256		1093
#26		49 12.8N	12 17.3W	RMT8M/2		Night	Flow Dist. 3.640 km.	
53305	20/ 4	49 12.8N	12 17.3W	RMT1M/3	495- 605	2256-2356		1101
#27		49 11.4N	12 19.3W	RMT8M/3		Night	Flow Dist. 3.708 km.	
53305	21/ 4	49 10.6N	12 20.9W	WB30	0- 50	0048-0124	WB@2.5,5,7.5,10,20,30,40,50m. (9 dips).	
#28		49 10.5N	12 21.0W			Night		

STN.	DATE 1994	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT		MEAN SOUND. (M)
53305	21/ 4	49 10.5N	12 21.0W	CTD	0- 98	0147-0156			
#29		49 10.5N	12 21.0W			Night			
53305	21/ 4	49 10.7N	12 20.5W	RMT1M/1	22- 100	0208-0308			1091
#30		49 12.3N	12 17.9W	RMT8M/1		Night	Flow Dist.	3.910 km.	
53305	21/ 4	49 12.3N	12 17.9W	RMT1M/2	100- 200	0308-0408			1091
#31		49 14.1N	12 15.2W	RMT8M/2		Night	Flow Dist.	3.820 km.	
53305	21/ 4	49 14.1N	12 15.2W	RMT1M/3	200- 310	0408-0458	Abbreviated haul - proximity of dawn.		1088
#32		49 15.6N	12 13.2W	RMT8M/3		Night	Flow Dist.	2.748 km.	
53305	21/ 4	49 16.1N	12 12.0W	PROD	0- 50	0551-1916	Times of deployment of in situ rig.		
#33		49 16.0N	12 2.8W						
53305	21/ 4	49 14.5N	12 14.6W	RMT1M/1	700- 810	0726-0826			1096
#34		49 12.9N	12 16.8W	RMT8M/1		Day	Flow Dist.	3.640 km.	
53305	21/ 4	49 12.9N	12 16.8W	RMT1M/2	798- 900	0826-0926			1098
#35		49 11.4N	12 18.7W	RMT8M/2		Day	Flow Dist.	3.393 km.	
53305	21/ 4	49 11.4N	12 18.7W	RMT1M/3	900-1000	0926-1026			1100
#36		49 10.1N	12 20.6W	RMT8M/3		Day	Flow Dist.	3.078 km.	
53305	21/ 4	49 10.6N	12 20.3W	RMT1M/1	400- 505	1250-1350			1109
#37		49 12.6N	12 18.9W	RMT8M/1		Day	Flow Dist.	3.370 km.	
53305	21/ 4	49 12.6N	12 18.9W	RMT1M/2	505- 600	1350-1450			1108
#38		49 14.5N	12 17.2W	RMT8M/2		Day	Flow Dist.	3.595 km.	
53305	21/ 4	49 14.5N	12 17.2W	RMT1M/3	600- 700	1450-1550			1107
#39		49 16.3N	12 15.4W	RMT8M/3		Day	Flow Dist.	3.730 km.	

STN.	DATE 1994	POSITION LAT.	LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53305	21/ 4	49 15.3N	12 4.9W	MSC	30- 50	1740-1808	MSC @ 30 & 50 m.	
#40		49 15.0N	12 4.4W			Day		
53305	21/ 4	49 15.0N	12 4.3W	APSTEIN	0- 75	1813-1818	Vertical haul.	
#41		49 15.0N	12 4.2W			Day		
53305	21/ 4	49 16.0N	12 2.6W	N113	0- 200	1926-1942	Vertical haul.	
#42		49 16.0N	12 2.1W			Dusk		
53305	21/ 4	49 14.8N	12 4.5W	RMT1M/1	890-1000	2047-2147		1038
#43		49 13.6N	12 6.9W	RMT8M/1		Night	Flow Dist. 3.280 km.	
53305	21/ 4	49 13.6N	12 6.9W	RMT1M/2	986-1015	2147-2248	Fished 52-25 mob.	1040
#44		49 12.6N	12 9.4W	RMT8M/2		Night	Flow Dist. 3.550 km.	
53305	21/ 4	49 12.6N	12 9.4W	RMT1M/3	1010-1025	2248-2348	Fished 25-10 mob.	1035
#45		49 11.9N	12 12.0W	RMT8M/3		Night	Flow Dist. 3.820 km.	
53305	22/ 4	49 11.5N	12 14.3W	CTD	0-1040	0057-0209		1055
#46		49 12.0N	12 14.8W	MSP		Night		
53305	22/ 4	49 12.1N	12 15.0W	WB30	10- 400	0220-0302	WB@10,30,50,80,100,200,400m.	
#47		49 12.3N	12 15.2W			Night		
53305	22/ 4	49 12.3N	12 15.2W	WB30	5- 5	0307-0310	WB@5m.	
#48		49 12.4N	12 15.2W			Night		
53305	22/ 4	49 13.5N	12 13.9W	RMT1M/1	690- 800	0350-0450	Only one net fished to complete series.	
#49		49 15.2N	12 11.2W	RMT8M/1		Night	Flow Dist. 3.595 km.	
53305	22/ 4	49 13.5N	12 13.9W	MSC	30- 50	0553-0615	MSC @ 30 & 50 m.	
#50		49 15.2N	12 11.2W			Dawn		

STN.	DATE 1994	POSITION LAT.	LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53306	22/ 4	49 25.8N	11 46.7W	CTD	0- 200	1635-1652	WB@75,100m.	
# 1		49 25.8N	11 46.7W	MS		Day		
53306	22/ 4	49 25.7N	11 46.6W	CTD	0- 50	1705-1718	WB@0,10,20,30,40,50m.	
# 2		49 25.7N	11 46.6W	MS		Day		
53307	22/ 4	49 21.0N	11 49.9W	WB30	5- 400	1955-2053	WB@5,10,30,50,80,100,200,400m.	
# 1		49 21.1N	11 49.7W			Dusk		
53307	22/ 4	49 21.1N	11 49.5W	CTD	0-1030	2133-2231		1048
# 2		49 21.2N	11 49.6W	MSP		Night		
53308	23/ 4	49 25.1N	11 33.0W	CTD	0- 300	0113-0151		
# 1		49 25.1N	11 33.5W	MSP		Night		
				UFL				
53308	23/ 4	49 25.1N	11 33.7W	WB30	5- 400	0202-0300	WB@5,10,30,50,80,100,200,400m.	725
# 2		49 25.1N	11 34.3W			Night		
53308	23/ 4	49 25.0N	11 35.1W	WB30	0- 50	0400-0440	WB@2.5,5,7.5,10,20,30,40,50m.	765
# 3		49 24.8N	11 35.6W			Night		
53308	23/ 4	49 24.6N	11 35.8W	MSC	60- 90	0450-0520	MSC@60 & 90 m.	784
# 4		49 24.4N	11 36.1W			Dawn		
53308	23/ 4	49 24.3N	11 36.4W	CTD	0- 200	0539-0550	WB@100,75m.	794
# 5		49 24.3N	11 36.5W	MS		Dawn		
				UFL				
53308	23/ 4	49 24.2N	11 36.6W	CTD	0- 100	0601-0608	WB@50,40,30,20,10,1m.	798
# 6		49 24.2N	11 36.6W	MS		Dawn		
				UFL				

