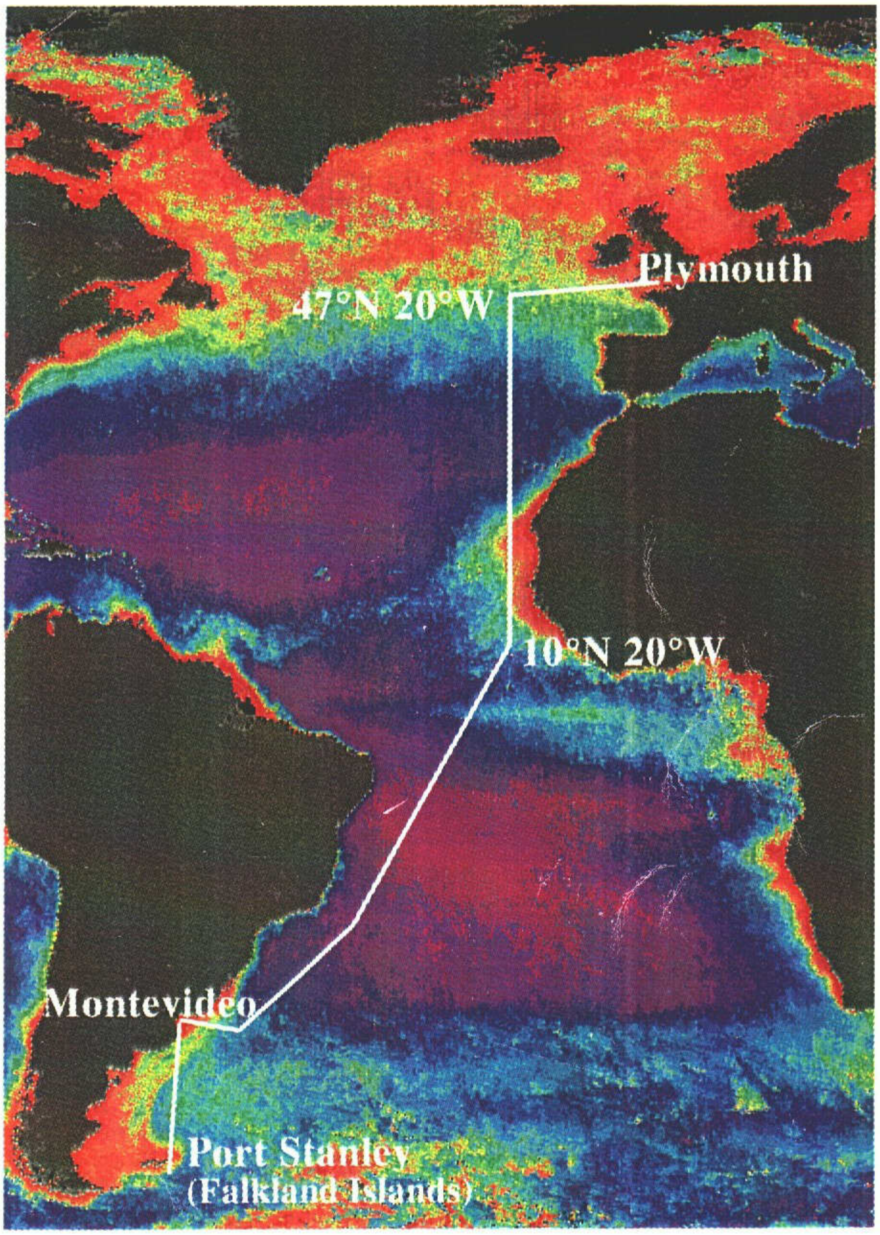
ATLANTIC MERIDIONAL TRANSECT (AMT)



AMT-2 CRUISE REPORT

Atlantic Meridional Transect

AMT-2
CRUISE REPORT

22nd April - 22nd May 1996

Port Stanley (Falkland Islands) to Plymouth (UK)

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ACKNOWLEDGEMENTS

AMT-2 is the second in a series of transects of the Atlantic Ocean using the RRS James Clark Ross, Britain's Antarctic research ship which is operated by the British Antarctic Survey (BAS) on behalf of the Natural Environment Research Council (NERC). The scientific team leading the AMT programme recognise and are most grateful for the level of support which the programme has received from Dr Barry Heywood (Director) and his staff at BAS. Particular thanks go to Frank Curry, John Hall, David Blake, Graham Hughes, Ian Collinge, Kath Nicholson, Mary Sutton, Prof. Andrew Clarke and Julian Priddle, for their continued help and support in ensuring the success of the AMT's to date.

The AMT programme would not be possible without the financial support of NERC. The programme has been supported with funds from NERC Scientific Services, through the offices of Brian Hinde, and more recently from Prof. Brian Bayne, Director of the NERC Centre for Coastal and Marine Sciences (CCMS). We are indebted to both for their strong support and encouragement. We also thank Prof. Fauzi Mantoura (Director), Roger Harris (Strategic Research Project Leader), Malcolm Woodward and colleagues at PML for their encouragement and practical support.

The National Aeronautics and Space Administration (NASA), through Dr Stanford Hooker at the Goddard Space Flight Center (GSFC), supported the programme with equipment and funding from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) project.

Finally, the officers and crew of the James Clark Ross played a most significant role in the success of the scientific programme. AMT-2 was initially under the command of Captain Jerry Burgan (Falklands to Montevideo) and then by Captain Chris Elliott (Montevideo to Plymouth). Both Captains lead an excellent team of officers and crew and we are indebted to them all for their help, support for the science, and friendship.

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1.0 RATIONALE AND AIMS

SECTION ONE

1.1 BACKGROUND

The *Royal Research Ship* James Clark Ross (JCR) is one of the world's most modern research ships. Commissioned in the early 1990's the JCR was designed to meet the scientific and logistical needs of the British Antarctic Survey in fulfilling their duties in the Southern Ocean and around Antarctica. However the ship was also built to meet the demands of the wider oceanographic community by being available to work in other parts of the world during her time away from the Antarctic. Each year the JCR leaves the UK in early autumn to take supplies and equipment to the British bases in Antarctica. The passage from the UK to the Falkland Islands takes about four weeks. On discharging her logistical duties in the early part of the season the JCR undertakes scientific cruises for BAS before completing her logistics programme at the end of the austral summer. As winter closes in on Antarctica the JCR sails for the UK, thus making a second transect of the Atlantic Ocean. At a time when the importance of understanding and improving the definition of broad-scale oceanographic processes is recognised as essential for developing new predictive models, the use of this passage time on the JCR for scientific research is most opportune. Funding from NERC has allowed the JCR to change her normal course to include some important regions of the Atlantic Ocean and to work outside Exclusive Economic Zones (EEZ's).

1.2 AIMS

The primary objective of this research cruise programme is to investigate biological processes in the open Atlantic Ocean over very broad spatial scales (for AMT-2 this was from 50°S to 50°N). The AMT-2 programme forms the second in a series of transects of the Atlantic Ocean which measured physical, chemical, biological and optical variables in the upper 200m of the water column along a 12,000 km transect between the Falkland Islands and the UK. These measurements help in defining important boundaries and regions of greatest plankton abundance and productivity. This is essential in testing hypotheses about biogeochemical processes and what drives them across regions (provinces) in the Atlantic Ocean. This will help further our understanding of the role of the world's oceans in global carbon cycles and is also important for understanding the plankton community structure over latitudinal scales and their role in the global ocean. This programme forms a significant component of two NERC Special Topic PRIME projects; P19: 'The optical characterisation of zooplankton in relation to ocean physics; discrimination of seasonal, regional and latitudinal variations' (Robins, Harris & Pilgrim), and P20: 'Holistic biological oceanography: mesoscale to basin-scale and seasonal studies of phytoplankton processes linked to functional interpretation of bio-optical signatures and biogeochemistry' (Aiken & Holligan). The programme is also meeting the needs of international agencies (e.g. NASA, NASDA & ESA) in their implementation of 'Sensor Intercomparison and Merger for Biological and Interdisciplinary Ocean Studies' (SIMBIOS), a programme to develop a methodology and operational capability to combine data products from the various ocean colour missions. In the longer term the AMT project aims to enhance our ability to model global primary production (at basin scales) and to help develop ecosystems dynamics models which will be important for our ability to forecast change.

1.3 SPECIFIC OBJECTIVES

This cruise formed the second of a series of Atlantic transects, initially over 3 years, to acquire data for the calibration of remotely sensed observations and the validation of remote sensing. products, leading to improved and more accurate interpretation of remote sensing observations. One of the primary objectives of the AMT programme is further understanding the interaction between physical processes and biological production. This will be essential for interpreting basin scale productivity and in leading to a new generation of advanced models. Testing hypotheses on the partitioning of the ocean into biogeochemical provinces, and defining these regions, is central to the overall objectives of the AMT programme.

The primary objectives of AMT-2 remained similar to those for AMT-1:

- To improve our understanding of the relationship between physical processes and biological production
- Identify, define and quantify latitudinal changes in biogeochemical provinces
- Determine phytoplankton characteristics and photosynthetic parameters
- Identify nutrient regimes and their role in biogeochemical cycles
- Characterise plankton community structure, including the accurate determination of carbon values (to JGOFS protocols)
- Relate the partial pressure of CO_2 (pCO_2) in surface waters with the biological production
- Acquire data for the calibration of remotely sensed observations (primary validation)
- Secondary validation of remotely sensed products (e.g. chlorophyll concentration)
- Interpret basin-scale remote sensing observations
- Develop models that enable the interpretation of satellite imagery in terms of total water column properties

2.0 ITINERARY AND NARRATIVE

SECTION TWO

2.1 ITINERARY

Thursday 18 April	Travel to Brize Norton: RAF flight to Falklands.
Friday 19 April	Arrive Mount Pleasant, transfer to Stanley
Saturday 20 April	Start installation of scientific equipment
Monday 22 April	Sail for Montevideo
	Underway sampling and daily station work from the Falklands to Montevideo.
Friday 26 April	Dock at Montevideo
Sunday 29 April	Sail for UK via 10°N 20°W & 47°N 20°W
	Underway sampling and daily station work
Wednesday 22 May	Dock in Plymouth, personnel disembark
Thursday 23 May	JCR/BAS/AMT exhibition/reception
	Equipment to stay onboard when the ship departs Plymouth for Grimsby
Tuesday 28 May	Unload equipment in Grimsby

2.1 NARRATIVE

The end of season schedule for the James Clark Ross (JCR) had been changed prior to the arrival of the AMT-2 scientific party in the Falkland Islands. This rescheduling, due to changes in end of season logistical work undertaken by both the JCR and Bransfield, had resulted in the JCR arriving in Port Stanley earlier than originally programmed. This meant that when the AMT-2 team arrived in Stanley they were able to board the ship immediately and start to set up scientific equipment. This process lasted for the weekend 21-22 April, which also saw official celebrations for the Queen's birthday. The much anticipated 'fly-past' over the JCR in Stanley Sound consisted of a C130 transport plane with a Tornado jet fighter on each wing-tip. Unfortunately the 'Top-gun' type flying displays were notable by their absence - as were the penguins!

The JCR was scheduled to sail from Stanley on Tuesday 23rd April, however the early arrival in Port Stanley and the good progress made in setting up the AMT scientific equipment allowed the JCR to sail early on the morning of Monday 22nd April. Before leaving the shelter of land, the optics rig and instrumentation were deployed and tested in the safety of Stanley Sound. An important part of this exercise was to ensure that the optics rig was perfectly balanced for optimal deployment. In contrast to the exceptionally fine and lucky weather encountered on the start of AMT-1, those onboard for the start of AMT-2 were thrown in at the deep end. By 16.00 GMT on the first day the JCR was in force 8 gale with rough seas and air temperature around 5°C. Underway sampling commenced as soon as the ship was clear of land and a test station was carried out to thoroughly test the CTD rosette system. The first full scientific station was scheduled for Tuesday 23rd. The leg from Stanley to Montevideo was dogged with technical problems to both the UOR and the optics instrumentation. Subsequent analysis and evaluation showed that the UOR had an over active alternator, which had caused severe damage to other components of the vehicle's instrumentation and a Satlantic optics unit had flooded, causing the loss of one complete system, because of what later transpired to be a faulty casing. As is so often the case with such failures, those onboard, with support and encouragement from colleagues on shore, persevered with diagnostic tests, modifications and eventual solutions. However the lack of technical documentation, particularly for systems developed in-house, is something which must be addressed as a high priority for future cruises. It was only with the expert help of BAS technical staff that some failures were resolved and later in the cruise that some instrumentation was recommissioned.

One notable feature of the first leg was a very sharp rise in temperature (6°C) as the transect crossed from the Falklands current into an eddy from the Brazil current. The report of this sharp change in temperature was soon confirmed from satellite images, originated in Miami and sent to the JCR via the PML Remote Sensing Centre.

The arrival of the JCR in Montevideo was the welcome end of a 4 month tour of duty for the officers and crew of the JCR. Captain Jerry Burgan and the ship's compliment had joined the JCR after Christmas and had experienced long periods of bad weather during the BAS Marine Life Science Division scientific cruise to South Georgia (January - February). It was clear that this had been a hard season and everyone was looking forward to a well earned period of leave. For the AMT-2 team it was a slightly odd experience watching everyone get excited about going home, just as we started our work! However the arrival of the new crew, led by Captain Chris Elliott, was an opportunity to reacquaint ourselves with the JCR crew who had brought many of us down on AMT-1. Our scientific programme required that pressure to stay in Montevideo for a few more hours was resisted and the ship sailed ahead of schedule from Montevideo (as it did on AMT-1); the captain did not lose another opportunity to remind the chief scientist that this was the second time he had ruined a potentially good day in Monte!

The course set on leaving Montevideo was almost due east in order to ensure that the AMT-2 sampling was extended as far south as possible for the Montevideo - UK leg in order to allow extrapolation of transect data between the break in transect either side of Montevideo. This meant that for AMT-2 the transect was extended further south than for AMT-1. However from available data it may appear that this extension to the UK to Montevideo part of the transect is more important on the southbound AMT's than the northbound. The early part of the Montevideo to UK leg encountered further bad weather and tested the resilience of personnel and robustness of equipment. However little was compromised in terms of sampling and data acquisition during this time.

Once AMT-2 got further north into the Brazil current a reoccurring problem with the ADCP was identified. Various causes were suggested to explain the ADCP not giving 'good' data. Initial thoughts included wire vibration from towing the UOR was responsible, this evolved into 'noise' from the UOR servo, together with an element of ship's speed. However, after some consideration, and trials involving the presence or absence of various components to eliminate individual possibilities, the cause was identified as predominantly the very low abundance of particulate material in the water, particularly zooplankton.

Whilst the southbound AMT-1 was notable for the good rate at which it progressed south, the northerly course of AMT-2, encountered and was hindered by, many of the prevailing conditions which had helped AMT-1. Notably the Brazil current and the north east trade winds, both of which are against the JCR on the northbound leg. Both were factors in slowing progress on AMT-2. Because the time of arrival in the UK was fixed due to a VIP reception in Plymouth, the progress and daily 'distance to go' (DTG) were closely monitored from Montevideo and to some extent determined some of the scientific priorities. Towing the UOR was significantly reduced from the strategy implemented on AMT-1, to a short 3-4 hour tow after the morning station, concentrating this part of the programme on the UOR optical measurements and not on fully characterising the physical structure each side of the daily station. Defining the physical structure was in part already being achieved by the XBT sections. This allowed the ship to make passage at greater than 12 kts when conditions allowed and was essential in meeting scheduling criteria towards the end of AMT-2.

Additional sampling, between 15° south and 10° north, was carried out by adding a second station during the evenings, doubling data frequency for some measurements. This was in response to preliminary results from AMT-1 where some of the daily data sets were limited in resolving important features across the equatorial region. Although the additional sampling incurred some time costs, it was useful in improving resolution across the equatorial upwelling and current systems, one of the major physical features of the transect. In the region north of the equator, the sampling strategy was modified to take account of territorial waters (EEZ's) through the upwelling off west Africa, as it had been with AMT-1

By the time the JCR reached the Canary-Azores region it was possible to programme in the AMT-2 sampling strategy for the UK shelf sea where a high priority was to guide the JCR through a coccolithophore bloom, which are fairly regular at that time of the year in the Celtic Sea. Remote sensing images were faxed to the ship to help plan and schedule the rest of the transect. As the JCR approached 40° north it had been possible to target a coccolithophore bloom south-west of the Isles of Scilly. However the time of sampling in this bloom was critical for optical measurements and back calculations were made to ensure that the run in from 20° west was optimised to arrive at the bloom site in daylight hours. This calculation resulted in leaving 20° west at about 44° north. Although the AMT preferred option is to sample 47° north, 20° west, the progress of AMT-2 north along 20° west would have put the JCR on 47° north at around midnight. This would have precluded many of the core AMT measurements (e.g. optics and production) and so the option to leave 20° and ensure optimising the time in the coccolithophore bloom was taken.