STN.	DATE 1994	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53309	24/ 4	49 24.6N	11 31.8W	MSC	50- 90	2030-2106	MSC@50 & 90m.	
# 1		49 24.2N	11 31.9W			Dusk		
53310	25/ 4	49 20.4N	11 38.4W	WB30	0- 50	0427-0500	WB@2.5,5,7.5,10,20,30,40,50m.	
# 1		49 20.3N	11 38.3W			Night		
53311	25/ 4	49 25.4N	11 42.7W	LHPR	0- 340	0905-1212	Net badly torn.	1030
# 1		49 17.1N	11 55.7W			Day		
53312	25/ 4	49 21.2N	11 36.8W	APSTEIN	0- 50	2055-2100	Vertical haul.	792
# 1		49 21.2N	11 36.9W			Dusk		
53312	25/ 4	49 21.2N	11 36.9W	APSTEIN	0- 50	2102-2108	Vertical haul.	
# 2		49 21.3N	11 36.9W			Dusk		
53312	25/ 4	49 21.3N	11 36.9W	APSTEIN	0- 50	2110-2119	Vertical haul.	
# 3		49 21.3N	11 36.9W			Dusk		
53312	25/ 4	49 21.3N	11 36.9W	CTD	0- 300	2150-2207	WB@100,75,50,30,10,1m.	
# 4		49 21.3N	11 36.9W	MS		Night		
				UFL				
53312	25/ 4	49 21.3N	11 36.9W	N113	0- 500	2220-2250	Vertical haul.	
# 5		49 21.3N	11 36.8W			Night		
53312	26/ 4	49 21.4N	11 36.9W	MSC	50- 60	0345-0413	MSC@50 & 60m.	
# 6		49 21.8N	11 36.7W			Night		
53312	26/ 4	49 21.9N	11 36.6W	WB30	0- 50	0420-0455	WB@50,30,20,10,7.5m.	
# 7		49 22.1N	11 36.3W			Night		
53312	26/ 4	49 22.2N	11 36.3W	WB30	400- 400	0500-	WB@400m.	
# 8						Night		

STN.	DATE 1994	POSITION LAT.	LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53312	26/ 4	49 22.3N	11 36.2W	CTD	0- 300	0518-0600	WB@100,75m.	
# 9		49 22.6N	11 35.8W	MS		Dawn		
				UFL				
				MSP				
53312	26/ 4	49 22.8N	11 35.6W	CTD	0- 50	0618-0621	WB@50,40,30,20,10,1m.	
#10		49 22.8N	11 35.6W	MS		Dawn		
				UFL				
53312	26/ 4	49 22.9N	11 35.5W	WB30	20- 200	0630-0710	WB@0,5,10,20,30,50,80,100,200m.	767
#11		49 23.2N	11 35.4W			Dawn		
53313	27/ 4	49 27.9N	11 11.2W	CTD	0- 194	0021-0117		226
# 1		49 27.8N	11 11.2W	MSP		Night		
				UFL				
53313	27/ 4	49 27.9N	11 11.2W	MSC	40- 80	0130-0145	MSC@40 & 80m.	
# 2		49 28.0N	11 11.2W			Night		
53314	27/ 4	49 30.0N	10 59.9W	WB30	2- 150	0300-0440	WB@150,50,30,30,10,7.5,5,2m.	
# 1		49 30.7N	10 59.2W			Night		
53314	27/ 4	49 30.7N	10 59.2W	APSTEIN	0- 44	0451-0503	Vertical haul.	
# 2		49 30.7N	10 59.1W			Night		
53314	27/ 4	49 30.7N	10 59.0W	CTD	0- 160	0537-0610	WB@150,120,100,75m.	192
# 3		49 30.8N	10 58.5W	MS		Dawn		
				MSP				
				UFL				
53314	27/ 4	49 30.8N	10 58.2W	CTD	0- 50	0634-0641	WB@50,40,30,20,10,1m.	
# 4		49 30.8N	10 58.0W	MS		Dawn		
				UFL				

STN.	DATE 1994	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53315 # 1	27/ 4	49 26.4N 49 26.4N	11 16.1W 11 16.0W	APSTEIN	0- 75	1950-1956 Dusk	Vertical haul.	265
53315 # 2	27/ 4	49 26.4N 49 26.5N	11 16.0W 11 15.8W	APSTEIN	0- 50	1957-2003 Dusk	Vertical haul.	
53315 # 3	27/ 4	49 26.5N 49 26.5N	11 15.8W 11 15.0W	APSTEIN	0- 50	2004-2110 Dusk	Vertical haul.	
53315 # 4	27/ 4	49 26.6N 49 26.6N	11 15.2W 11 15.1W	N113	0- 200	2025-2037 Dusk	Vertical haul.	
53315 # 5	27/ 4	49 26.5N 49 26.4N	11 15.0W 11 14.7W	CTD MS UFL	0- 200	2115-2207 Night	WB@200,100,50m.	242
53315 # 6	27/ 4	49 26.2N 49 26.2N	11 14.7W 11 14.7W	CTD MS UFL	0- 50	2221-2225 Night	WB@50,40,30,30,10,1m.	
53315 # 7	27/ 4	49 26.2N	11 14.7W	MSC	60- 60	2238- Night		
53315 # 8	27/ 4	49 26.1N	11 14.7W	MSC	40- 40	2240- Night		
53315 # 9	27/ 4	49 25.9N 49 25.5N	11 14.7W 11 14.7W	WB30	5- 200	2300-2345 Night	WB@200,100,80,50,30,20,10,5m.	
53316 # 1	29/ 4	48 58.1N	16 29.0W	SED TRAP CM	1000-4700	1228-	Sediment traps @ 1000,3000 & 4700 m.	4808
53317 # 1	30/ 4	49 5.0N 49 5.2N	13 18.0W 13 18.1W	CTD MS UFL MSP	0- 300	0220-0240 Night	WB@300,200,175,150,120,100m.	3600

STN.	DATE 1994	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53317 # 2	30/ 4	49 5.3N 49 5.4N	13 18.0W 13 18.0W	CTD MS UFL	0- 75	0305-0320 Night	CTD connection lost - dip aborted	
53317 # 3	30/ 4	49 5.4N 49 5.6N	13 18.0W 13 18.0W	MSC	30- 40	0320-0336 Night	MSC@30 & 40m.	
53317 # 4	30/ 4	49 5.6N 49 6.1N	13 18.0W 13 17.7W	WB30	5- 200	0340-0425 Night	WB@200,100,80,50,30,20,10,5m.	
53317 # 5	30/ 4	49 6.1N 49 6.3N	13 17.6W 13 17.4W	WB30	10- 10	0430-0440 Dawn	WB@10m.	
53317 # 6	30/ 4	49 6.4N 49 6.5N	13 17.3W 13 17.2W	APSTEIN	0- 75	0446-0452 Dawn	Vertical haul.	
53317 # 7	30/ 4	49 6.5N 49 6.5N	13 17.2W 13 17.1W	APSTEIN	0- 60	0454-0500 Dawn	Vertical haul.	
53318 # 1	30/ 4	49 19.0N 49 29.3N	11 31.6W 11 25.0W	LHPR	0- 304	1123-1420 Day		875
53318 # 2	30/ 4	49 28.6N 49 28.5N	11 28.3W 11 31.4W	RMT1M/1 RMT8M/1	520- 602	1547-1647 Day	10-28 mob Flow Dist. 3.460 km.	
53318 # 3	30/ 4	49 28.5N 49 27.5N	11 31.4W 11 32.9W	RMT1M/2 RMT8M/2	570- 630	1647-1747 Day	25-89 mob Flow Dist. 2.920 km.	
53318 # 4	30/ 4	49 27.5N 49 26.3N	11 32.9W 11 34.9W	RMT1M/3 RMT8M/3	505- 600	1747-1847 Day	Flow Dist. 3.820 km.	722
53318 # 5	30/ 4	49 24.8N 49 27.4N	11 30.9W 11 28.7W	RMT1M/1 RMT8M/1	300- 405	2102-2202 Night	Flow Dist. 4.090 km.	603

STN.	DATE 1994	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53318	30/ 4	49 27.4N	11 28.7W	RMT1M/2	405- 510	2202-2303		574
# 6		49 30.2N	11 28.8W	RMT8M/2		Night	Flow Dist. 4.000 km.	
53318	30/ 4	49 30.2N	11 28.8W	RMT1M/3	510- 575	2303-0003	72-26 mob	601
# 7	1/ 5	49 32.6N	11 30.0W	RMT8M/3		Night	Flow Dist. 3.595 km.	
53318	1/ 5	49 35.0N	11 31.3W	RMT1M/1	28- 100	0100-0200		610
# 8		49 33.3N	11 30.4W	RMT8M/1		Night	Flow Dist. 4.000 km.	
53318	1/ 5	49 33.3N	11 30.4W	RMT1M/2	97- 100	0200-0209	Net closed prematurely; catch discarded	
# 9		49 33.0N	11 30.3W	RMT8M/2		Night		
53318	1/ 5	49 33.0N	11 30.3W	RMT1M/3	100- 195	0209-0309		620
#10		49 31.3N	11 29.3W	RMT8M/3		Night	Flow Dist. 4.180 km.	
53318	1/ 5	49 30.8N	11 29.0W	WB30	2- 200	0330-0500	WB@200,50,40,30,20,15,10,7,5,2m.	
#11		49 31.3N	11 28.6W			Night		
53318	1/ 5	49 31.3N	11 28.6W	CTD	0- 400	0500-0545		581
#12		49 31.4N	11 28.4W	MSP		Dawn		
				UFL				
53319	1/ 5	49 28.7N	11 51.2W	ADCP(V)	0- 909	1000-1142		1010
# 1		49 29.4N	11 51.6W					
53320	1/ 5	49 33.8N	11 30.4W	RMT1M/1	0- 100	1422-1452	1/2 hour tow	640
# 1		49 33.1N	11 31.0W	RMT8M/1		Day	Flow Dist. 1.730 km.	
53320	1/ 5	49 33.1N	11 31.0W	RMT1M/2	100- 200	1452-1522	1/2 hour tow	644
# 2		49 32.4N	11 31.5W	RMT8M/2		Day	Flow Dist. 1.730 km.	
53320	1/ 5	49 32.4N	11 31.5W	RMT1M/3	200- 300	1522-1552	1/2 hour tow	652
# 3		49 31.6N	11 32.0W	RMT8M/3		Day	Flow Dist. 1.640 km.	

STN.	DATE 1994	POSITION LAT.	LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53320	1/ 5	49 30.9N	11 32.6W	RMT1M/1	300- 400	1654-1739	3/4 hour tow	685
# 4		49 29.4N	11 33.3W	RMT8M/1		Day	Flow Dist. 2.618 km.	
53320	1/ 5	49 29.4N	11 33.3W	RMT1M/2	400- 500	1739-1824	3/4 hour tow	708
# 5		49 28.0N	11 33.8W	RMT8M/2		Day	Flow Dist. 2.798 km.	
53321	1/ 5	49 31.0N	11 28.6W	RMT1M/1	200- 300	2238-2338		590
# 1		49 29.2N	11 29.9W	RMT8M/1		Night	Flow Dist. 3.370 km.	
53322	2/ 5	49 27.3N	11 19.7W	RMT1M/1	20- 100	0109-0209		335
# 1		49 25.1N	11 21.4W	RMT8M/1		Night	Flow Dist. 3.460 km.	
53322	2/ 5	49 25.1N	11 21.4W	RMT1M/2	100- 200	0209-0309		350
# 2		49 22.7N	11 22.5W	RMT8M/2		Night	Flow Dist. 4.000 km.	
53322	2/ 5	49 22.7N	11 22.5W	RMT1M/3	200- 300	0309-0400	Abbreviated haul.	349
# 3		49 20.6N	11 23.2W	RMT8M/3		Night	Flow Dist. 2.920 km.	
53323	2/ 5	49 19.8N	11 23.8W	WB30	2- 50	0445-0512	WB@50,40,30,20,10,7,2 m.	
# 1		49 19.8N	11 24.0W			Dawn		
53323	2/ 5	49 19.8N	11 24.0W	CTD	0- 300	0528-0600	WB@various depths.	376
# 2		49 19.9N	11 24.2W	MS		Dawn		
				MSP				
				UFL				
53323	2/ 5	49 19.9N	11 24.4W	CTD	0- 50	0619-0627	WB@various depths.	
# 3		49 19.9N	11 24.4W	MS		Dawn		
				UFL				
53323	2/ 5	49 20.0N	11 24.5W	WB30	5- 200	0630-0705	WB@200,100,80,50,30,20,10,5m.	
# 4		49 20.4N	11 24.7W			Day		

STN.	DATE 1994	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53323 # 5	2/ 5	49 20.5N 49 20.6N	11 24.7W 11 24.6W	MSC	40- 60	0713-0727 Day	MSC@60 & 40 m.	
53323 # 6	2/ 5	49 20.6N 49 20.8N	11 24.6W 11 24.5W	APSTEIN	0- 50	0725-0745 Day	2 deployments. Vertical haul.	
53323 # 7	2/ 5	49 20.6N 49 22.5N	11 22.6W 11 20.2W	RMT1M/1 RMT8M/1	22- 100	0828-0928 Day	Flow Dist. 3.865 km.	300
53323 # 8	2/ 5	49 22.5N 49 24.5N	11 20.2W 11 17.9W	RMT1M/2 RMT8M/2	100- 200	0928-1029 Day	Flow Dist. 3.820 km.	280
53323 # 9	2/ 5	49 24.5N 49 28.3N	11 17.9W 11 19.5W	RMT1M/3 RMT8M/3	0- 273	1029-1215 Day	Net failed to close. Flow Dist. 0.000 km.	298
53323 #10	2/ 5	49 29.0N 49 17.4N	11 20.4W 11 28.2W	LHPR	0- 302	1305-1609 Day		375
53324 # 1	2/ 5	49 30.0N 49 30.0N	10 59.7W 10 59.5W	APSTEIN	0- 50	1851-1900 Day	Vertical haul.	
53324 # 2	2/ 5	49 30.0N 49 30.0N	10 59.4W 10 59.2W	APSTEIN	0- 50	1902-1910 Dusk	Vertical haul.	
53324 # 3	2/ 5	49 30.0N 49 30.1N	10 59.1W 10 58.8W	N113	0- 150	1915-1932 Dusk	Vertical haul.	
53325 # 1	2/ 5	49 29.5N 49 29.7N	10 59.4W 10 59.5W	CTD MS MSP UFL	0- 163	2140-2230 Night	WB@various depths.	187
53325 # 2	2/ 5	49 29.7N 49 29.6N	10 59.5W 10 59.5W	WB30	5- 150	2240-2300 Night	WB@150,100,80,50,30,20,10,5m.	

STN.	DATE 1994	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES GMT	COMMENT	MEAN SOUND. (M)
53325	2/ 5	49 29.4N	10 59.6W	MSC	40- 40	2330-2344		
# 3		49 29.4N	10 59.6W			Night		
53325	2/ 5	49 29.3N	10 59.6W	MSC	20- 20	2352-2356		
# 4		49 29.3N	10 59.6W			Night		
53325	3/ 5	49 28.7N	11 0.5W	RMT1M/1	18- 55	0033-0133		192
# 5		49 27.0N	11 2.4W	RMT8M/1		Night	Flow Dist. 3.550 km.	
53325	3/ 5	49 27.0N	11 2.4W	RMT1M/2	55- 108	0133-0233		192
# 6		49 25.2N	11 4.7W	RMT8M/2		Night	Flow Dist. 3.460 km.	
53325	3/ 5	49 25.2N	11 4.7W	RMT1M/3	98- 135	0233-0258	Abbreviated haul due to bad weather.	192
# 7		49 24.5N	11 5.7W	RMT8M/3		Night	Flow Dist. 1.599 km.	
53326	4/ 5	49 15.7N	11 32.5W	SEASOAR	0- 300	0836-0142	Recovered due to predicted gale!	
# 1	5/ 5	49 21.0N	11 7.7W					
53327	5/ 5	49 34.2N	11 10.7W	CTD	0- 238	0353-0440		254
# 1		49 33.9N	11 10.6W	MSP		Night		
				UFL				
53328	5/ 5	49 34.0N	11 7.5W	MSC	20- 60	1118-1124	MSC@ 60 & 20 m.	254
# 1		49 33.9N	11 7.5W			Day		
53328	5/ 5	49 33.8N	11 7.3W	WB30	5- 200	1144-1228	WB@200,100,80,50,30,20,10,5m.	
# 2		49 33.8N	11 7.0W			Day		
53328	5/ 5	49 33.8N	11 7.1W	CTD	0- 190	1246-1300	WB@150,100,70,50,20,5m.	225
# 3		49 33.7N	11 7.0W	MS		Day		
				UFL				

TABLE 1

Details of XBT Deployments.