The arrival in the Celtic sea was co-ordinated from the ship with members of AMT team in PML who arranged an over-flight with the NERC aircraft to support airborne remote sensing of the coccolithiphore bloom. The aircraft was given a course the JCR was to follow through the bloom, while it made a series of optical measurements. The bloom was subsequently found and a series of measurements made for sea truth data of remote sensing. The intense sampling activity associated with the coccolithophore bloom in the Celtic Sea marked the end of station work while the underway sampling was continued in the English Channel. Arrival in Plymouth was on time and the JCR entered Plymouth Sound on Wednesday 22nd May under grey dank cloud and drizzle - hardly a fine spring day! On docking in the Royal Naval Port of Devonport,. the scientific areas of the ship were transformed into an AMT display and exhibition area, accompanied by BAS MLSD and Geophysics displays in the saloon and conference room together with BAS logistics displays on the bridge. On Thursday 23rd May a VIP reception was held onboard highlighting a year in the life of RRS James Clark Ross, focusing on the season just completed which started with AMT-1, included the BAS scientific programme during the season south and which had just ended with AMT-2. The NERC chief executive was present, together with senior naval officers and a selection of other guests.

The completion of AMT-2 with virtually a complete data set, was in no small part due to the efficiency and support of the ships officers and crew. For the second time, the AMT had not lost any time due to bad weather or ships problems. The scientific achievements of any cruise ultimately rests on the shoulders of those onboard. The AMT-2 team, listed below, represented a blend of experienced sea-going expertise and young scientists. They achieved everything they set out to achieve, which is a great testament to their abilities, particularly given the weather conditions and technical problems. The younger team members will have learnt much and it is now up to all of the team, and their colleagues who were not onboard, to maximise using the scientific data gathered to ensure the programme progresses for the future.

2.3 AMT-2 PERSONNEL

From PML:

DAVID ROBINS
TONY BALE
GERALD MOORE
ALAN POMROY
NIGEL REES

University of Plymouth (UoP):

CHRIS GALLIENNE
GUY WESTBROOK (Stanley to Montevideo)

Southampton Oceanography Centre (SOC):

PROF. PATRICK HOLLIGAN
EMILIO MARAÑÓN

University of Reading (UoR):

GAVIN REEDER

Centro Oceanografico de La Coruña, Spain

MANUEL VARELA

JRC-ISPRA; Italy

JOHN DOYLE

University of Warwick (UoW):

NICK FULLER

BAS:

PAUL WOODROFFE
GRAHAM BUTCHER

2.4 Figure 1. CRUISE TRACK FOR AMT-2

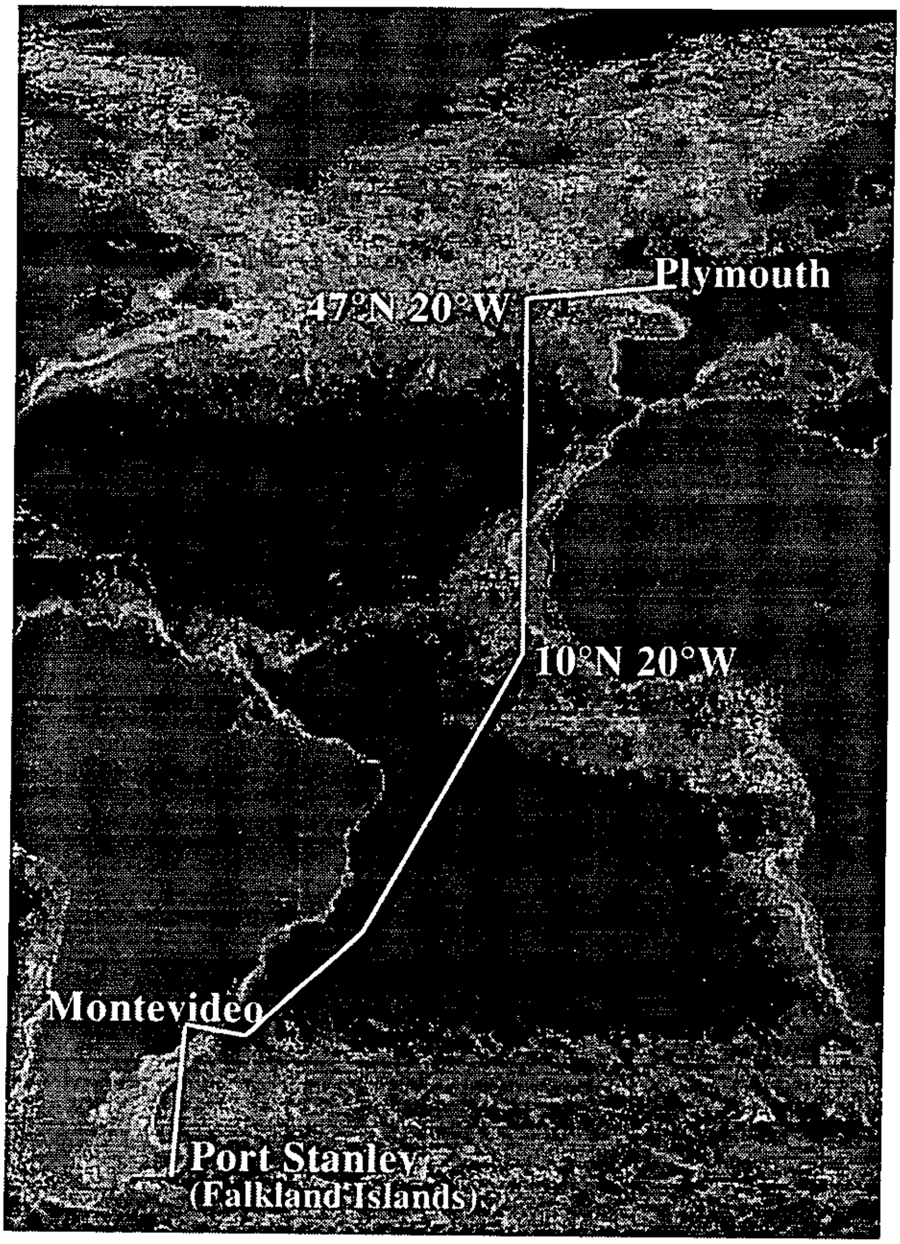
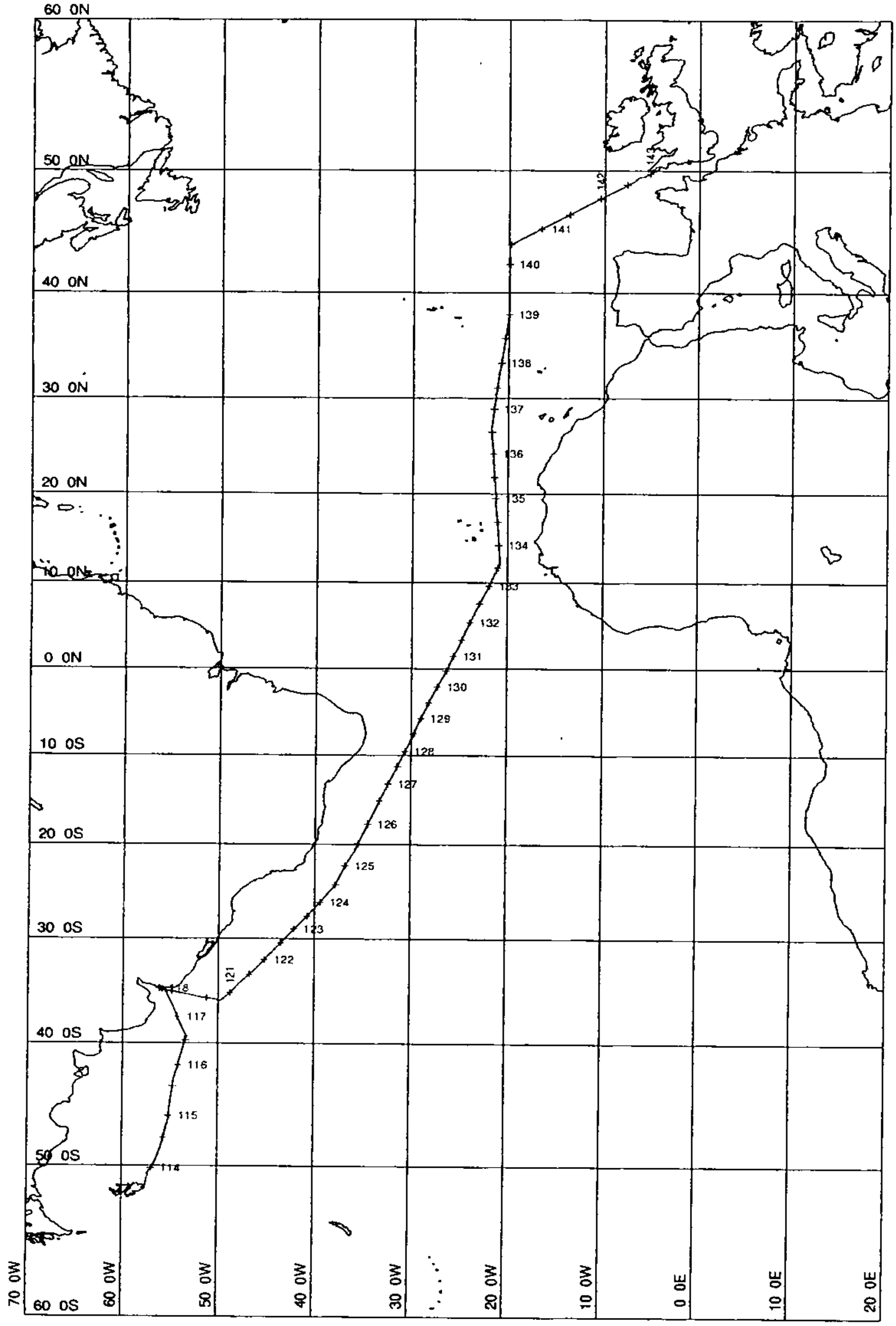


Figure 2 (over): AMT-2 stations - plotted on a Mercator Projection of the Atlantic Ocean. Following the station plot are two colour plates (**Figure 3**): (a). Satellite data of sea surface temperature along the South American coast and down to the Falkland Islands, which shows the 6°C change in surface temperature SE of Montevideo. (b). RS images of a coocolithophore bloom off the Southwest coast of Cornwall as the JCR sailed towards Plymouth (cruise track in white). The inset plot (top right) shows the series of stations as the AMT cruise track was changed to sample into the coccolithophore bloom.



MERCATOR PROJECTION

SCALE 1 TO 55661934 (NATURAL SCALE AT LAT. -0)

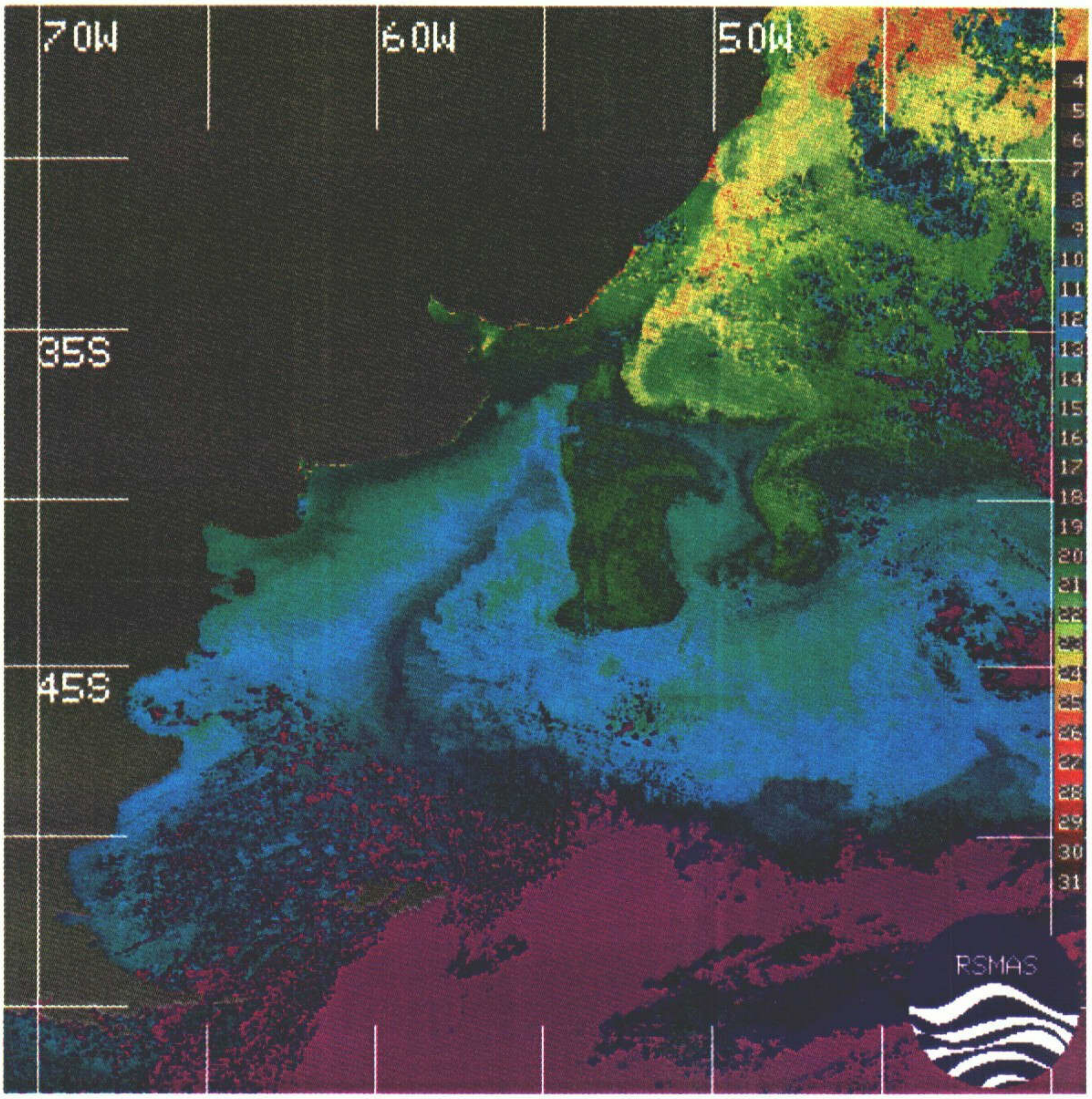
INTERNATIONAL SPHEROID PROJECTED AT LATITUDE -0

GRID NO. 1

— Track plotted from bestnav

Ship's track during AMT2 Cruise

FIGURE 2



Sea-surface temperature 22 April 1996

FIGURE 3(a)

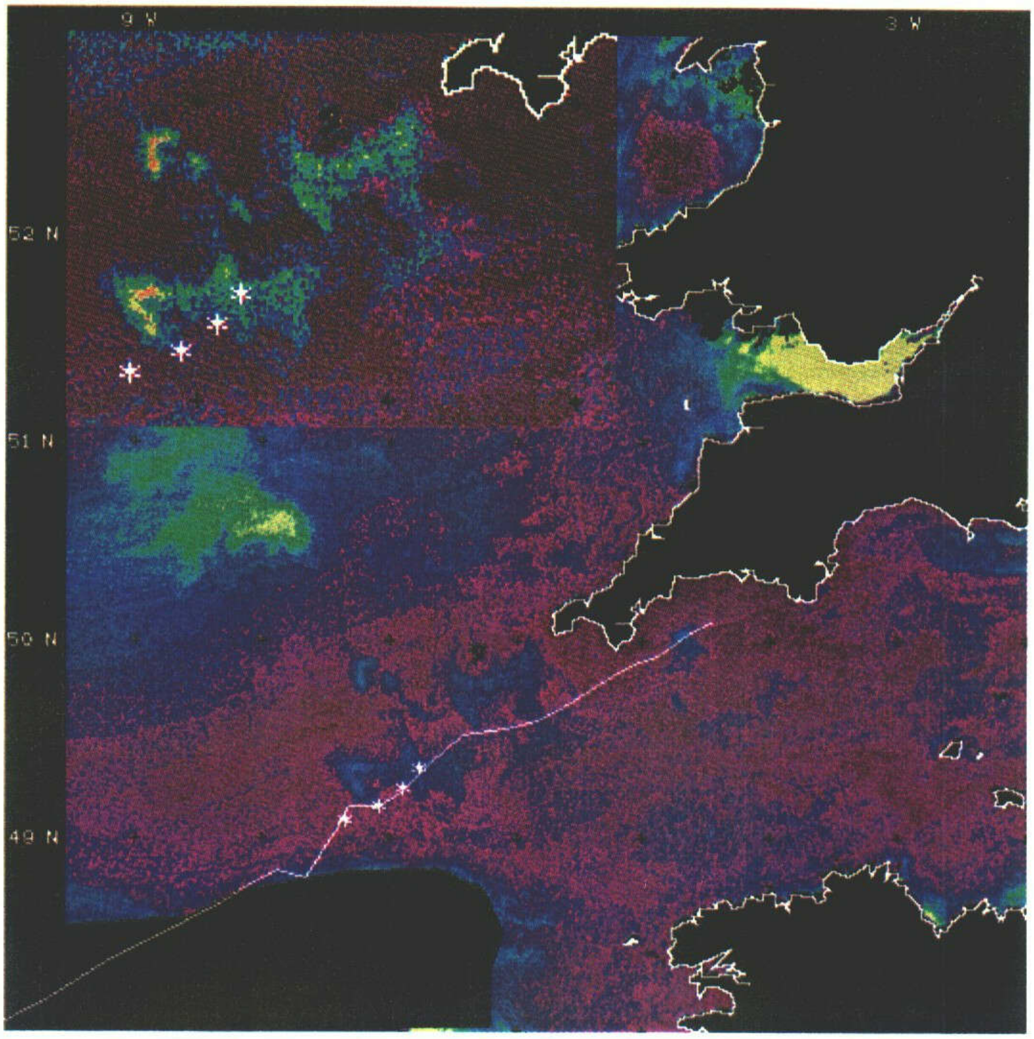


FIGURE 3(b)

3.0 PROGRAMME METHODOLOGY AND APPROACH

SECTION THREE

3.1 STRATEGY

The research strategy for the cruise has brought together 'state of the art' marine technology with well established methodologies for investigating oceanographic processes at the basin scale. A combination of this approach, together with the spatial scales resulting from the transect, provide a unique opportunity to improve our understanding of biological oceanography and interpretation of remote sensing.

The AMT programme has dual sampling strategies: Underway sampling of surface water (7m) while the ship steams at about 11.5 knots, and a daily station which lasts up to 2 hours. On station, a range of parameters were measured by vertical profiles (to about 200m) and discrete samples taken for further analyses. The timing of the daily station was changed from AMT-1. On the first AMT the timing of the station was optimised for the optics programme. This meant aiming to stop the ship as close to local solar noon as possible. This resulted, for the sake of routine, in the stopping at around 13.00 ship's time on AMT-1. Although this optimised protocols for optical work, it was less than optimal for other parts of the AMT programme, notably the primary production experimental programme. Therefore the strategy for AMT-2 was revised to bring the timing of the station forward to the earliest suitable time for optics protocols in order to improve the length of time available for productivity experiments. The result was a daily station each morning at around 10.00 local ships time.

3.2 METHODOLOGY

Physical measurements

During the passage of the JCR the Undulating Oceanographic Recorder (UOR) was towed out of the station area. This provided contoured vertical sections of physical structure for the top 100m in the waters adjacent to each station. Continuous underway surface logging of temperature and salinity were used to relate the daily station measurements to the wider physical structure of the Atlantic Ocean. Expendable Bathy-Thermographs (XBT's) from the UK hydrographic office were deployed throughout the course of the transect to record temperature profiles to depths of 700m. The Acoustic Doppler Current Profiler was used to provide data on current velocities and direction.

Optical and bio-optical measurements

Measurements were taken to determine the optical attenuation coefficients of the water and its reflectance both above and below surface. In addition to providing physical measurements, the UOR was fitted with a set of precision light sensors to measure the vertical structure of optical properties at SeaWiFS wavelengths. The surface reflectance of the water was measured by a deck mounted spectro-radiometer, a measure that is directly compatible with satellite imagery. The absorption and attenuation of the water was measured continuously by the NASA AC/9 instrument coupled to the non-toxic seawater supply. On station, optical properties was measured from vertical casts using the NASA multi-spectral profiling rigs (at SeaWiFS wavelengths). The instruments was not calibrated daily with the new NASA SeaWiFS Quality Measurement System (SQM) due to technical faults with the system.

In addition to these measurements, on station measurements of atmospheric optical properties were made with the JRC sun photometer, these results will allow a full simulation of satellite imagery.

Chemical and biological measurements
Samples for chemical and biological analyses (nutrients, autonomous pCO_2, POC & PON, chlorophyll, pigments, size fractionated production, phytoplankton, microzooplankton and zooplankton carbon, community size structure and taxonomy) were taken on either surface profiles between stations or vertical profiles at each station, or both. Nutrients (nitrate, nitrite, phosphate and silicate) were analysed onboard using a 4 channel Technicon segmented-flow auto-analyser. Chlorophyll samples were extracted using acetone and analysed by fluorometry onboard. Samples for pigment analysis (HPLC) were taken and frozen in liquid nitrogen for subsequent analysis in the laboratory. Size fractionated primary production experiments were conducted at each station and ^{14}C analyses were partially performed on-board. Bacterial abundance and production were carried out by on board experimentation. Samples for various size fractions and total C/N were taken for the size range <1μm to zooplankton over 1000μm in accordance with JGOFS protocols. These samples were processed on-board in preparation for analysis back in the laboratory. Samples for phytoplankton, microzooplankton and zooplankton distribution and composition were also taken and preserved on the cruise for analysis by microscope back in the laboratory. The ships ADCP was used for logging zooplankton distribution and abundance from back-scatter. Automated analysis was carried out towards the end of the transect in the region of the coccolithophore bloom for particle size structure and concentration (Coulter Multisizer). Zooplankton community size structure (Optical Plankton Counter and high speed video camera) was carried out along the whole of AMT-2.

3.3 PROGRAMME OF RESEARCH
On leaving the Falkland Islands surface mapping was started and logged underway for a standard suite of sensors (e.g. temperature, salinity, fluorescence, pCO_2 , irradiance). The non-toxic sea water supply was run continuously for regular discrete samples of other physical, chemical and biological measurements. The main screening mesh for the non-toxic supply was replaced with 6 mm mesh to allow underway sampling for zooplankton.

The ship sailed from the Falklands to Uruguay (see AMT-2 cruise track) stopping for a station each day. On arrival in Montevideo liquid nitrogen was taken onboard for the preservation of pigment samples. On leaving Montevideo the course stayed outside Brazilian waters and headed for 10°N, 20°W, then sailed north, through the Mauritanian upwelling off west Africa (at about 20°N) along 20°W to 44°N 20°W. The ship then change course for Plymouth. The ship completed extra stations and minor deviations from its course into UK shelf waters to allow responsive sampling directed from ship and shore with information from remote sensing observations. The

NERC aircraft was used for over-flights of the Celtic Sea to coincide with the JCR transect.

Each day around mid morning (local time) the ship will stop to acquire a series of vertical profiles, using the CTD-rosette system for discrete water samples from selected depths, optical rig profiles and plankton net hauls. These data will provide a spatially extended set of detailed analyses of the surface waters (upper 200m) of the Atlantic in relation to ocean optics and remote sensing measurements. These stations will be linked with the surface underway sampling to map the changes between stations.

3.4 SAMPLING

CTD and discrete vertical sampling

Measurements of temperature and salinity were obtained from vertical profiles using a Neil Brown Mark IIIB (Instrument Systems, Inc.) CTD instrument with a rosette sampling system, fitted with 12 (10 l) General Oceanics water bottles. The CTD system was deployed to 200m (where depth allowed) at each station. Two deployments were made at each station. The first was to 200 m and water samples taken for a range of analyses and experiments. The system was deployed a second time primarily to collect water from a reduced number of depths in order to obtain a complete set of analyses. The CTD system used did not have a fluorometer fitted and so a second CTD/F system was deployed simultaneously with the CTD-rosette system in order to provide 'real time' fluorescence profiles, against which water bottle depths were selected. Accurate temperature readings were also recorded from the two reversing thermometers (RTM 4002; manufactured by Sensoren-Instrmente Systeme) fitted to the Rosette system. These thermometers were used to record temperature, accurate to three decimal places, on the surface and deepest bottle of one of the two profiles.

4.1 XBT - TEMPERATURE PROFILES: *(Nigel Rees)*

175 Sippican Mark 7 XBT's were deployed during the AMT-2, the probes yield a trace of temperature against depth to a depth of 760 m. A study of the results of the data set provide fundamental background information on the deeper physical structure of the Atlantic Ocean (figure 4). The probes were deployed at regular intervals @ 0600, 1100, 1700, 2300 (local) ships time, during the transect. Three regions were 'targeted' as being of special scientific interest, the confluence of the Brazil and Falkland currents at the Sub-tropical front circa 46° to 39°S (figure 5), the Equatorial upwelling from 5°S to 7°N , and the entry of water transported by the Azores current, into the North Atlantic current circa 36°N. In these regions the frequency of XBT deployments was increased to provide a detailed study of the physical changes occurring in the water column. A summary of the XBT deployments during AMT-2 is provided below.

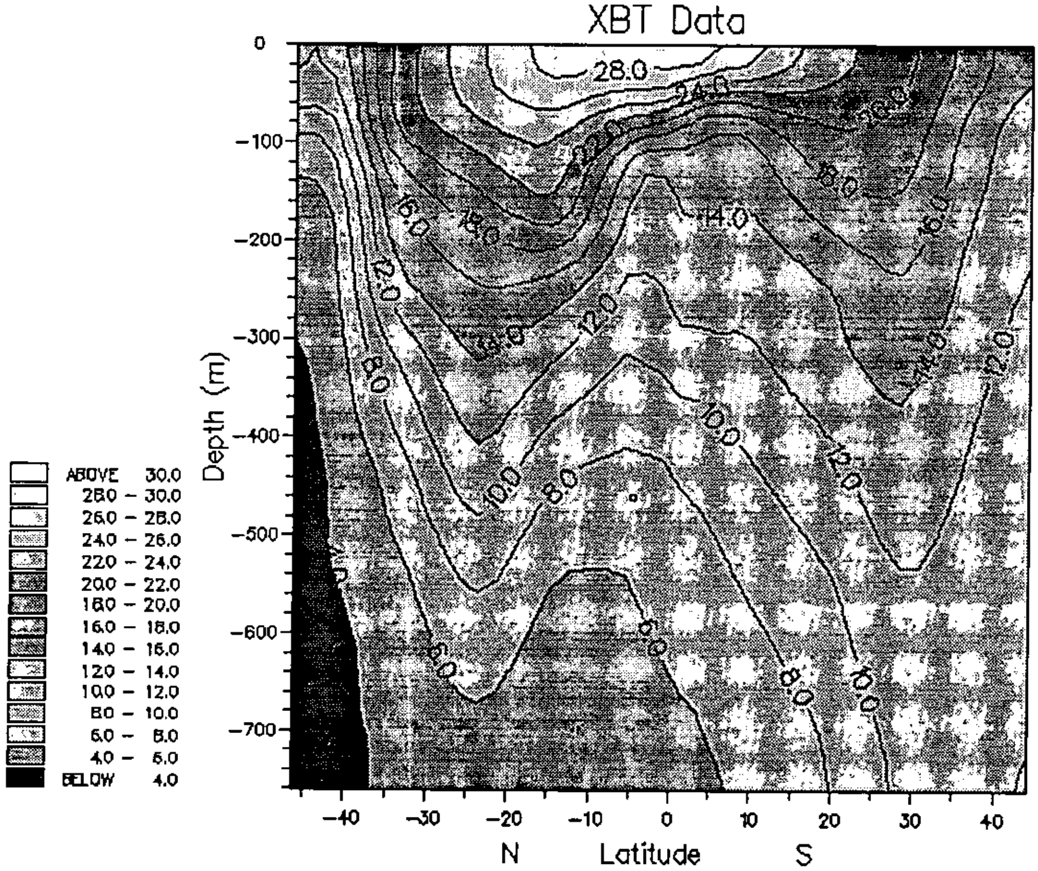


Figure 4. XBT contour plot of temperature (surface to 700m) for AMT-2

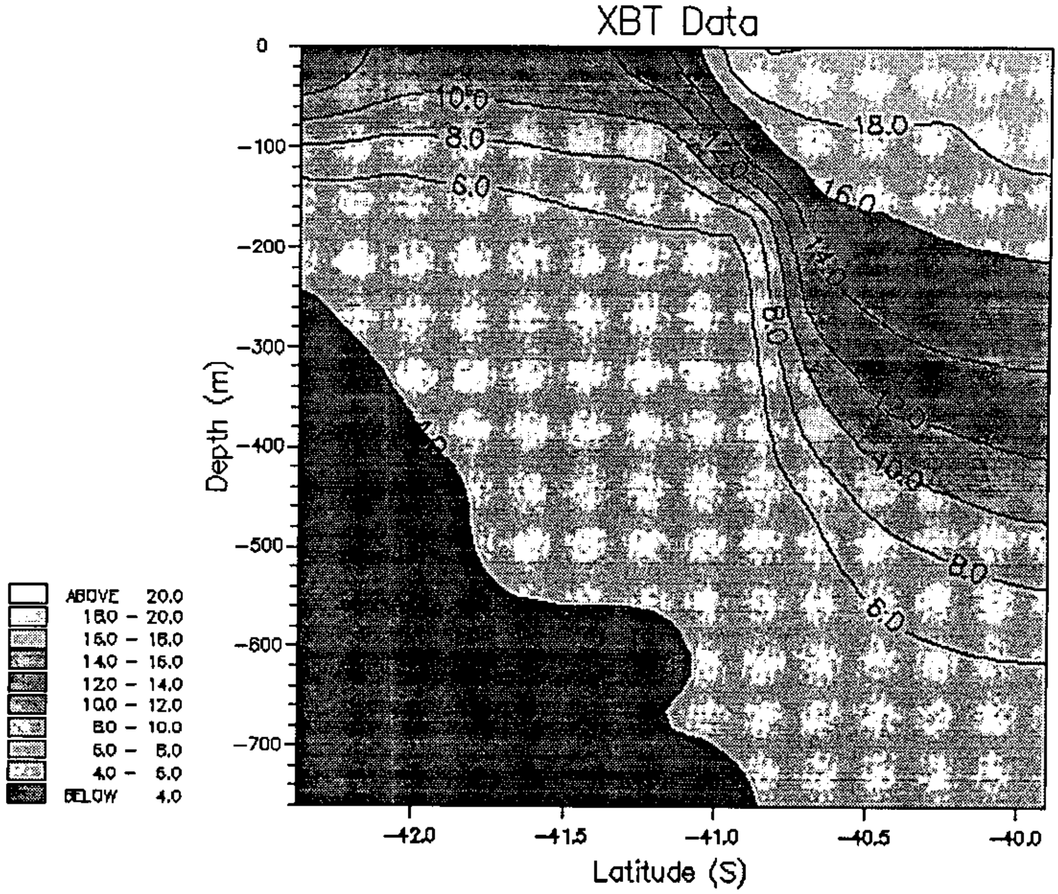


Figure 5. XBT temperature contour plot of the confluence of the Falkland and Brazil current, as also shown from satellite image, where a strong temperature gradient of 6°C was observed

4.2 ADCP - ACOUSTIC PROFILES: *(Nigel Rees)*

The ADCP is an instrument primarily designed to measure the direction and speed of ocean currents. By emitting four acoustic pulses at 45°angles to one another, an ADCP can resolve the Doppler shifted reflected pulses into vector components, i.e., water velocity and direction. The ADCP used during AMT-2 emits at 250 KHz, which is preferentially back-scattered from particles of the approximate size of zooplankton in the water column. The daily cycle of vertical migration exhibited by zooplankton, from surface to deeper water at dawn returning at dusk, affected the strength of signal received from back-scatter. In the oceanographic desserts, during the daylight hours, the ADCP received signals that could be resolved into its vector components only when the vessel was stationary (on station). The data from the ADCP was partially processed at sea, selected sections of the cruise have been processed further in the laboratory, figure 2 shows the currents from Port Stanley to Montevideo at a depth of 45 m.

4.3 SALINITY AND TEMPERATURE CALIBRATIONS: *(Tony Bale)*

Temperature and salinity readings given by both the SBE thermosalinograph which monitors the ships pumped supply and the Neil Brown CTD instrument, were checked by comparison with precision reversing thermometers and with salinity samples. The conductivity of the salinity samples was measured using the Autolab precision salinometer calibrated, according to the manufacturers instructions against standard sea water which had an accurately known conductivity ratio. Temperature readings and salinity bottles were taken from the 7m CTD bottle on every station from SDY 114 to SDY 133. These covered the temperature range of 7.4 °C to 28.6 °C. The measured salinity (psu) ranged from 34.00 in the South Atlantic to 37.34 in the tropics. Simultaneously with the CTD sample at the surface, a second salinity bottle was taken from the ships pumped supply.