XBT No.	Type	Date	Time GMT	Depth (m).	Position N	Position W
1	T7	28/04	0200	760	49° 23.28'	11° 31.96'
2	T7	28/04	0300	760	49° 22.00'	11° 41.85'
3	T7	28/04	0400	760	49° 21.40'	11° 52.45'
4	T7	28/04	0457	760	49° 20.42'	12° 01.48'
5	T7	28/04	0558	760	49° 19.12'	12° 10.79'
6	T7	28/04	0700	Failed	49° 18.58'	12° 21.40'
7	T7	28/04	0704	760	49° 18.43'	12° 21.53'
8	T7	28/04	0758	760	49° 17.11'	12° 30.50'
9	T7	28/04	0900	760	49° 16.50'	12° 42.21'
10	T7	28/04	0958	750	49° 15.15'	12° 54.74'
11	T7	28/04	1100	750	49° 13.58'	13° 08.93'
12	T7	28/04	1158	760	49° 12.56'	13° 22.00'
13	T7	28/04	1258	760	49° 11.75'	13° 35.42'
14	T7	28/04	1359	760	49° 10.55'	13° 48.14'
15	T7	28/04	1500	760	49° 09.54'	14° 00.29'
16	T7	28/04	1559	760	49° 08.81'	14° 12.57'
17	T7	28/04	1659	760	49° 07.79'	14° 24.82'
18	T7	28/04	1800	760	49° 07.22'	14° 38.45'
19	T7	28/04	1900	760	49° 05.95'	14° 51.21'
20	T7	28/04	2002	760	49° 04.67'	15° 05.26'
21	T5	28/04	2102	1500	49° 03.85'	15° 19.42'
22	T7	28/04	2201	760	49° 02.86'	15° 33.52'
23	T5	28/04	2258	1400	49° 02.00'	15° 46.98'
24	T7	28/04	2359	760	49° 00.83'	16° 01.93'
25	T5	29/04	0059	1400	48° 59.70'	16° 17.86'
26	T7	29/04	1601	760	48° 59.37'	16° 15.10'
27	T5	29/04	1712	1200	49° 00.16'	15° 53.98'
28	T7	29/04	1755	760	49° 00.59'	15° 40.73'
29	T7	29/04	1901	760	49° 01.35'	15° 20.66'
30	T7	29/04	2004	760	49° 01.66'	15° 02.22'
31	T5	29/04	2105	1200	49° 02.20'	14° 43.78'
32	T7	29/04	2159	760	49° 02.87'	14° 27.19'
33	T5	29/04	2259	1200	49° 03.56'	14° 09.01'
34	T7	29/04	2358	760	49° 04.27'	13° 51.32'
35	T7	30/04	0058	760	49° 04.66'	13° 34.82'
36	T5	30/04	0158	1800	49° 04.96'	13° 19.72'

TABLE 2

Details of Primary Productivity Experiments.

Date	Station	Depths (m)	Incubation
16/04/94	53304#9	2.5, 7.5, 10, 20, 30, 50	on deck
18/04/94	53304#39	2.5, 5, 7.5, 10, 15, 20, 30, 40, 50	*in situ*
18/04/94	53304#54	2.5, 7.5, 10, 20, 30, 50	on deck
21/04/94	53305#28	2.5, 5, 7.5, 10, 15, 20, 30, 40, 50	*in situ*
23/04/94	53308#3	2.5, 7.5, 10, 20, 30, 50	on deck
25/04/94	53310#1	2.5, 7.5, 10, 20, 30, 50	on deck
26/04/94	53312#7	2.5, 7.5, 10, 20, 30, 50	on deck
27/04/94	53314#4	2.5, 7.5, 10, 20, 30, 50	on deck
28/04/94	53315##1	2.5, 7.5, 10, 20, 30, 50	on deck
30/04/94	53317#4	2.5, 7.5, 10, 20, 30, 50	on deck
01/05/94	53318#10	2.5, 5, 7.5, 10, 15, 20, 30, 40, 50	*in situ*
02/05/94	53322#4	2.5, 7.5, 10, 20, 30, 50	on deck

TABLE 3

Details of Microzooplankton Biomass Studies.

Date	Station	Sampling Event
15.4.94	53304#5	Apstein 75 m.
16.4.94	53304#9	Dilution Experiment No.1 10 m
	53304#10	Biomass profile 0-100 m
	53304#19	Apstein 50 m.
18.4.94	53304#39	Dilution Experiment No.2 10 m
	53304#47	Biomass profile 0-100 m
	53304#46	Pigments profile 0-200 m
	53304#51	Apstein 75 m.
18.4.94	53304#54	Dilution Experiment No.3 10 m
	53304#52	Biomass profile 0-100 m.
20.4.94	53305#14	Biomass profile 0-100 m
	53305#24	Apstein 50 m.
21.4.94	53305#28	Dilution Experiment No.4 10 m
	53305#42	Apstein 75 m.
22.4.94	53306#1	Biomass profile 0-100 m.
23.4.94	53308#3	Dilution Experiment No.5 10 m
	53308#6	Biomass profile 0-100 m
	53307#1	Pigments profile 5-400 m.
25.4.94	53310#1	Dilution Experiment No.6 10 m
	53312#4	Biomass Profile 0-100 m
	53312#1	Apstein 50 m.
26.4.94	53312#7	Dilution Experiment No.7 10 m
	53312#9	Biomass profile 0-100 m.
27.4.94	53314#4	Dilution Experiment No.8 10 m
	53314#3	Biomass profile 0-150 m
	53314#2	Apstein 44 m
	53315#1	Apstein 75 m
	53315#3	Biomass profile 0-200 m.
28.4.94	53315#9	Dilution Experiment No.9 10 m.
30.4.94	53317#5	Dilution Experiment No.10 10 m
	53317#1	Biomass profile 5-300 m
	53317#4	Pigments profile 5-300 m
	53317#6	Apstein 75 m.
02.5.94	53322#4	Dilution Experiment No.11 10 m
	53323#2	Biomass profile 0-100 m
	53323#6	Apstein 50 m
	53325#1	Biomass profile
	53324#1	Apstein 50 m.

TABLE 4

Details of Sediment Trap Moorings.

	Station H	**OMEX 2**
Station:	5336#1	53304#50
Position:	48°58.2'N 16°29.0'W	49°11.2'N 12°49.2W'
Deployed	1100-1330Z on 29.4.94	1602Z on 18.4.94
On bottom	1421Z	
Sounding	4807 ucm	1450 ucm
Traps depths:	1038, 3063 & 4714m	620 & 1070m
Current meters:	986 & 4664m	580 & 1000m

Event	**Date**		**Date**	
1	30/04/94	1200h	26/04/94	0100h
2	10/05/94	1200h	08/05/94	0100h
3	20/05/94	1200h	20/05/94	0100h
4	30/05/94	1200h	01/06/94	0100h
5	09/06/94	1200h	13/06/94	0100h
6	19/06/94	1200h	25/06/94	0100h
7	29/06/94	1200h	07/07/94	0100h
8	09/07/94	1200h	19/07/94	0100h
9	19/07/94	1200h	30/07/94	0100h
10	29/07/94	1200h	11/08/94	0100h
11	08/08/94	1200h	23/08/94	0100h
12	18/08/94	1200h	03/09/94	0100h
13	28/08/94	1200h	14/09/94	0100h
14	07/09/94	1200h		

TABLE 5

Details of Marine Snow Profiles.

Film No.	Station	Date	Turn on Time	Blank Frame	Time in Water	f stop	Cast Depth (m)
66	53303	15.4.94	00:06:00	00:10:44	00:23:59	11	1000
67	53304#11	16.4.94	06:45:00	06:49:00	06:52:41	11	1358
68	53304#48	18.4.94	05:45:00	05:49:15	05:52:34	11	200
69	53304#53	18.4.94	21:03:00	21:09:15	21:15:08	11	1580
70	53305#46	22.4.94	00:50:00	00:55:30	00:57:12	11	1065
71	53307#2	22.4.94	21:24:00	21:29:00	21:31:59	5.6	1052
72	53308#1	23.4.94	01:05:00	01:09:45	01:13:13	11	300
73	53312#9	26.4.94	05:11:00	05:15:15	05:17:48	11	300
74	53313#1	27.4.94	00:16:00	00:19:00	00:23:55	11	194
75	53314#3	27.4.94	05:26:00	05:31:15	05:36:25	5.6	180
76	53315#3	27.4.94	21:10:00	21:12:30	21:14:47	11	240
77	53317#1	30.4.94	02:18:00	02:20:15	02:24:02	11	300
78	53317#2	30.4.94	same as 77	03:04:45	03:09:09	11	
79	53318#12	1.5.94	05:00:00	05:02:45	05:07:39	11	400
80	53323#2	2.5.94	05:20:00	05:26:00	05:29:34	11	365
81	53325#1	2.5.94	21:04:00	21:07:30	21:15:35	11	163
82	53327#1	5.5.94	03:46:00	03:48:45	03:52:39	11	

Film: XP2 on all deployments except for 71 and 75 which used TMax

Focus (all films): 0.8m

Frame interval (all films): 15sec.