The results of the calibration exercise are given in Table 1 for the Neil Brown (CTD) instrument and in Table 2 for the SBE system. The salinity values derived for samples from the pumped supply and from the co-incident 7m bottle were virtually identical at every station.

Table 1. CTD values checked against Autolab and Hg thermometer

station	CTD salinity	true salinity 7m bottle	CTD error	CTD temp	Hg temp	CTD temp error
114	33.993	33.978	0.015	7.339	7.336	0.003
115	34.037	34.022	0.015	12.787	12.765	0.022
116	35.914	35.904	0.010	19.102	19.097	0.005
120	36.073	36.054	0.019	20.759	20.72	0.039
121	35.815	35.796	0.019	20.49	20.45	0.040
122	36.379	36.358	0.021	23.287	23.27	0.017
123	36.678	36.659	0.019	24.547	24.52	0.027
124	36.829	36.811	0.018	25.186	25.17	0.016
125	37.339	37.321	0.018	27.353	no data	no data
126	37.286	37.267	0.019	28.148	28.13	0.018
127	36.701	36.683	0.018	28.49	28.47	0.020
128	36.409	36.389	0.020	28.58	28.56	0.020
129	35.739	35.725	0.014	28.376	28.35	0.026
130	35.954	35.937	0.017	28.472	28.45	0.022
131	35.432	35.391	?0.041	28.644	28.55	?0.094
132	35.959	35.941	0.018	26.767	26.74	0.027
133	36.056	36.041	0.015	26.129	26.11	0.019

Because of the close-coupling between the CTD values and the corresponding bottle samples, the differences between the instrument and calibration salinity's, apart from one outlier, are very consistent at +0.017 ppt (17 ppm) with a SD 0.003 ppt. That is, on the basis of this calibration, CTD salinities were reading 0.017+/-0.003 ppt high. CTD temperatures, relative to the precision thermometers were typically 0.02-0.03 degrees C high.

Because of the nature of the pumped supply, the relatively large volume of the pipe and finite flushing time, it is much more difficult to collect representative samples from this system (NB future samples will be taken from the SBE TS cell effluent discharge and timed). However, despite the scatter and ignoring a number of outliers, the calibration results obtained here indicate that the errors are small, typically - 0.013 to + 0.017 ppt, and may vary with temperature or salinity since slightly negative salinity errors tend to be associated with low salinity, low temperature waters and positive errors with high salinity's and temperature.

Table 2. Ocean logger TS values checked against Autolab and Hg thermometer

station	Ocean L. salinity	TRUE salinity	error on Ocean L.	Ocean L. temp	true (Hg) temp	error on Ocean L.
114	33.986	33.978	0.008	7.31	7.336	-0.026
115	34.009	34.022	-0.013	13.39	12.765	
116	35.891	35.904	-0.013	19.07	19.097	-0.027
120	36.054	36.055	-0.001	20.73	20.72	0.010
121	35.772	35.796	-0.024	20.42	20.45	-0.030
122	36.305	36.358	-0.053	23.27	23.27	0.000
123	36.716	36.659	0.057	24.65	24.52	0.130
124	36.84	36.811	0.029	25.21	25.17	0.040
125	37.36	37.32	0.040	27.42	no data	no data
126	37.325	37.26	?0.065	28.21	28.13	?0.080
127	36.695	36.682	0.013	28.55	28.47	?0.080
128	36.406	36.39	0.016	28.6	28.56	0.040
129	35.729	35.724	0.005	28.38	28.35	0.030
130	35.942	35.93	0.012	28.49	28.45	0.040
131	35.403	35.362	0.041	28.62	28.55	0.070
132	35.925	35.942	-0.017	26.86	26.74	?0.120
133	36.044	36.039	0.005	26.17	26.11	0.060

4.4 UOR Operations: *(Tony Bale, Gavin Reeder, Gerald Moore, John Doyle)*

The Undulating Oceanographic Recorder (UOR), a towed body capable of deploying a number of sensor packages through an undulating profile in the surface waters at passage speeds, was deployed on AMT-2. The UOR used for this work was a PML 'Nu Shuttle' (801 & 802) fitted with micro-processor controlled servo and data logger. A standard PML instrument package (CTDF) was deployed in the body along with Satlantic light sensors for up and down-welling light measurement at six visible wavelengths (Ed 412, 443, 490, 510, 555, 670, 700 & Lu 412, 443, 490, 510, 555, 670, 683) which correspond to SeaWiFS satellite bands. The servo also monitored and logged pitch and roll so that light measurements could be screened using body attitude criteria. With the configuration employed on AMT-2, i.e. 400m of plain, 8mm towing wire and at a speed of 12.0 kts, a depth range of 15-80m was obtained. Maximum wire strains were of the order of 700-900 Kg at this speed.

The original objective was to deploy the undulator for 7-8 hours either side of the daily station in order to extend the description of temperature, chlorophyll and the light field over a broader spatial scale than provided by the single, daily, vertical profile. In the event, mainly because of pressure on time and the need to achieve a higher speed than the 12 kts maximum allowed for towing, the amount of UOR work was reduced. Continuous towing was carried out over the Equatorial up-welling region (Tows 15-24 see the summary of UOR tow information given in the attached table) but, otherwise, the routine consisted of about 3 to 4 hours of UOR observation either side of the daily station. North of the Equatorial region, the UOR was only towed once a day for 3 to 4 hours over solar noon. This was undertaken immediately following the daily vertical profile and was principally to characterise the light field using the Satlantic light sensors. For much of the time the UOR would not have been able to sample sufficiently deep to describe the chlorophyll maximum or thermocline.

From Montevideo to Plymouth, data was obtained from every deployment except Tows 21 and 31 (see Table 1). No data was acquired between Stanley and Montevideo because of technical problems caused by an alternator which was producing an excessively high voltage. This was replaced in Montevideo and the burnt out regulator circuitry was repaired and replaced. The failure on Tow 21 was because the instrument was deployed with the memory card switched to 'write protect'. A chlorophyll fluorometer failed at the start of Tow 26 but was replaced with a spare for Tow 27. The 801 body was damaged during recovery on Tow 30 which resulted in it failing to undulate on Tow 31. The body was replaced by 802 for the rest of the cruise. A long tow (12 hrs) was attempted as we crossed the shelf break and measurement of the feature was accomplished although the body ceased to undulate about three hours before it was due to be recovered. The servo failed in full climb.

Data was processed to a first level in real time using Systat routines and contoured plots of salinity, chlorophyll and temperature are available for every tow. Examples of contoured results for the period of continuous towing across the Equatorial region are given with this report. In addition, the optical properties: Kd, in-situ fluorescence and reflectance at the wavelengths measured were derived.

4.5 CORE OPTICS: *(Gerald Moore, Gavin Reeder & Tony Bale)*

4.5.1 INTRODUCTION

The primary objective of the profile optical measurements on AMT-2 was to determine the optical properties of the water column to an accuracy suitable for calibration of the SeaWiFS sensor (which is to be launched in late 1996 - early 1997). With the absence of a suitable ocean colour sensor for AMT-2, results were to be used for algorithm development. However, AMT-2 provided a chance to test field calibration equipment and protocols for the primary calibration/validation (Cal-Val) activities planned for AMT-3 or AMT-4.

To meet these aims the optical instrumentation was enhanced for the AMT-2 cruise, with the following equipment:

1) The SeaWiFS Quality Monitor (SQM) field calibration source;
2) Concurrent Tilt and Roll measurements;
3) Concurrent CTD, Chlorophyll Fluorescence and Beam Transmissometer.

lumen
Soli → rad
/data/sdb/ch133

irrad : L^rad;t

Chlorophyll data

ve9970102 BEØ6ØA.

The use of the SQM will be essential for future cruises if the goal of ±5% absolute measurement is to be achieved; instruments commonly show drifts of this magnitude for pre versus post cruise calibrations. The orientation of the optical sensor rig is similarly important for near surface extrapolation. The concurrent measurements of CTD, chlorophyll fluorescence and beam transmissometer are essential for providing a check on water or ship movements, between the CTD bottle cast and the optics cast. In addition the ability to rapidly deploy the optics profiler proved invaluable for determining bottle depths.

4.5.2 OPERATIONS SUMMARY

The profiling rig was upgraded from AMT-1 to include CTD, fluorometer, transmissometer and tilt and role sensors. As in AMT-1 the data logging computers were set-up in the UIC room. The balance of the rig was reset to account for the new equipment on departure in relatively calm water, at the same time a full test of all the equipment was carried out. To reduce pre soak times, the rig was stored in shade just adjacent to the rough workshop. Although this approach may not be successful in polar waters where wind cooling may be significant, over the AMT-2 transect the optics rig was found to be within 2°C of the water temperature (as determined by the CTD thermometer) over the entire transect. The winch was capable of operation on two speeds (10m/minute and 50m/minute). The fast speed capability was not used on AMT-1 due to communications problems and the longer pre-soak required because the rig was kept on deck exposed to direct sunlight. In AMT-2 with the provision of dedicated radios and a knowledge of the rig temperature, it was possible to use the higher speed to provide rapid CTD / fluorescence profiles that were used to determine bottle depths. On the down cast the rig was lowered to 10 m at slow speed and then to the end of the profile (usually 200m) at high speed. This approach enabled the CTD / fluorescence profiles to be available within 5-8 minutes of deploying the rig on station. The approach also had the advantage of allowing the upcast to be delayed to avoid cloud effects without affecting time on station.

Despite the problems with hardware described below, the organisation of optics profiles had a common timing and are listed below. Aspects such as washing the equipment are omitted.

1) Pre Deployment Checks
   - Night time MVDS Dark
   - Check rig for security of cables and equipment (Pressure cycling seemed to loosen the screws in the Satlantic OCR).
   - Check logger / CTDF batteries
   - Check radio batteries

2) Deployment set-up - 1 hour before profile
   - Check clocks on logging PC's / PML data logger to within 1 second (& dates)
   - Check radio channels (69 worked best) / power (Radio used in UIC must be on low power to avoid interference)
   - Set day on sea / sky camera(s)
   - Transmissometer Air Cal
   - Clean windows of OCI / OCR sensors
   - Dry and place caps on OCI / OCR sensors for pre-cast darks
   - Test CTDF and MVDS (DATA 100) logging system. / Load PML Logger

3) Downcast

Start

Final communications check

Start logging Files

10m

Set winch speed to fast

Continuously give winch operator position

190m

Stop winch (in coastal waters allow 20m stopping time)

200m

Download CTDF profile for rapid processing

4) Upcast

Set up new logging files

Check illumination conditions

Take sky / sea state photographs

Set winch speed to slow

Monitor MVDS display for significant changes of illumination

20m

Provide warnings to winch operator

Surface

Close files

Check surface offsets on depth readings

Dump data from optics system to provide light profile for productivity.

Set-up MVDS to log underway light for the UOR tow.

4.5.3 SYSTEM PERFORMANCE

Satlantic in water optics

The system consisted of a Macintosh computer system which logged RS232 data from the Satlantic Deck 100 deck box. The deck box powered and received data from the Data 100 analogue to digital converter located on the optics rig. To provide a backup for the Macintosh system a PC (provided by BAS) ran the Satlantic Proview data display/logging program.

On day 114 there was a severe roll, this caused a hard disk crash on the Macintosh system. The optics rig was not deployed on this day due to bad weather. Despite efforts to recover the software, the optics profiler was deployed using the PC/Proview system on day 115. Early on in the profile records from the tilt and roll sensor became erratic and the system eventually failed during the upcast. The Deck 100 showed that there was a short circuit on the Data 100. Initially it was thought that the termination on the conductor cable had failed, but a full electrical test of the winch cabling found no faults. The Data 100 was tested using a surface test lead, and the short fault persisted, although some records were received from the unit. Electrical tests of the inputs to the Data 100 also showed a low resistance, incompatible with the input to an amplifier. The Data 100 was then opened and found to be flooded. The Data 100 was stripped down and the components in the system were washed in clean water.

Both Dr Hooker and Satlantic provided useful advice in determining faults; however it was unlikely that a field repair was possible on the unit. The logistics of flying a replacement unit to Montevideo were explored, but it was very unlikely that a replacement unit sent to Montevideo could be received in time for departure. It was thus decided to construct a replacement unit using the spare PML UOR logger cylinder (the details of this system are given below).

The cause of the flooding in the Data 100 was later traced by the manufacturer to a machining error in the cylinder end cap bolts.

PML Logger
The PML data logger consists of a microcomputer controlled 16 channel 16 bit oversampled analogue to digital converted with 2M byte of solid state storage. The logger is intended for autonomous storage of UOR optical and CTD data. By using this system it was necessary to lose the real time optics acquisition. Cabling constraints required that one channel of the OCR and OCI were not logger; the channels lost were Ed 683nm and Lu 670 nm. Both the channels show little or no data in the waters encountered over the AMT transect. The logger was cross linked to the CTD fluorometer unit to provide a depth input. The data logged consisted of 12 channels of light and one channel of depth that could be used to integrate the CTD fluorometer data with the optics data, and additionally made the data provided by the logger suitable for rapid analysis without the necessity to time merge data from the CTD system.

The replacement system was commissioned and tested during the short port call to Montevideo; a feat that would not have been possible without the electronic support of Paul Woodruff and the provision of mounting hardware by the ship's engineers. The data logger optics system worked perfectly for the first 5 days (days 120 - 125) but on day 125 only partial records were stored. Thorough checks were carried out but no problems with the downloading/electrical system could be found. Several test runs with the rig at the surface were carried out successfully. The next day (day 126) the unit failed to respond when recovered. The memory card was swapped to the primary UOR logger and no data was found to be logged.

No circuits were provided for this system and PML was contacted for information on the unit. Some summary information was provided by telephone, but this was no more than could be worked out from the construction of the unit. Circuits were promised but were never sent. In the light of this, it was decided to deploy the UOR logger on day 127, despite the effects that this had on both UOR and optics deployment. The logger faults were diagnosed by swapping units and sub components. The fault was traced at first to the EPROM of the controlling computer. By reprogramming EPROM's from the old UOR logger system it was possible to repair the control computer. At this point it was found that the analogue to digital converter circuitry had failed. This failure was traced by Paul Woodruff to a burnt track on the circuit board and a faulty regulator. The repaired logger was then recalibrated over a voltage ramp for each of the channels and redeployed on day 128. At this time it was thought that the cause of the failure was a short caused by loose bare crimp terminals in the unit. After this the logger continued to work to day 141, when an identical failure occurred. The units was again repaired. The fault was then surmised to be a possible pressure short on one of the Satlantic cables (there is no short circuit protection on the 12 v power output). The logger was modified with two resistors in series with the Satlantic power output, so that shorts should not damage the logger. On day 141 the logger was redeployed with only partial loss of data. On the series of casts on day 141 (A to E) over the coccolithophore bloom both sensor heads and leads were swapped with the UOR system to complete the casts. However no coherent pattern was found. Eventually this was traced to a plug faults on the Satlantic head.

Despite these problems it was possible to recover and process 23 out of a possible 26 profiles during the transect; one was lost due to bad weather, and two due to equipment failures.

MVDS
The MVDS deck cell consists of an irradiance sensor and the Deck 100 deck box. Data was logged by the Satlantic Proview program rather than the Macintosh system (see above). The irradiance sensor was fitted to an aluminium pole and raised about 2m clear of port side of the A-Frame. Data was recorded during casts and along track with the UOR. In addition, checks were made of the dark voltage at night. The unit performed with only one problem; the Deck 100 box occasionally indicated an open circuit or short circuit fault. The condition of the cable was checked and no abrasion or other indications of abuse could be found. On all occasions the fault could be cleared by switching the Deck 100 on then off. The most likely cause of this problem is an inductive surge being picked up by the telemetry cable. The power to the unit is 60-80 volts and the cut-out represents a safety feature and cannot be disabled. So long as the unit is checked whilst collecting profile data or along track UOR data, there is little problem with data loss.
The radiometric performance of the MVDS was monitored by checking the dark values over time and by checking the downwelling light for spectral consistence. At no time were spectra observed from the MVDS that were inconsistent with a normal daylight spectra. The darks in all the bands showed a consistent variation with internal temperature, with a variation of around one count for a 25° temperature change. In terms of the uncertainty of calibration, this variation is insignificant. This variation may be important in the in-water data, if there is a similar response in the Data 100.

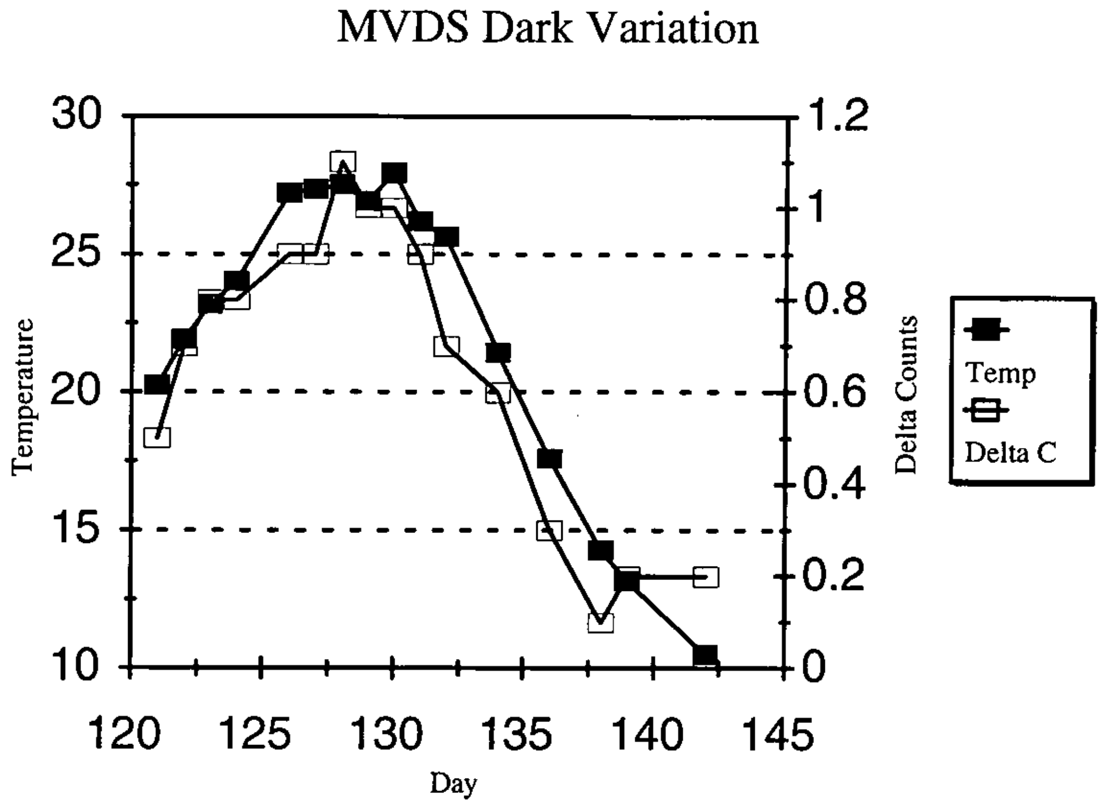


Figure 6. Temperature (solid squares) and Delat C (open squares)

CTD/Fluorometer
The CTD / Fluorometer was a converted UOR logging/CTD Fluorometer. The standard logging unit was replaced by an eight channel analogue to digital converter with RS-485 output (ADAM-4014). The data was logged on a PC with a commercial PCMCIA RS-485 interface. Simple logging and display software was written. The software also provided a RS-232 output for the Macintosh system. The data was stored a simple comma separated ASCII file that could be rapidly incorporated into a number of analysis programs. In addition, a liquid level tilt and roll sensor and transmissometer were interfaced to the system.

Throughout the transect the system operated without fault, providing CTDF profiles both during optics casts and for the casts taken at night to increase the spatial resolution of the AMT-2 data. The transmissometer on the system showed some consistent drift, which was reset when the batteries were replaced on the system. Since air calibrations were taken on the transmissometer, this proved to be no problem.

SeaWiFS Quality Monitor (SQM)
The SQM was developed by NIST (US Nation Institute of Standards) in co-operation with the NASA SeaWiFS projects. The instrument was designed to track and potentially calibrate optics sensors during bio-optical cruises. The first prototype was taken on the AMT-2 cruise. It consists of a precision light source with two sets of light

of different intensity giving three levels of illumination. The light source is powered by two precision power supplies controlled by a computer to give a current regulation of better than ±0.05%. Both the temperature and light output of the instrument are continually monitored during operation.

The SQM as delivered for the cruise was not yet fully operational, with a fault in one of the light sources. The unit had suffered some damage in transport and spares had to be fitted on the cruise. During the cruise new light bulbs and a thermo-electic controller were fitted. On trying to get the unit running a number of wiring faults were found. These proved difficult to repair because of the nature of the plugs fitted (small LEMO connectors), and because of the lightweight cabling of the instrument. In addition, the organisation of the racking system often made access to the internal parts of the instruments difficult.

The instrument never worked to specification on the cruise. The faults and problems with the wiring and the layout of the instrument were reported to NASA /NIST and, as a result of the experiences on AMT-2, aspects of the instrument have been redesigned. In particular internal cabling has been upgraded, the control system has been mounted in a single rack and connectors have been upgraded. It is difficult to determine whether or not the unit was ready for deployment; however the experience of trying to use it has produced a better unit than would otherwise be the case. Certainly the exercise has improved the chances of having a good field source for AMT-3 and AMT-4.

4.5.4 ANCILLARY MEASUREMENTS

In support of the optics data a number of ancillary observation were made at the time of the cast. These were:

- Photographs and notes of wire angle;
- Both digital and file photographs of sea and sky state;
- Sun position and cloud cover;
- Barometric pressure, wind speed and Wet / Dry bulb temperature;
- And concurrent sun photometry.

These measurements can be used in modelling studies to compare observations under cloud with cloud free conditions. When used as inputs to atmospheric visibility models, the meteorological observations can be used to validate the MVDS observations.

4.5.5 RESULTS

The diffuse attenuation coefficient (Kd) is one of the most robust measure that can be derived from the optics data. Measures of Kd can be checked by comparison with Kw (the K coefficient for pure water). In open ocean water 490nm is the wavelength of maximum transparency, and is influenced by the absorption of phytoplankton pigments (principally carotenoids). Figure 7 shows the Kd490 data for the AMT-2 transect, compared with the CZCS climatology (solid line), AMT-2 chlorophyll calculated from fluorescence and Kw (horizontal solid line). All the Kd490 values are greater then Kw, and the AMT-2 data follows the CZCS climatology with the exception of the region around 35°S where the CZCS climatology shows a greater Kd. However the rise of chlorophyll in this area was not pronounced, indicating that in AMT-2 the more productive waters with higher Kd's were further south.

Chlorophyll was determined from the optics data using the algorithm described in Aiken et al 1995. Figure 8 shows the along track comparison of the optically derived chlorophyll with the calibrated fluorometer chlorophyll. Broadly similar patterns are found, although there does seem a tendency for the optical data to be an underestimate. Regression of the optical estimate with the fluorescence values gives a slope of 1.224±0.222 and an intercept of 0.106±0.072 [R^2=0.81] and is shown in figure 9. The slope is greater than one, but not significantly so; however the intercept indicates some error in the calibrations algorithm. These are only intended to provide a preliminary validation of the bio-optical measurement, and full analysis will require the results of the HPLC pigments samples.

These preliminary results indicate the optical data is consistent with known algorithms and climatology.

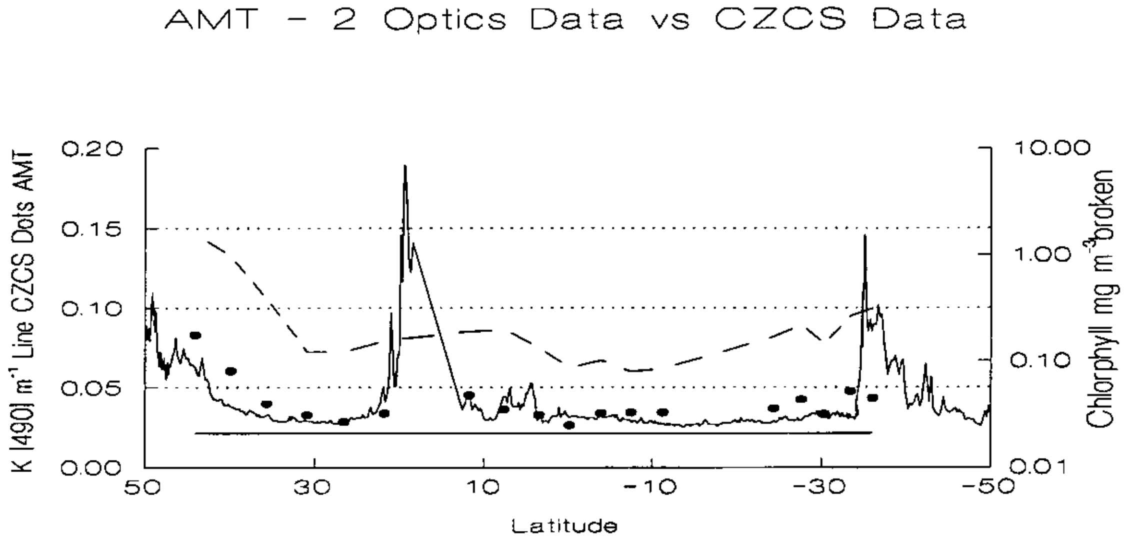


Figure 7.

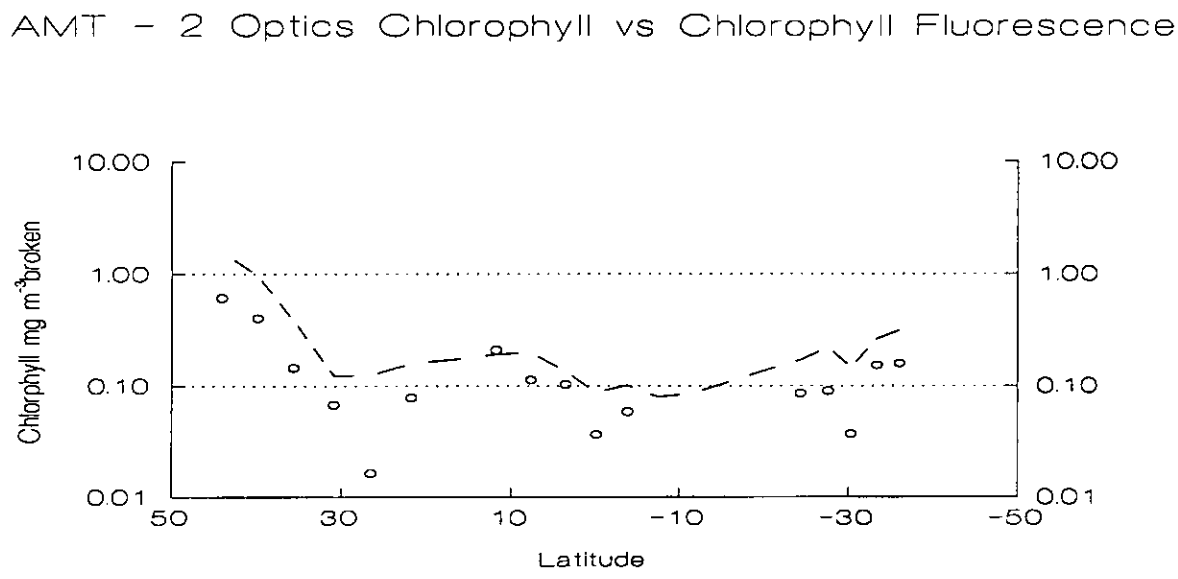


Figure 8.

AMT2 Optics Chlorophyll vs Measured

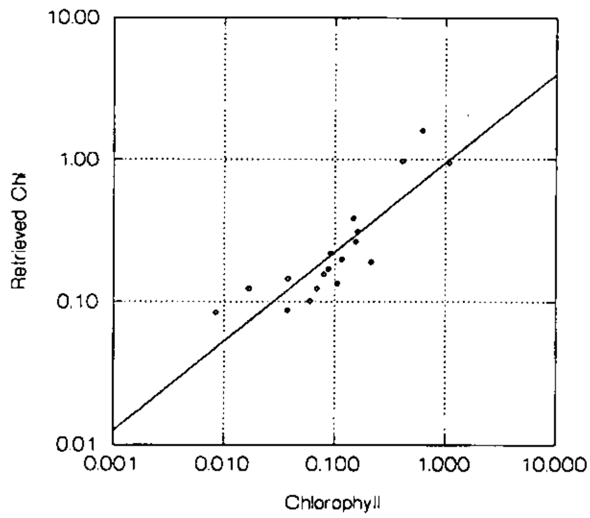


Figure 9.

4.5.6 OPTICS SENSOR CALIBRATIONS

1) OCI 29 SeaOPS irradiance

Wavelength	Pre-AMT-2	Post AMT-2	%Change
412.8	6.2410E-03	6.2014E-03	0.63
442.3	6.3335E-03	6.5667E-03	-3.68
490.5	6.4723E-03	6.4850E-03	-0.20
509.2	6.4799E-03	6.4085E-03	1.10
555.0	6.6910E-03	6.8275E-03	-2.04
664.8	6.5682E-03	6.7377E-03	-2.58
682.6	6.7702E-03	6.6185E-03	2.24

2) OCR 21 SeaOPS radiance

Wavelength	Pre-AMT-2	Post AMT-2	%Change
412.8	7.8791E-05	7.9293E-05	-0.64
443.6	8.0580E-05	8.0438E-05	0.18
489.5	9.0750E-05	9.0491E-05	0.29
509.2	5.4591E-05	5.4427E-05	0.30
555.4	5.6677E-05	5.6910E-05	-0.41
665.7		5.0503E-05	ERR
683.2	3.6232E-05	3.6003E-05	0.63

MVD - 35 Deck Irradiance

Wavelength	Pre-AMT-2	Post AMT-2	%Change
412.8	0.0082823	0.0083113	-0.35
442.3	0.0096615	0.0098484	-1.93
490.5	0.0095758	0.0099093	-3.48
509.2	0.0090053	0.0090929	-0.97
555.0	0.0097622	0.0099697	-2.13
664.8	0.0096535	0.0098291	-1.82
682.6	0.0092079	0.0092237	-0.17

OCI - 001 SeaOPS and UOR

Wavelength	Pre AMT-2	Post AMT-2	% Change
412.3	0.0049452	0.0043511	12.013436
442.4	0.0051993	0.0048291	7.1209465
490.1	0.0048186	0.004803	0.322367
509.9	0.0051619	0.0047553	7.8773725
555.6	0.0045769	0.0043087	5.8604445
670.4	0.0047509	0.0043886	7.6259696

OCR - 001 UOR Radiance

Wavelength	Pre AMT-2	Post AMT-2	% Change
411.9	1.0693E-04	1.1864E-04	-10.95189
442.5	8.2031E-05	8.6024E-05	-4.867025
489.9	5.3146E-05	5.6779E-05	-6.835012
509.7	5.3894E-05	5.7083E-05	-5.917766
555.4	4.8813E-05	5.0692E-05	-3.849477
669.8	3.4317E-05	3.5644E-05	-3.866014

4.6 AC-9 MEASUREMENTS: *(Tony Bale, Gavin Reeder and Gerald Moore)*

The attenuation of light due to scattering and absorption by species within sea water was measured at nine wavebands in the visible spectrum (412, 440, 488, 510, 555, 630, 650, 676 & 715nm) using a Wetlabs AC-9 2-channel, transmissometer. These measurements are the fundamental link between the optical properties of sea water and the various constituents of the water which influence light. The instrument was connected to the ship's pumped supply and, except in the estuary of the R. Plate where the supply was switched off to prevent contamination of the flow system, measurements were obtained continuously between Stanley and Plymouth. Data logging was stopped each day co-incident with the profile station in order to prevent contamination by bubbles caused by propeller wash during manoeuvring on station. The data file was closed at this time. A new file was started as the ship left the station and this was closed late each night when the instrument calibration was checked. Thus, two data (.DAT) files were generated each day; these were all prefixed BA followed by the SDY number and A or B to denote the first or second file, respectively. The instrument calibration was checked every night by taking readings of pure, 0.2um-filtered water from the ultra-pure water supply and pumping this through the AC-9 flow cell. In addition, every 3 or 4 days the instrument was removed from the flow cell after the water calibration had been completed and the optical windows were cleaned and dried. After cleaning, the air calibration was checked and then a second water calibration was obtained. The combination of these two approaches provided a rigorous tracking of both instrument stability and of the optical 'cleanliness' of the windows which tend to accumulate adsorbed organic films with time. The response of the instrument can be seen to be very stable after SDY 122 (Figure 10).