TABLE 6

Details of Marine Snow Catcher Sampling.

Station No.	Sample No.	Depth	Time sampled	Time drained down
53304#32	1	50	? on 17.4.94	?
	2	50		
53305#19	1	40	1400 on 19/04	1400 on 20.4.94
#20	2	40		
53305#40	1	30	1730 on 21.4.94	?
	2	50		
53305#50	1	50	0550 on 22.4.94	1700 on 22.4.94
	2	30		
53308#3?	1	60	0500 on 23.4.94	1600 on 23.4.94
	2	90		
53309#1	1	50	2100 on 24.4.94	1300 on 25.4.94
	2	90		
53312#6	1	60	0350 on 26.4.94	1600 on 26.4.94
	2	50		
53313#2	1	40	0130 on 27.4.94	1530 on 27.4.94
	2	80		
53315#5	1	40	2240 on 27.4.94	?
	2	60		
53317#3	1	40	0340 on 30.4.94	1500 on 30.4.94
	2	30		
53323#5	1	40	0720 on 2.5.94	1900 on 2.5.94
	2	60		
53325#3	1	40	2350 on 2.5.94	1600 on 3.5.94
	2	20		

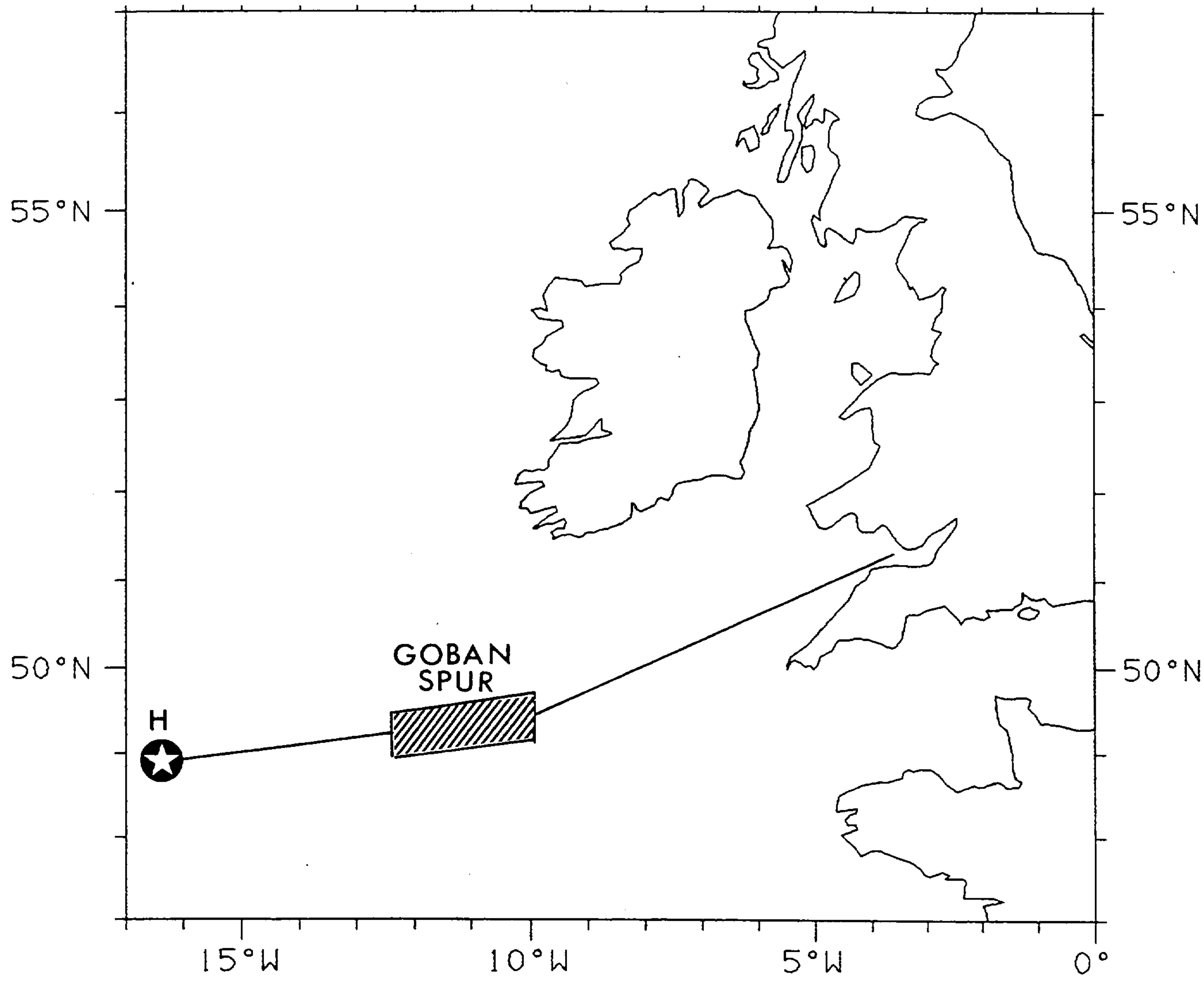

Figure 1. Track chart for RRS *Charles Darwin* Cruise 85 11 Apr - 7 May 1994. The main work area, on the Goban Spur, is shown in more detail in Figure 2.

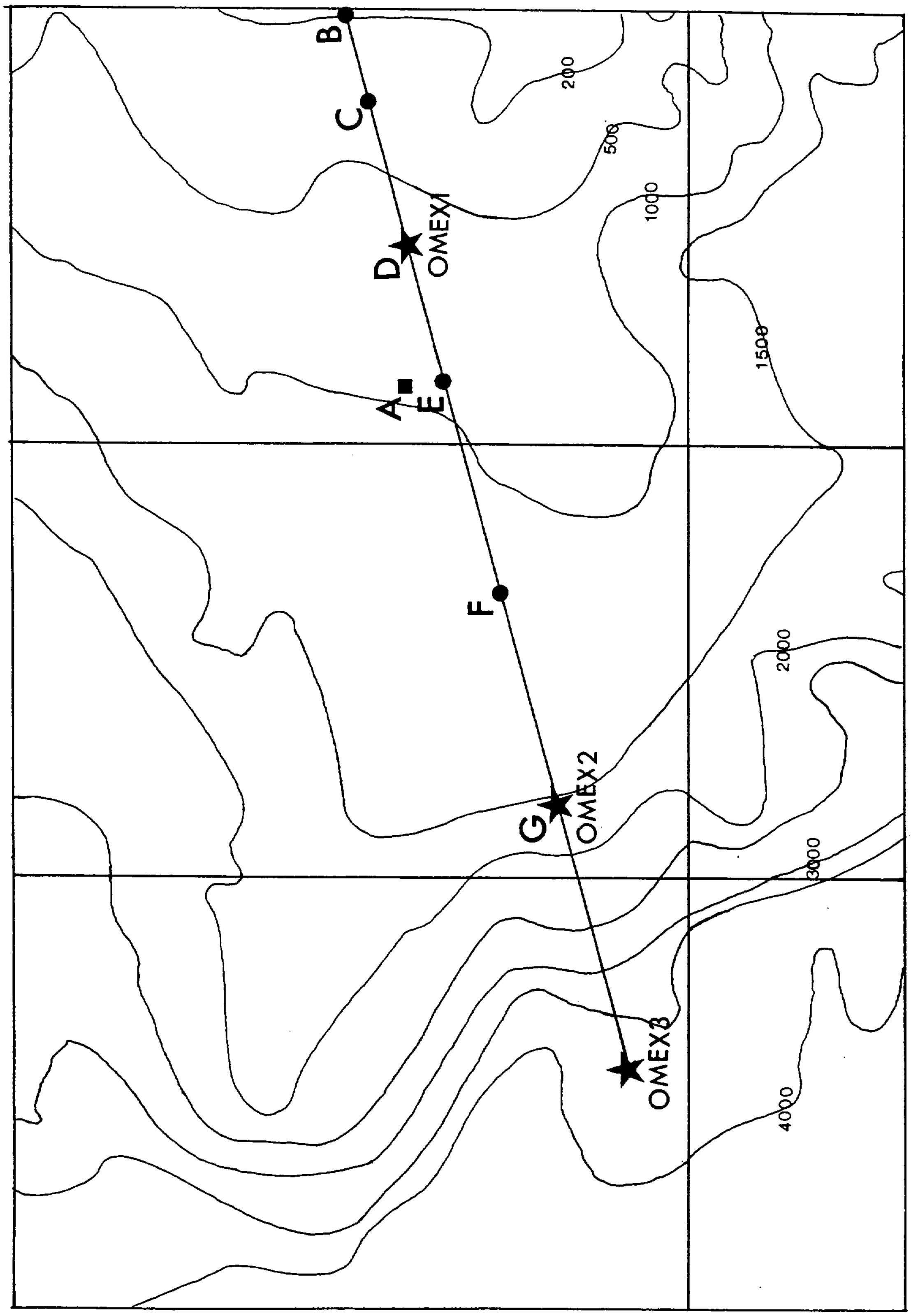

Figure 2. Detail of the main work area on the Goban Spur (48.6-50°N 11-14°W) and the OMEX line of sampling stations.

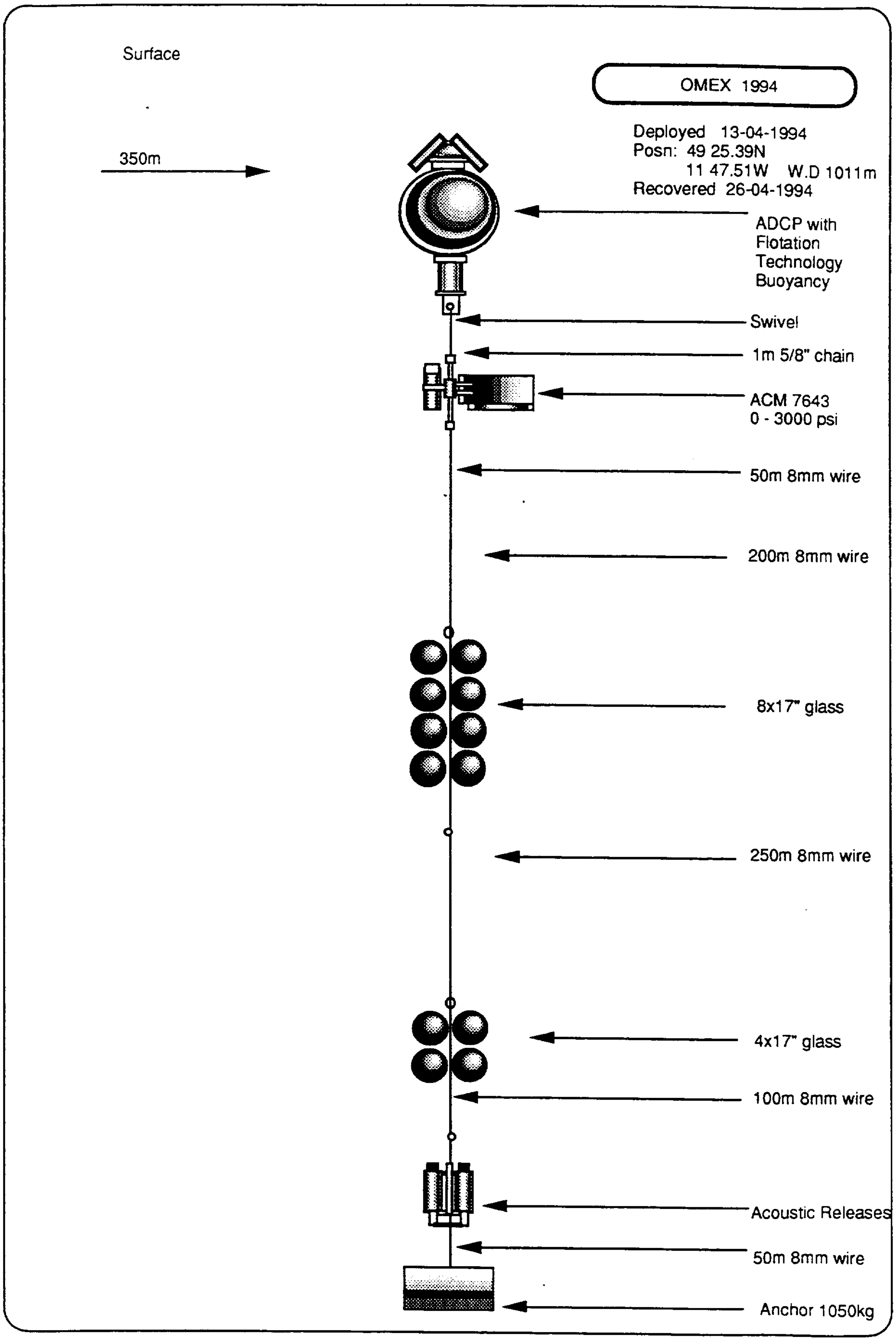

Figure 3. Details of the ADCP mooring at station A.

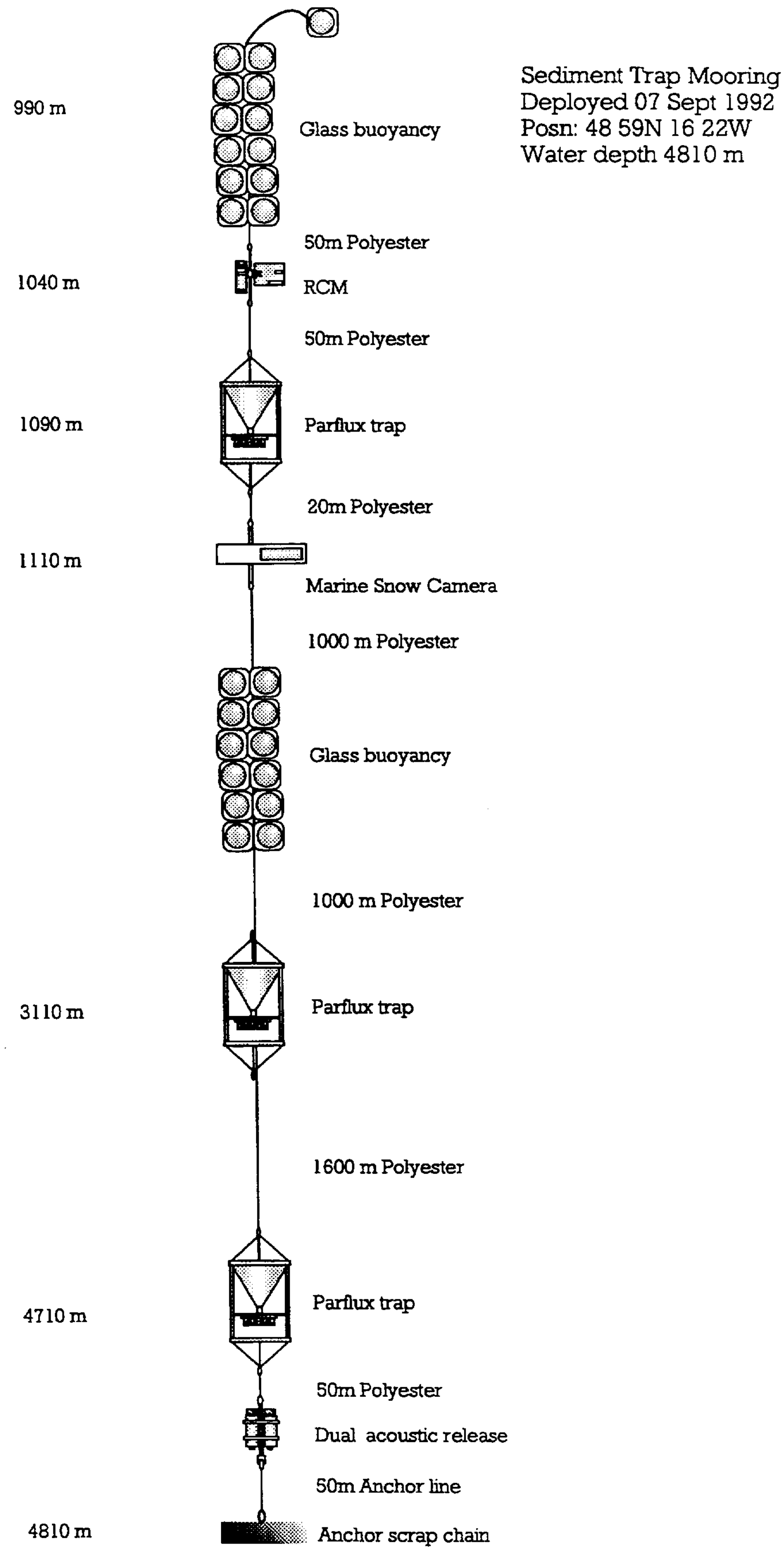

Figure 4. Detail of the unrecovered sediment trap mooring at station H.