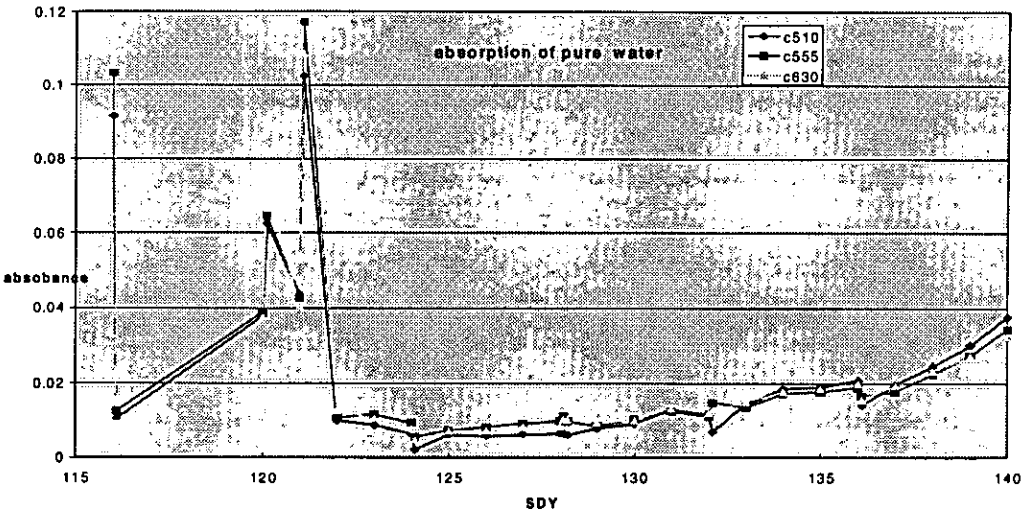


Figure 10. AC-9 attenuation values for pure water measured on channels: c510, c555 and c630 daily during AMT-2

The reason for the inconsistent calibration performance before SDY 122 is not clear at present but might be related to the difference in temperature between the ambient sea water and the temperature of the calibration water (room temp) during the early stations. Alternatively, it may reflect improving technical skill in cleaning the optical surfaces.

The results obtained on the transect clearly show how the inherent optical properties of the water are related to biological, mainly phytoplanktonic, activity. Figure 2, in the upper two boxes, show the absorption, scattering and attenuation coefficients at two wavelengths for the section 30S to 22N. Extremely low values were returned in the oligotrophic Brazilian Basin (20S to 5S) with high values associated with photosynthetic activity in the up-welling region off the African coast (10N-20N). The ratio of a/b (lower box of Figure 2) is compared with chlorophyll and reflects along-track changes in scattering efficiency. Figure 3 shows how strongly chlorophyll is related to light absorption at red wavelengths.

4.7 Sun Photometry *John Doyle*

Accurate atmospheric correction is crucial for the interpretation of ocean colour imagery. In order to correct a satellite image for the effects of the intervening atmosphere, knowledge of the air mass, absorbing gasses and particulates (aerosols) is required. The air mass and absorbing gasses can be estimated from meteorological data and other satellite sensors (e.g. TOMS in the case of ozone). However the aerosol optical properties represent the largest uncertainty in the process of atmospheric correction. The data obtained on aerosol optical thickness will add to the climatological knowledge of aerosol properties over the Atlantic. Additionally, the ability to measure aerosol optical thickness concurrent with in-water measures will be crucial to the Cal/Val role of future AMT cruises.

Data were collected with an EKO 4 channel (368, 500, 675 & 778nm) hand held peak reading sun photometer. Readings were taken over days with clear sun views, concurrent with the optics cast and through the day with more readings being taken to the end of the day. The readings at the end of the day are important since the air mass is greater and there is an increase in the accuracy of the retrieved aerosol optical thickness.

Analysis will be completed at ISPRA using an inversion model that requires:

solar angle (taken from the Nautical Almanac Tables)

Extraterrestrial solar irradiance

Rayleigh and Ozone optical thickness (available from climatology & tabulated values)

4.8 PARTICLE SIZE ANALYSIS BY COULTER MULTISIZER:

(Tony Bale, David Robins)

This instrument was not commissioned until near the end of the transect where it was used to quantify particle numbers and their size distribution in the range 2-60 mm for the run into and over the shelf break. This work was aimed principally at quantifying the particulate components giving rise to the scattering signals measured with the AC-9 instrument but it was anticipated that the results would also complement the intensive sampling for coccolithophores through the predicted bloom off Lands End.

At stations 139 to 142 (see Table 3), size analyses were carried out at each of the five depths sampled for pigments. A number of samples were also taken from the underway, pumped supply (see Table 4).

Table 3. Stations and bottle depths sampled for particle size analysis

SDY	Z1	Z2	Z3	Z4	Z5
139	7	20	30	40	120
140	7	20	30	50	120
141	7	20	30	50	120
142	7	20	30	50	120

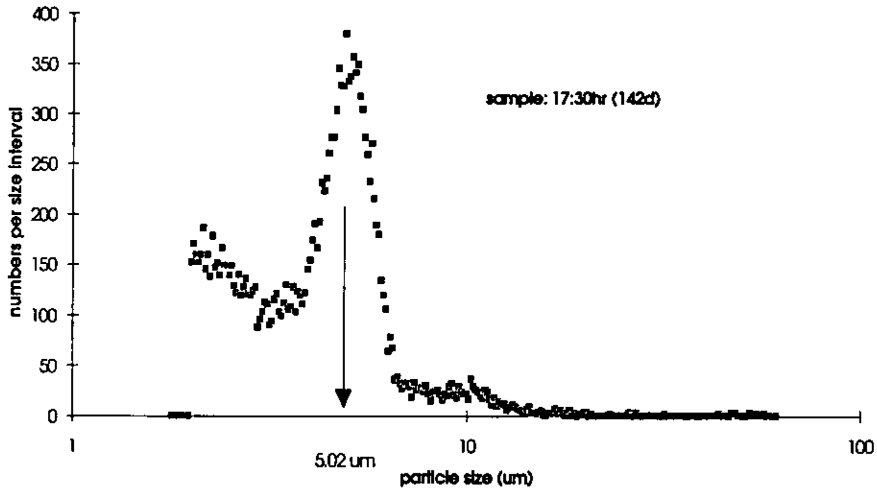
Table 4. Sampling times for particle size analysis from underway pumped supply.

SDY	time	GMT									
139	1200	1346	1628	2132							
140	0726	1242	1536	1934							
141	1616	1500	1700	1945	2100						
142	0000	0200	0300	0506	0609	0810	1200	1348	1511	1625	1729
						bloom	142	142a	142b	142c	142d

Calibration of the 100 mm orifice tube used for this work was achieved using 14.02 mm diameter latex beads and the manometer sample volume was calibrated relative to the siphon volume so that particle numbers could be calculated per unit volume from the sampling time. Samples taken from within the coccolithophore bloom exhibited a distinct peak (Fig. 11) centred on 5.02 mm which was not evident in samples from outside the bloom.

Figure 11. Example of Coulter Multisizer analysis of a sample from within the coccolith bloom

In Figure 12, the numbers of particles falling in the size range 2.5-6.6 mm (bracketing



the prominent peak) in each sample have been plotted against the time of sampling from the underway pumped supply and clearly show a good relationship with light scattering.

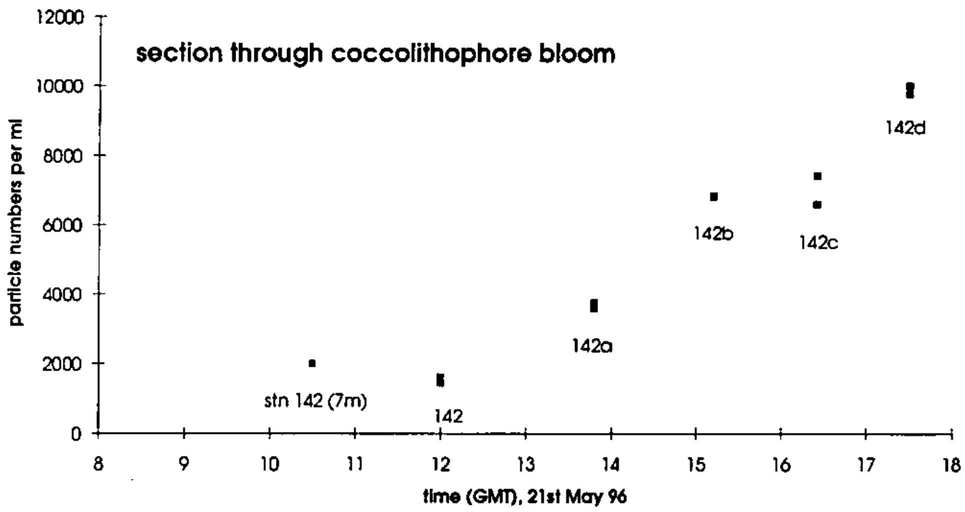


Figure 12. Particle numbers in the size range 2.5 to 6.5 mm for samples taken through the bloom.

4.9 DISSOLVED GASSES *(Gerald Moore)*

4.9.1 INTRODUCTION

The measurement of CO_2 concentrations in the atmosphere and in seawater provide an essential measure for the constraint of models of the carbon cycle. Together with the wind speed, CO_2 measurements provide an estimate of air-sea carbon flux. The AMT measurements are complimented by a pre-existing PML ship of opportunity CO_2 measurement program. In particular, the AMT-1 results and some results from ship of opportunity showed a drawdown (negative air-sea) difference in the tropical Atlantic (10°N to equator) where an outgassing of CO_2 was expected. Seasonal variation in this drawdown was expected and one of the aims of AMT-2 was to see if this drawdown was observed in the spring as well as autumn. Possible mechanisms for this drawdown were changes in salinity (rainfall or precipitation-evaporation) or advection of water from areas of high production. As such, the latter mechanism would be subject to greater seasonal variation.

4.9.2 SYSTEM

The semiautomated system for recording CO_2 concentration consists of a computer controlled infra-red transmissometer (LICOR) which through a system of solenoids alternately measures gas from a seawater equilibrator, a marine air line and two WMO traceable standards.

At the outset of AMT-2 there were initial problems in that one pump had become weak and one of the air lines from the standards had broken. The result was that initial data was lost or poorly calibrated, and that the system was only fully operational from Montevideo. These problems were in part caused by the lack of time available for routine servicing of the instrument, and to the bad weather that caused entry of spray into the marine air line.

4.9.3 RESULTS

The pCO_2 from AMT-2 does not show the drawdown in the equatorial region compared with AMT-1. Figure 13 shows the AMT-2 results as the solid line and the AMT-1 results as the dotted line. There is a difference in two areas: firstly, the drawdown observed between 10°N and the equator has almost disappeared apart from a small drawdown at 10°N; and secondly, the region from 10°S to 15°S where there was a weak drawdown in AMT-1 has changed to positive outgassing. South of 20° there seems to be a similar drawdown but north of 20° some equilibrium associated with spring productivity is shown in the AMT-2. It is surprising that a different disparity is not show south of 20°.

Figure 14 shows the salinity for the AMT-2 and AMT-1 transects. The drawdown from 10°N to the equator seem to be associated with the salinity change. However, no such pattern can be found for the 10°S to 15°S region. It may be possible that the pCO_2 data for the latter region can be explained by advection from the West African coast.

AMT 1 vs 2 Data

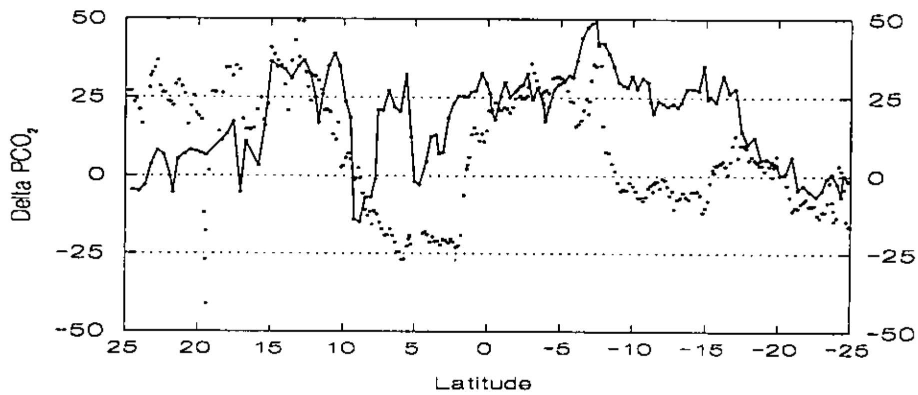


Figure 13

AMT 1 vs 2 Data

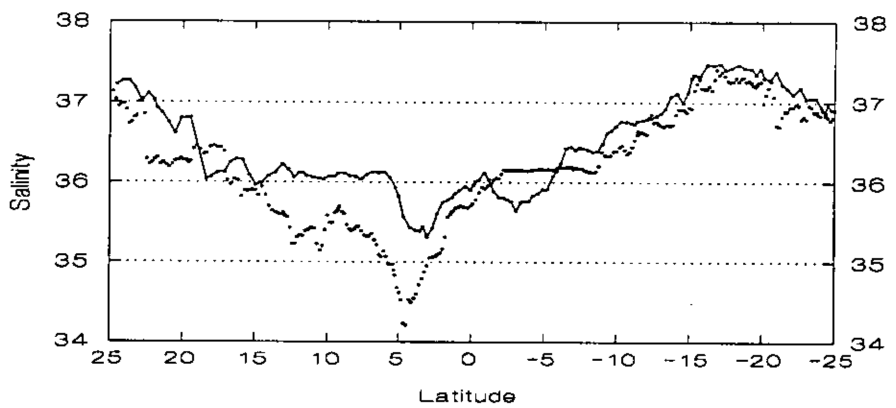


Figure 14

4.10 INORGANIC NUTRIENT ANALYSIS *(Alan Pomroy)*

4.10.1 OBJECTIVES

To determine concentrations of dissolved nitrate, nitrite, phosphate and silicate from CTD and underway samples to assist in the characterisation of the various hydrographic provinces crossed during the voyage.

4.10.2 METHODS AND SAMPLES ANALYSED

Concentrations of dissolved nitrate, nitrite, phosphate and silicate were measured using a 4-channel Technicon® autoanalyser. All depths from all standard CTD vertical profiles were analysed. Additional, underway samples, taken from the ships non-toxic supply at approximately 4 hourly intervals, were also analysed. A complete list of underway samples is presented in table n. A total of 349 water samples were processed, with all 4 nutrients being successfully determined in 99.4% of the underway samples and 97.6% of the CTD samples.

4.10.3 ANALYTICAL PROBLEMS

On the whole, the system was stable and reliable from day to day. There were some initial problems with bubble patterns at the beginning of the cruise due, in part, to the severity of the weather on leaving Port Stanley. Lubrication of the autoanalyser pumps rectified the majority of the hydraulic problems, indicating that the pump oil had dried out between AMT-1 & AMT-2 and that lubrication of the pumps and rollers should become standard procedure prior to commencing analysis on subsequent cruises. Problems with the nitrite channel persisted for a further 3 days before a constricted return line was identified. Following its replacement, no further problems were encountered. It should be noted that the chart recorder leads are approaching the end of their useful working life and need replacing before the next cruise.

4.11 BACTERIAL NUMBERS AND BIOVOLUME (*Alan Pomroy*)

4.11.1 OBJECTIVES

To determine the vertical and horizontal concentrations and biomass of heterotrophic bacteria along the cruise transect in relation to the various hydrographic provinces encountered and other biological factors, such as primary production. To use bacterial numbers and biovolume estimates to attempt to establish a relationship with absorbance in oligotrophic waters, where absorbance by phytoplankton and other particulate material is at a minimum.

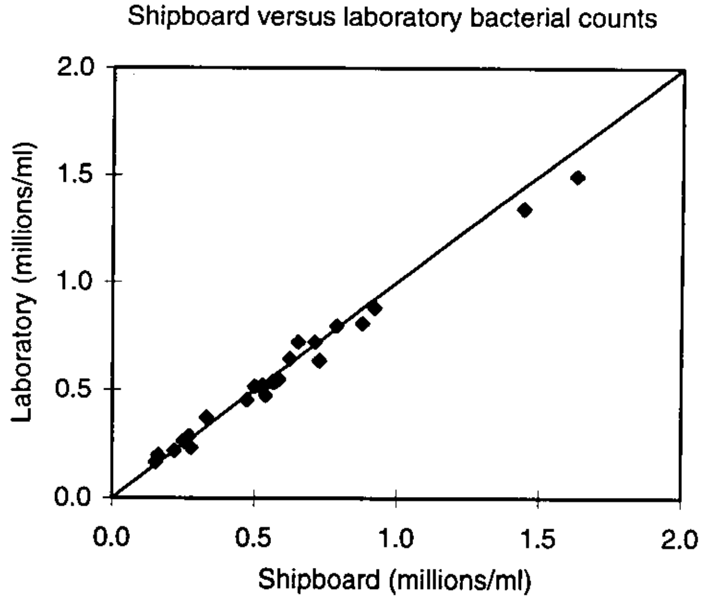
4.11.2 METHODS AND SAMPLES ANALYSED

Samples for the enumeration of bacteria were taken from every water bottle depth on each of the standard CTD casts. Samples were fixed with 2% (final concentration) electron microscope grade glutaraldehyde before staining with the fluorochrome DAPI (4′6-diamidino - 2- phenylindole). Stained samples were filtered and stored at 4°C prior to counting using epifluorescence microscopy. Similar methodology was applied to underway samples, taken at approximately 4 hour intervals, from the ships non-toxic supply. A complete list of underway samples is presented in table n.

During shipboard analysis the total number of bacteria present in a sample was determined together with the numbers present either as rods or cocci. The slides were then stored at -20°C. These will be re-examined, using image analysis techniques, to determine accurately the variability in bacterial biovolume along the transect. The same slides have also been used to complement the data of N.Fuller by providing a complete underway record of the distribution of the coccoid cyanobacterium Synechococcus. A total of 418 samples were analysed on board for bacterial numbers and the proportion of rods and cocci. A further 238 samples have been analysed at PML for Synechococcus concentrations.

4.11.3 ANALYTICAL PROBLEMS

No significant problems were encountered. On several occasions microscopic analysis was made more difficult by the motion of the ship. On these occasions it was particularly difficult to distinguish the smallest rods present from cocci. However, subsequent re-examination of the samples in question at PML has shown that the shipboard counts were accurate.



4.12 BACTERIAL PRODUCTIVITY

4.12.1 OBJECTIVES

To determine vertical and horizontal differences in rates of production of heterotrophic bacteria along the transect. Associated experiments to determine variations in temperature response, optimum substrate concentration and uptake kinetics along the cruise transect in relation to the various hydrographic provinces encountered and other biological factors, such as primary production.

4.12.3 METHODS AND SAMPLES ANALYSED

Two related methods, involving the rate of incorporation of ^{3}H-thymidine into nucleic acid and the rate of incorporation of ^{3}H-leucine into protein were employed. The former relates directly to the rate of division of the bacteria and the latter to growth rate. All incubations involve 5 replicate samples from each depth, one of which is fixed with 2% glutaraldehyde to act as a control. Differences in the ratios of uptake of the two substrates associated with the various hydrographic provinces traversed will be examined. All depths from all standard CTD vertical profiles were analysed. Additionally, 32 incubations, using water from the 7m CTD bottles, were completed to assist with the interpretation of the standard incubations. These were as follows:

1. Temperature response curves. Replicate samples were incubated in a temperature gradient ranging from 7-43°C. Thymidine and leucine uptake rates were determined on 6 occasions each.
2. Time course experiments, lasting up to 2 hours, were conducted to ensure that uptake rates were linear for the duration of a standard incubation. Thymidine and leucine uptake rates were determined on 3 occasions each.
3. Substrate concentration. To ensure that sufficient radiolabelled substrate was being added to experimental samples to swamp any

extracellular, unlabelled thymidine or leucine present. Thymidine concentrations ranged from 1-20nM and leucine from 2-40nM. Thymidine and leucine uptake rates were determined on 5 occasions each.

4. Conversion factors. Incubations lasting 24 hours to relate increases in bacterial numbers with changes in uptake rates. Conversion factors to determine the number of bacterial cells produced per mol. label incorporated can then be calculated. Thymidine and leucine conversion factors were determined on 2 occasions each.

Date and approximate latitude of all bacterial productivity experiments:

Date	Julian day	Latitude	Standard incubation	Temperature exp. (1)	Time course exp. (2)	Substrate conc. (3)	Conversion factors (4)
23.04.96	114	47°35´S	X	X			
24.04.96	115	43°25´S	X			X	
25.04.96	116	40°00´S	X		X		
29.04.96	120	36°03´S	X				
30.04.96	121	33°23´S	X	X			
01.05.96	122	30°18´S	X			X	
02.05.96	123	27°37´S	X		X		
03.05.96	124	24°21´S	X				
04.05.96	125	20°00´S	X				
05.05.96	126	15°10´S	X	X			
06.05.96	127	11°14´S	X				
07.05.96	128	07°28´S	X			X	X
08.05.96	129	03°55´S	X				
09.05.96	130	00°11´S	X	X			X
10.05.96	131	03°24´N	X				
11.05.96	132	07°34´N	X			X	
12.05.96	133	11°44´N	X				
13.05.96	134	17°00´N	X				
14.05.96	135	24°45´N	X		X		
15.05.96	136	26°32´N	X	X			
16.04.96	137	30°54´N	X				
17.05.96	138	35°40´N	X			X	
18.05.96	139	38°00´N	X				
19.05.96	140	44°04´N	X	X			
20.05.96	141	46°29´N	X				
21.05.96	142	48°45´N	X				

A total of 3940 radiolabelled samples was prepared during the cruise.

4.12.4 ANALYTICAL PROBLEMS

No significant problems were encountered with any of the incubations. Analysis of the samples on board was not possible due to mechanical problems with the shipboard scintillation counter. This caused some concern, as the lack of data made it impossible to optimise substrate concentrations and incubation length during the cruise. However the concentrations selected proved to be adequate when samples were analysed at PML.

4.13 SYNECHOCOCCUS AND THEIR VIRUSES *(Nick Fuller)*

4.13.1 OBJECTIVE

To determine the abundance, diversity and distribution of the cyanobacterium Synechococcus and their viruses horizontally and vertically in the Atlantic Ocean.

4.13.2 TECHNIQUES

Synechococcus cells were enumerated onboard ship by epifluorescence microscopy of seawater filtered onto 0.2 µm pore-size filters. Synechococcus viruses (cyanophages) will be enumerated by quantitative PCR (polymerase chain reaction), a rapid molecular biological method of DNA amplification. Litre samples of seawater were first concentrated to 10 ml by tangential flow filtration, which will be further concentrated to 0.5 ml by ultracentrifugation, and DNA preparations made of the resultant concentrate. Both Synechococcus and their viruses will be strain-characterised by molecular biological analysis of the PCR products; either by sequence data or RFLP (restriction fragment length polymorphism) analysis. Distribution of specific cyanophages and their hosts will then be compared with other biological, chemical and biophysical data obtained on the cruise.

4.14 BASIN-SCALE DISTRIBUTION OF PHYTOPLANKTON ABUNDANCE, COMPOSITION AND PRODUCTION IN THE ATLANTIC OCEAN *(Emilio Marañón and Manuel Varela)*

4.14.1 OBJECTIVES

1. To describe the basin-scale patterns of distribution of phytoplankton abundance and their taxonomic composition.

2. To determine the patterns of latitudinal distribution of photosynthesis rate in 3 different size-fractions: picoplankton, nanoplankton and net-plankton.

3. To characterize the latitudinal and vertical variability in the photosynthetic parameters of the phytoplankton assemblages.

4.14.2 METHODS

Phytoplankton abundance and composition

Water samples collected from the Niskin bottles at 5-6 depths per station were used for conduction of different standing stock and rate measurements. Size-fractionated chlorophyll *a* concentration was determined fluorometrically after sequential filtration of a 250 ml sample through 20 µm, 2 µm and 0.2 µm polycarbonate filters and subsequent extraction in 90 % acetone at - 20 °C overnight.

100 ml samples were taken at each sampling depth for identification and counting of the microplankton species. Samples were preserved in lugol's iodine solution. Examination of the samples will be conducted following the Uthermol's sedimentation technique under an inverted microscope.

Rates of size-fractionated photosynthesis

Triplicate water samples for the determination of primary production were contained in 70 ml polycarbonate bottles, spiked with 10 µCi $NaH^{14}CO_3$ and incubated in an on-deck incubator. The incubator was equipped with a set of filters providing a range of 10 irradiances from 97 % to 1 % of I_o. Each sample was incubated at an irradiance level close to the original irradiance experienced by the phytoplankton cells, taking into account the PAR profile provided by the optical rig. At 3 depths, additional dark incubations were carried out. Incubations typically started at 11 am (*ca* 30 minutes after sampling) and lasted for 7-8 hours. At the end of the incubation, the contents of each bottle was sequentially filtered through 20 µm, 2 µm and 0.2 µm polycarbonate filters. Filters were then exposed overnight to concentrated HCl fumes for removal of inorganic ^{14}C. Finally, filters were placed in scintillation vials, 3.5 ml scintillation cocktail added to each vial and radioactivity on each sample determined using a Beckman liquid scintillation counter. Due to a serious failure of the ship's scintillation counter, photosynthesis samples from stations 14-25 had to be measured in the Southampton Oceanography Centre, using a Wallac 1411 scintillation counter. There was a good agreement between measurements from both counters. The relationship between both types of counts was linear and highly significant:

$$B = 1.023 * W + 53.367, r^2 = 0.998, n = 136$$

where B is the DPM activity of a sample measured on the Beckman counter, and W is the DPM activity measured on the Wallac counter. The slope of the line was not significantly different from zero.

Photosynthetic parameters (photosynthesis-irradiance experiments)

At 3 depths on each station (surface, chlorophyll *a* maximum and an intermediate depth) additional water samples were collected for conduction of photosynthesis-irradiance experiments. Each experiment involved incubation of 20 70 ml water samples on a bench incubator equipped with an 100 W halogen lamp which provided a range of light intensities from approximately 5-2500 µE m^{-2} s^{-1}. The samples were cooled using the uncontaminated surface water supply and the incubations lasted for 3 hours. At the end of the incubation, each sample was filtered through 0.2 µm polycarbonate filters. Decontamination and counting of the filters was conducted as described above.

4.14.3 PRELIMINARY RESULTS

Chlorophyll a distribution

During most of the transect, chlorophyll *a* concentration ranged between 0.2 and 0.4 mg m^{-3} (Figure 15). Lowest values (below 0.2 mg m^{-3}) were found in the tropical and subtropical South Atlantic region and in the subtropical North Atlantic. Maximum concentrations took place in subsurface waters on the Mauritania upwelling region (>2 mg m^{-3}) and on surface waters in temperate regions. In the oligotrophic areas, where phytoplankton abundance was low, most of the chlorophyll *a* (70-80 %) belonged to the picoplankton size class. By contrast, the contribution of large phytoplankton to total chlorophyll *a* was high (40-60 %) in those areas with relatively high levels of microalgal abundance.

During most of the cruise, the vertical distribution of chlorophyll *a* showed a distinct maximum located in the vicinity of the thermocline. However, this deep chlorophyll maximum did not represent a biomass maximum. Phytoplankton carbon estimates made from the microplankton counts on the microscope showed no significant differences between surface and deep samples. The deep chlorophyll maximum reflected photoadaptation of microalgae to low irradiances, which results in enhanced levels of cellular chlorophyll *a*, rather than a biomass maximum.

Size-fractionated primary production
The latitudinal distribution of total primary production followed in general the same trend as that of chlorophyll concentration (Figure 16). Enhanced levels of productivity were detected in those areas where mixing processes had brought the nutricline upwards. Higher rates of primary production were measured in Southern temperate waters (0.4 - 1.0 mgC m^{-3} h^{-1}), in the northern subequatorial region off Northwest Africa (0.4 - 0.5 mgC m^{-3} h^{-1}) and in northern temperate waters (1.0 - 5.0 mgC m^{-3} h^{-1}). In general, photosynthesis was higher in surface waters, and the deep chlorophyll *a* maximum did not show any enhanced productivity.

Most of the total photosynthesis was accounted for by the smaller size fraction, and therefore the latitudinal distribution of 0.2-2 µm photosynthesis is quite similar to that of total photosynthesis (Figure 17). However, the contribution of nanoplankton and net-plankton to total photosynthesis increased dramatically in the higher productivity areas (Figures 18 and 19). Photosynthesis in the oligotrophic areas is mainly carried out by very small cells which presumably are able to grow on extremely low amounts of recycled nutrients, whereas growth of larger phytoplankton is mainly fuelled by new nutrient inputs from below the euphotic layer.

Photosynthetic parameters
Although all the curves from the light-saturation experiments have already been plotted, statistical fitting of the results to appropriate models has yet to be completed. Therefore, the results from these experiments will be discussed here only very briefly.

The light-saturated rate of chlorophyll *a*-specific photosynthesis ($P^{B}max$) varied widely throughout the cruise and also between depths. Higher values were always found in surface populations. Surface $P^{B}max$ ranged from 1 - 2 mgC mgChl a^{-1} h^{-1} in the Southern subtropical and tropical waters to 10 - 12 mgC mgChl a^{-1} h^{-1} in the North Atlantic region. Photoinhibition was present in most samples from the deep chlorophyll maximum, indicating photoadaptation to low light levels (Figure 20). In those stations where stratification was intense, marked differences in $P^{B}max$ and the initial slope of the curve (α) were found between surface and deep phytoplankton assemblages (Figure 20). By contrast, very similar values of $P^{B}max$ and α were found throughout the water column in those situations where the euphotic layer was well mixed (i.e., spring conditions in the North Atlantic), indicating that vertical mixing was fast enough to prevent phytoplankton photoadaptation to a particular light regime (Figure 21).

Once statistical analysis of these data is finished, the latitudinal and vertical variability of the P-I parameters will be compared to the distribution of other variables, such as temperature, nutrient concentration and phytoplankton composition. This will allow us to estimate the relative importance of physiological and ecological factors in determining the large scale patterns of phytoplankton photosynthetic performance.

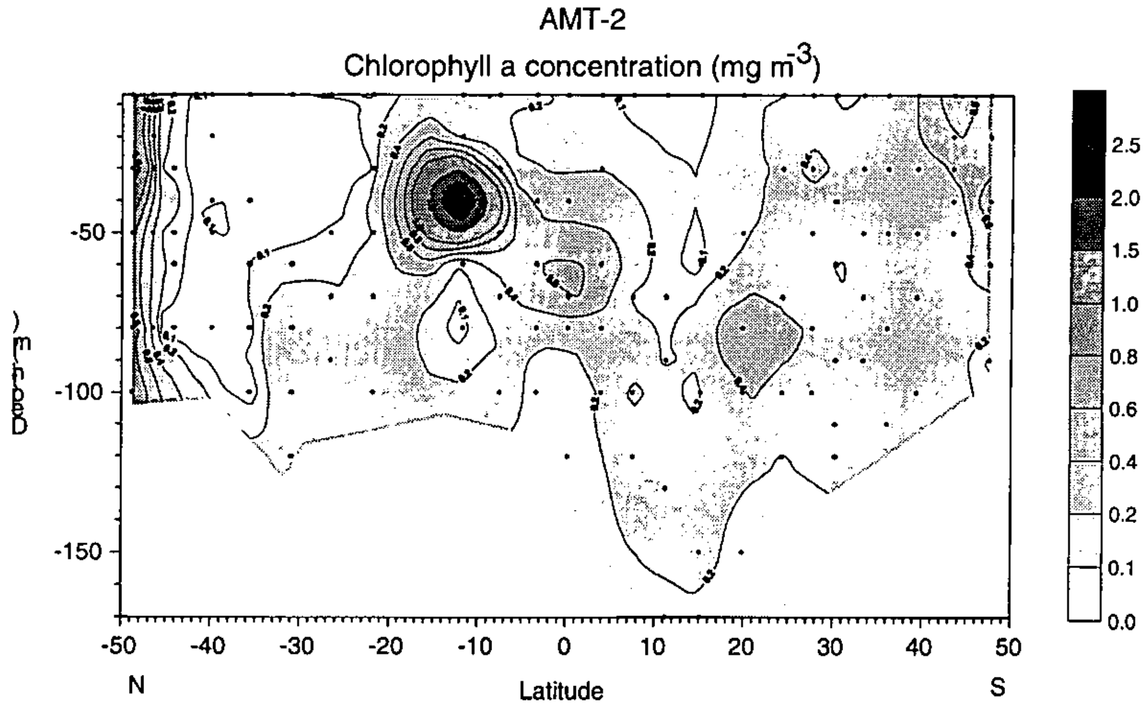


Figure 15

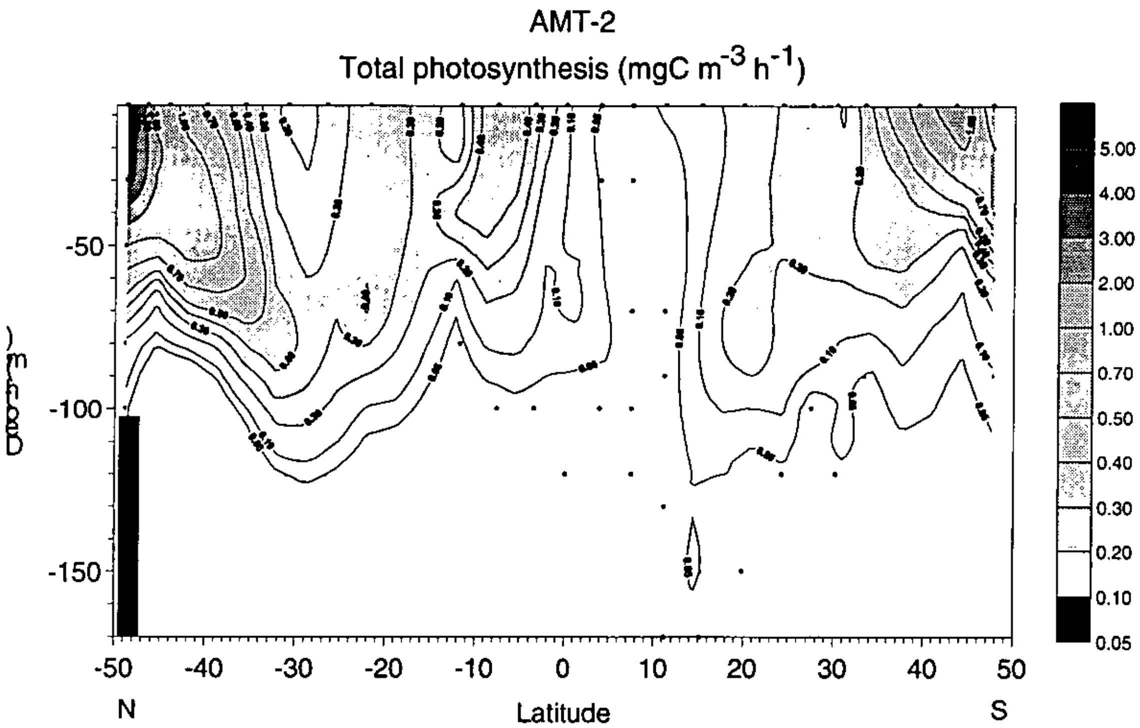


Figure 16

AMT-2

0.2-2 µm photosynthesis (mgC m^{-3}h^{-1})