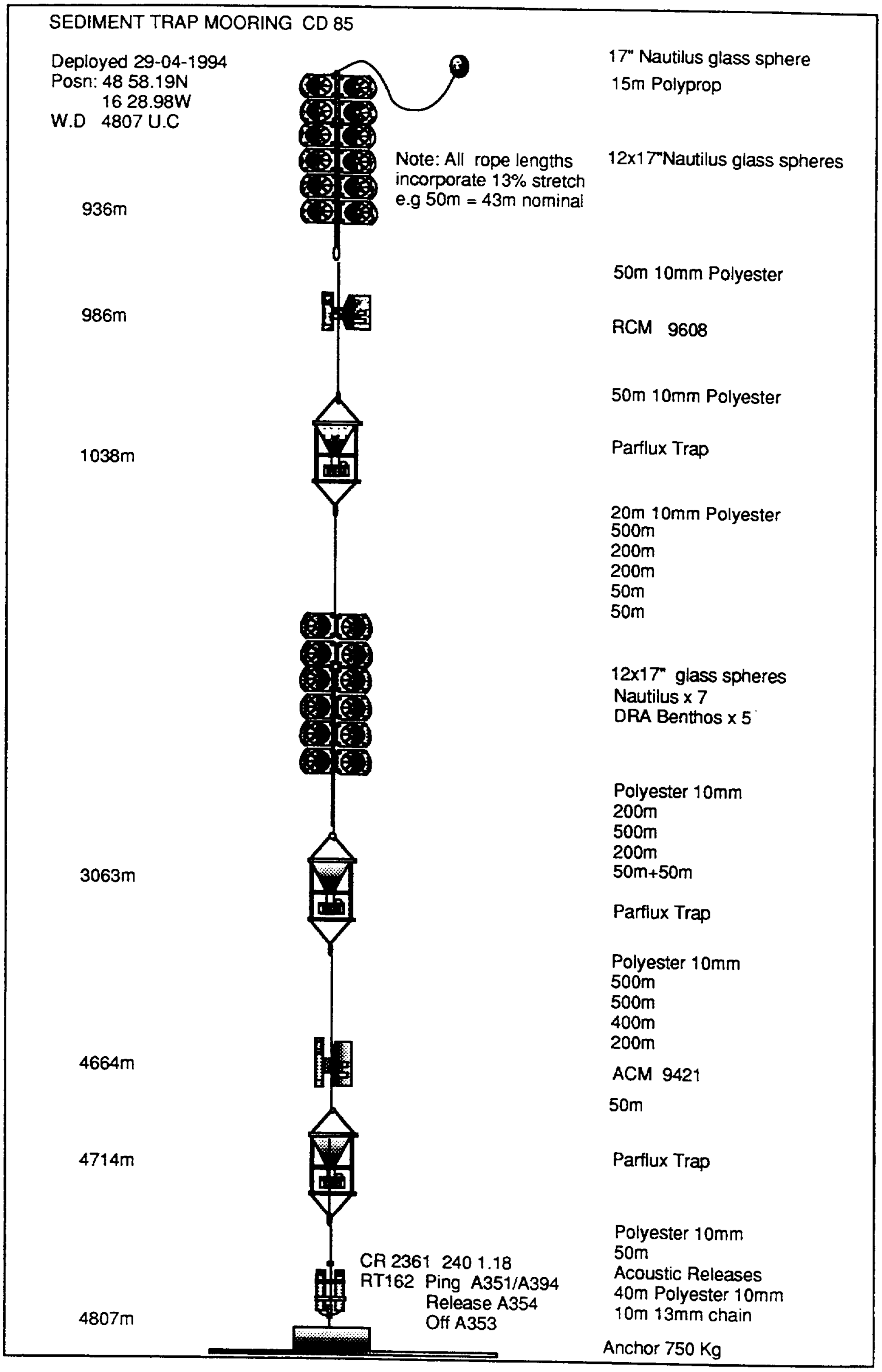

Figure 5. Detail of the sediment trap mooring deployed at station H.

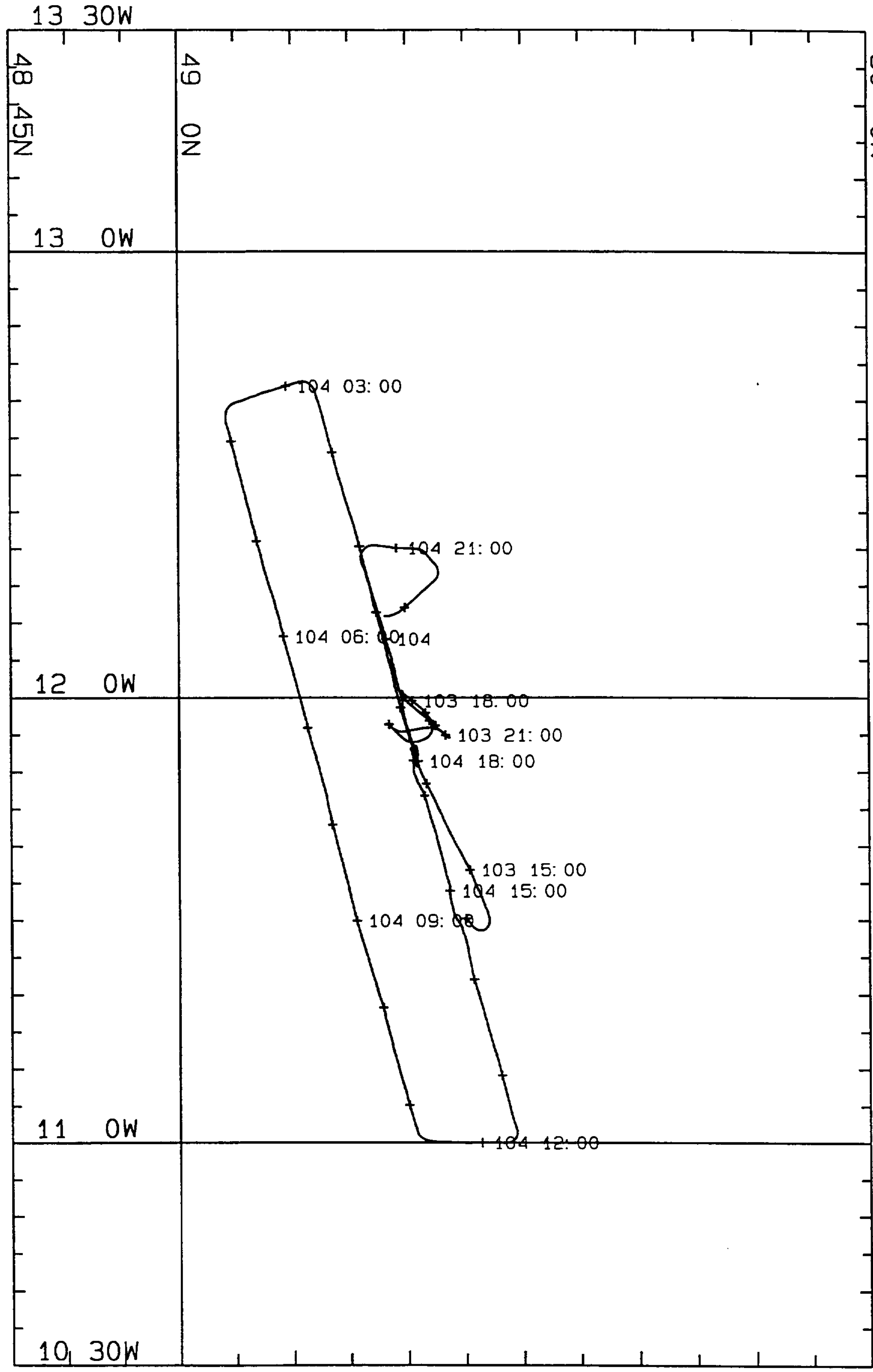

Figure 6. Ship's track during the first SeaSoar survey.

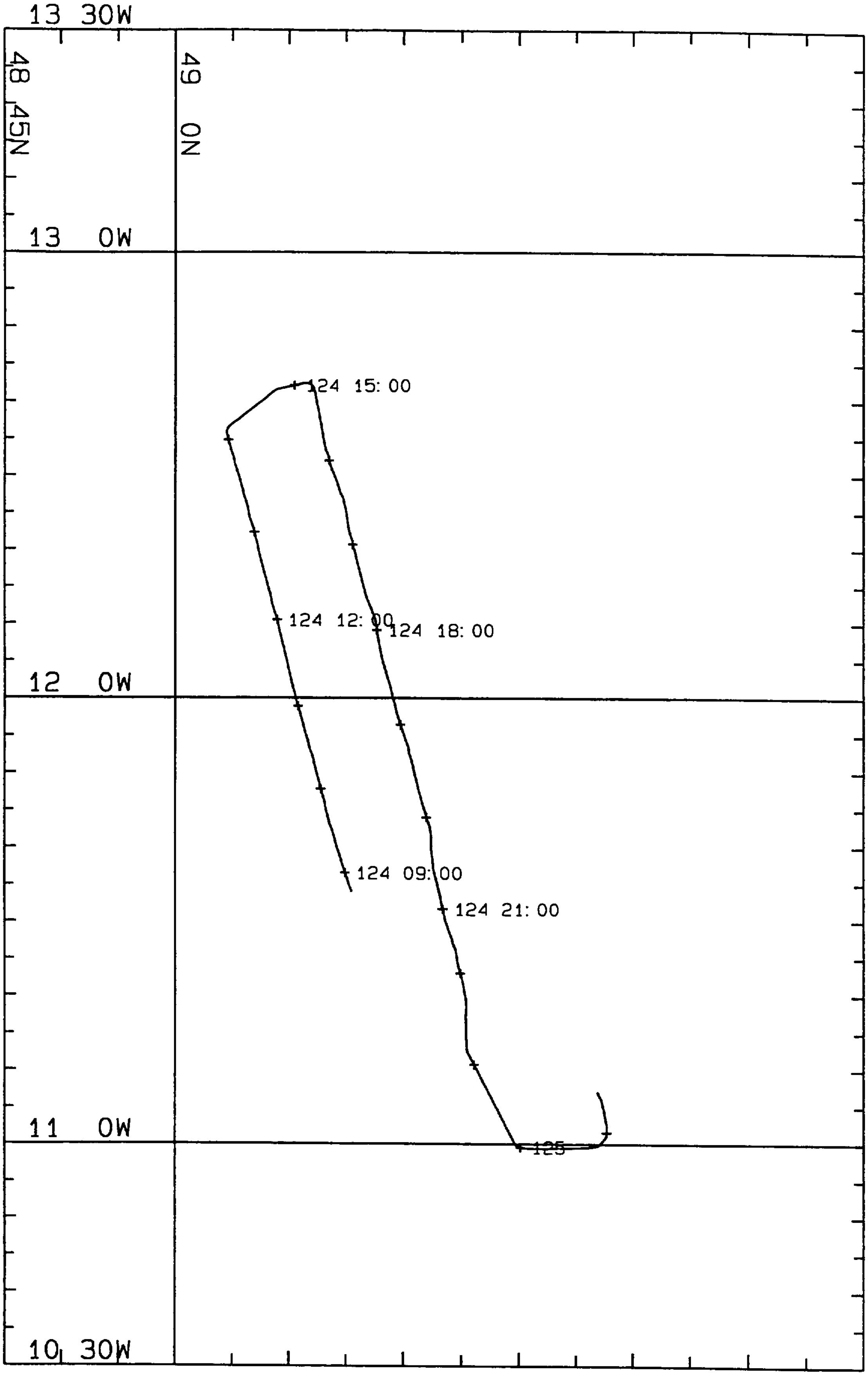

Figure 7. Ship's track during the second SeaSoar survey.

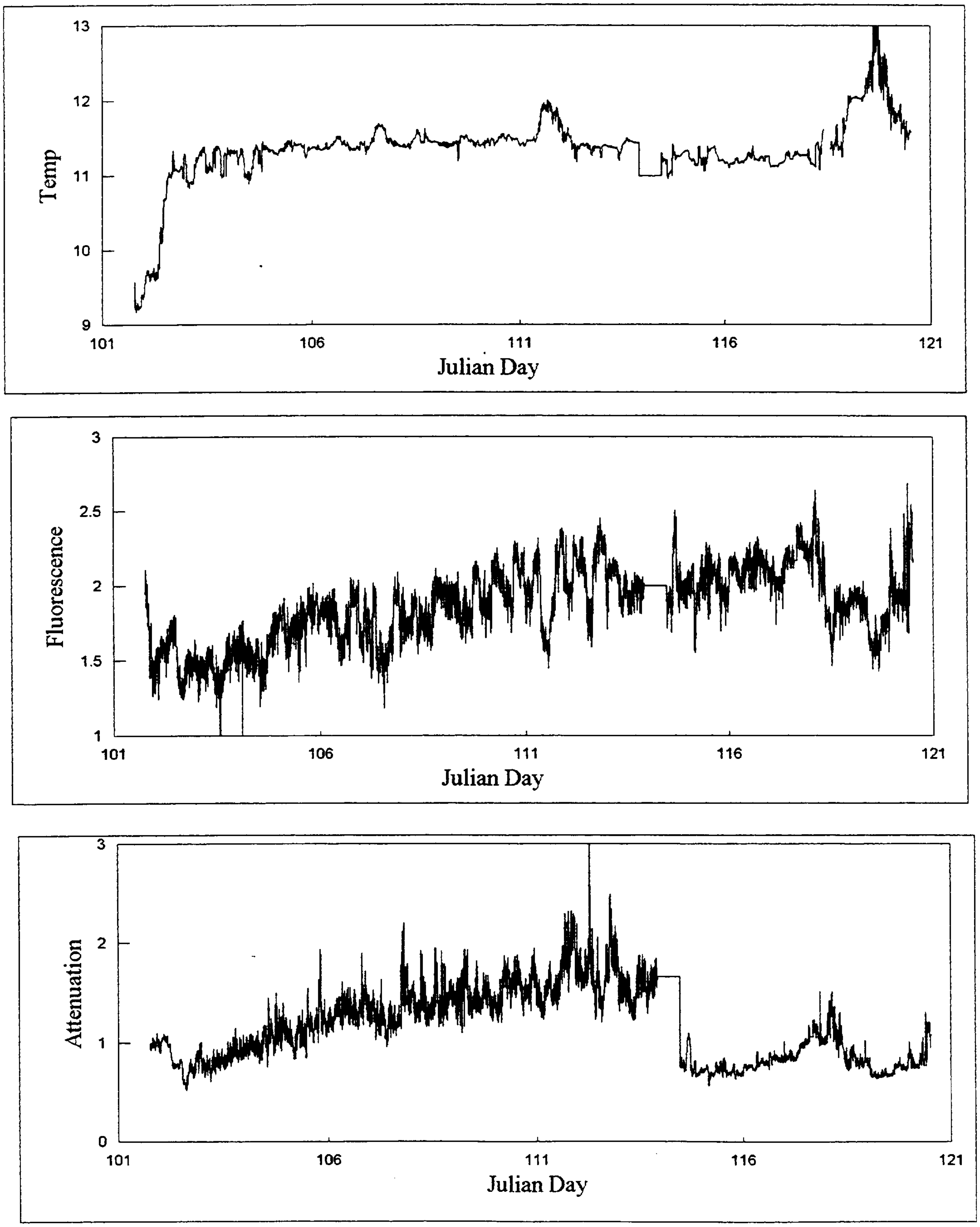

Figure 8. Surface temperature, fluorescence and attenuation throughout the cruise.