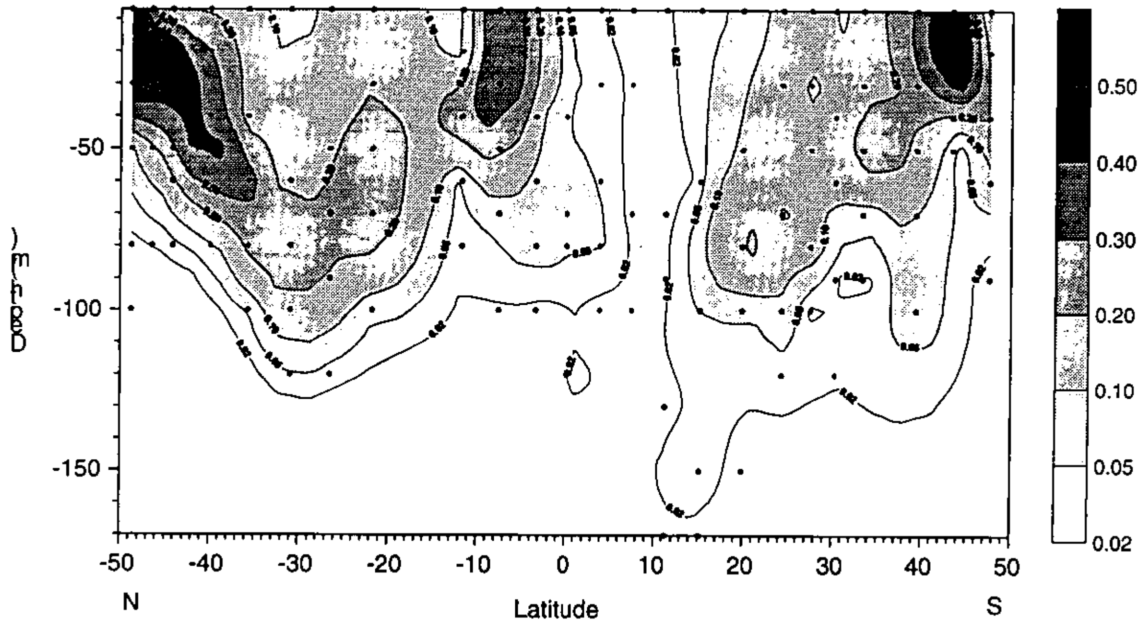


Figure 17

AMT-2

2-20 µm photosynthesis (mgC m^{-3} h^{-1})

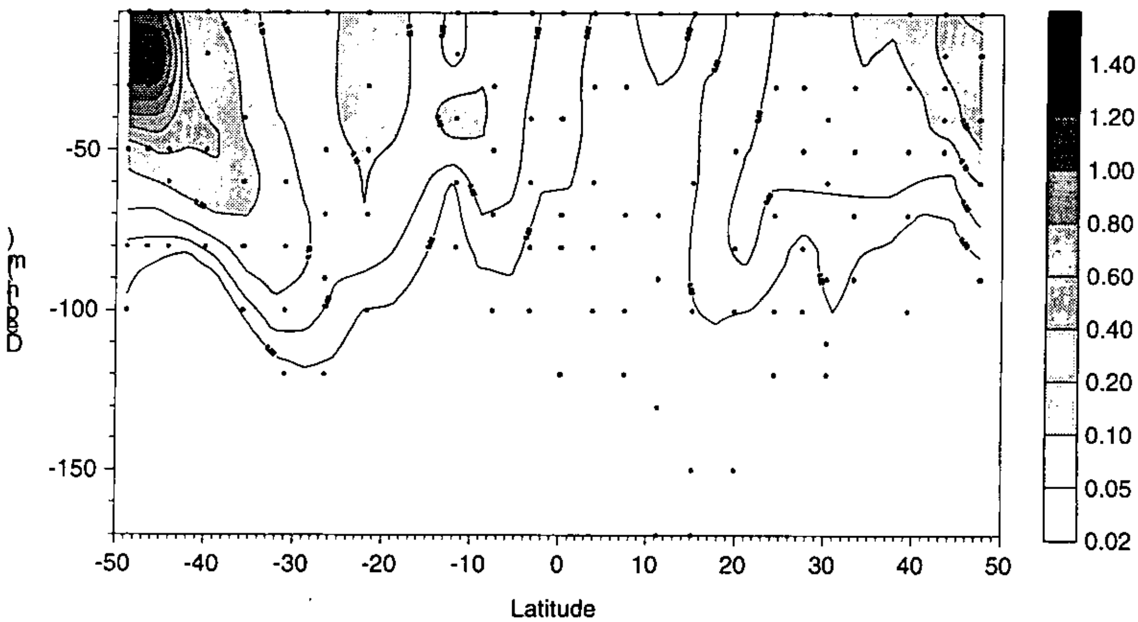


Figure 18

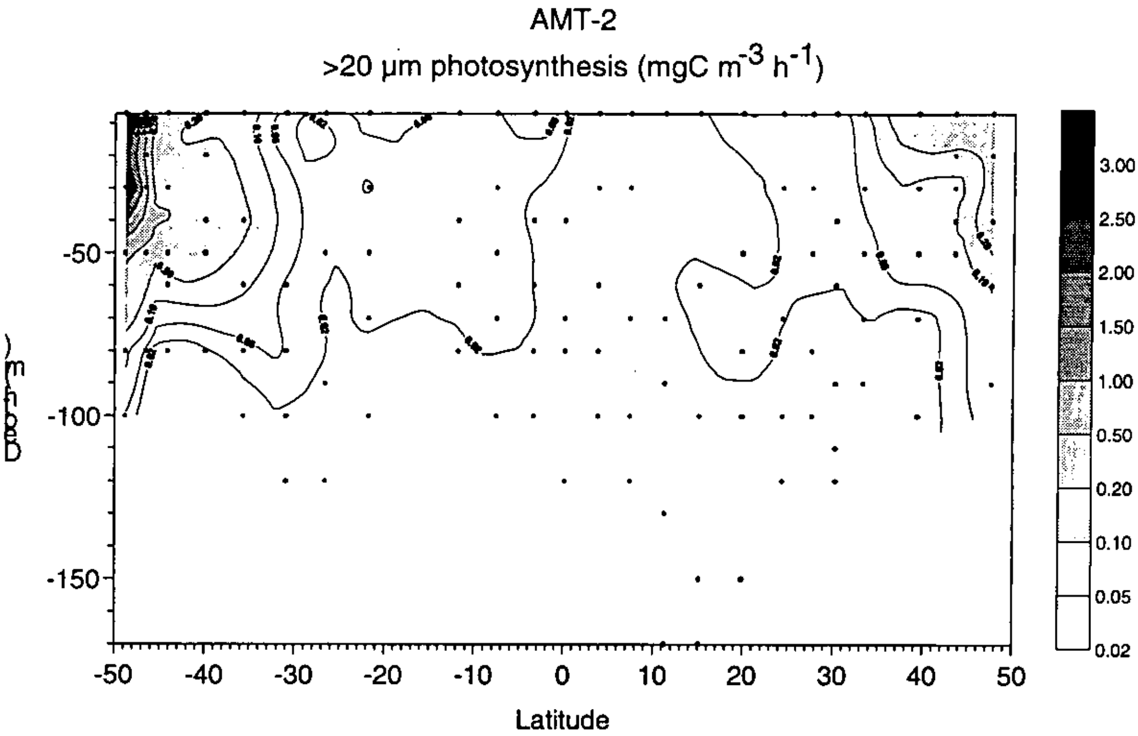


Figure 19

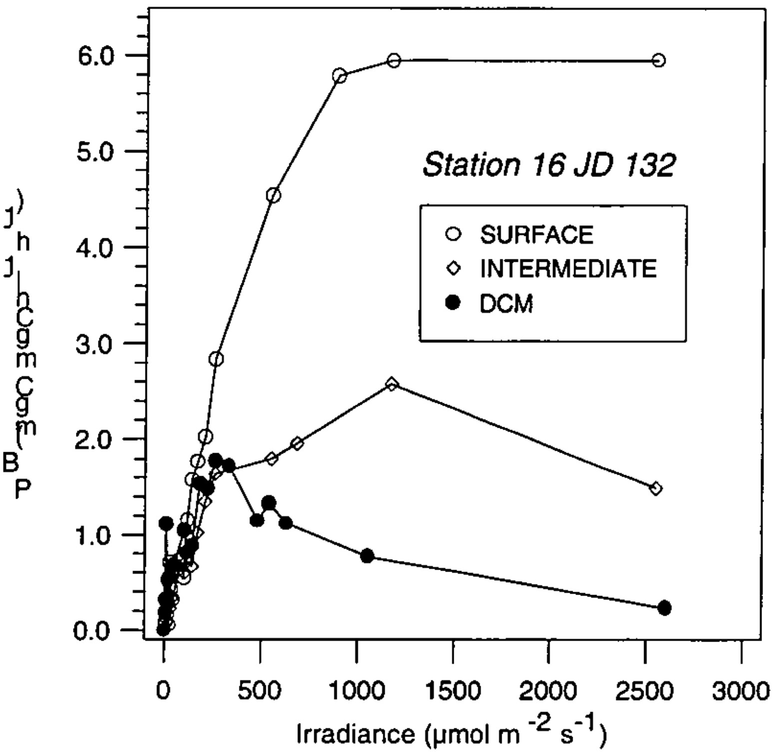


Figure 20

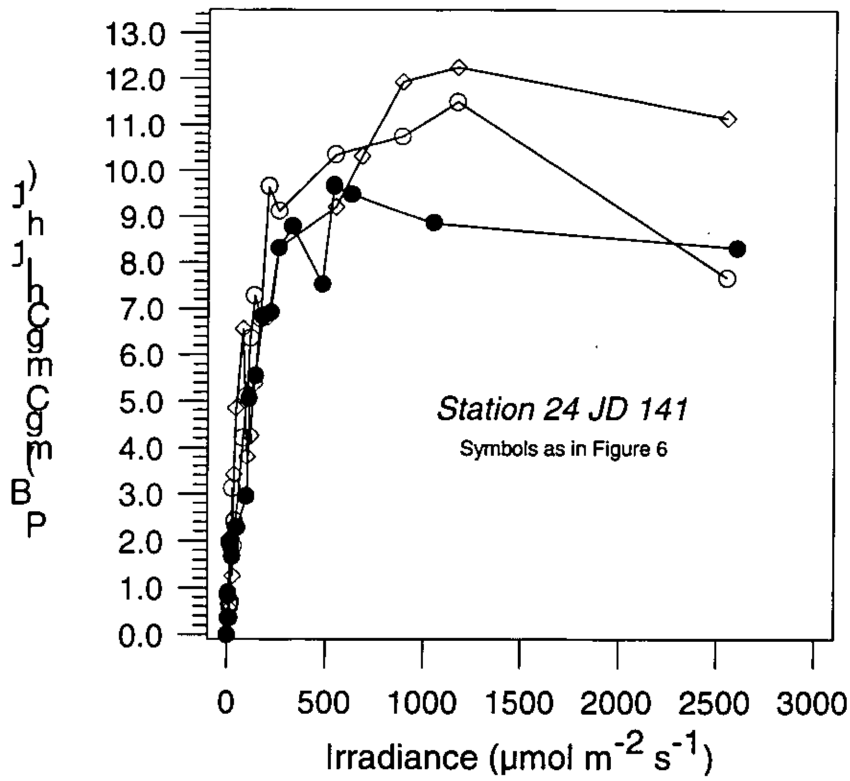


Figure 21

4.15 ZOOPLANKTON COMMUNITY STRUCTURE AND PARTICULATE CHARACTERISATION *(Chris Gallienne & Dave Robins)*

4.15.1 PLANKTON CHARACTERSIATION AND CARBON

One of the primary aims of the AMT programme is to define and characterise changes in plankton community structure in relation to latitude and physical regimes. The use of size fractionated carbon has been accepted as an international standard for JGOFS related programmes. The AMT-2 protocols for size fractionated carbon of both particulate and zooplankton remained the same as those used for AMT-1. These size fractionated data were supplemented with phytoplankton and zooplankton taxonomy, together with optical techniques for the sizing and characterisation of zooplankton.

Particulates

Water from two of the five main sampled depths at each station (7m and the chlorophyll maximum, as determined by *in-situ* fluorescence) was filtered in four batches through membrane filters of 2, 5 and 10µm and a 200µm gauze. The filtrate from each size fraction was then filtered, in triplicate, onto Whatman GF/F pre-ashed filters to produce a series of replicate samples in the following size fractions: <2µm, 2-5µm, 5-10µm and 10-200µm, plus the total. Two samples of 100ml of water from each of these two depths were also taken for phytoplankton taxonomy by preserving in 1% lugol iodine and 1% formaldehyde.

Zooplankton
At each station a WP2 plankton net (200μm) was deployed to 200m for a depth integrated sample of zooplankton between 200m and the surface. The sample from the net was then split into two halves, with one half for size fractionated carbon and the other for real-time characterisation through the Optical Plankton Counter (Focal Technologies, Inc., Dartmouth, Nova Scotia) and for post cruise analysis using video analysis system (VISA).

The zooplankton size fractionated carbon samples (to JGOFS protocols) were obtained by screening half the net sample through 2,000, 1,000 and 500μm sieves to create fractions of 200-500μm, 500-1,000μm, 1,000-2,000μm and >2,000μm, which were sub-sampled and filtered in triplicate onto pre-ashen Whatman GF/C filters. The remainder of the sample was preserved with borax buffered formaldehyde (4% final concentration) for later taxonomic identification.

4.15.2 OPTICAL PLANKTON COUNTER

Equipment
The optical plankton counter (OPC) can produce reliable real time abundance and size distributions of mesozooplankton (250 μm - 16 mm equivalent spherical diameter - ESD). The device uses a collimated beam of light received by a sensor. When this beam is occluded by a particle, the sensor response is a pulse whose size is proportional to the cross-sectional diameter of the particle. This pulse is digitised, and the digital size mathematically converted to equivalent spherical diameter using a semi-empirical formula.

The OPC was deployed as for AMT-1, both for continuous underway sampling from the ship's uncontaminated supply, and for processing samples from 200 m. integrated vertical net samples from daily stations. The seawater intakes had 6 mm. steel mesh filters, as on AMT-1. A modified de-bubbling device with a larger cross-section was used, in the light of the limitations of the device used on AMT-1.

Methods
At each daily station, two WP-2 (200 μm. mesh) net casts were made, to 200 m. and to 20 m. Each sample was divided in half using a splitter, half of the sample being passed through the OPC, and collected and preserved for subsequent microscopic taxonomy analysis.

The OPC was used in continuous flow-through mode during the whole cruise, using the uncontaminated seawater supply. This was interrupted only briefly at local dusk and dawn to change data files, and for about an hour once a day on station to process the net samples. On days 126 to 134 a night net cast was also done, and the underway sampling was also interrupted for about one hour to process these samples. For about two hours each day a 200 μm. mesh filter was connected to the flow outlet to collect the sample passed through the OPC. This was preserved for subsequent analysis to validate the OPC data.

4.15.3 VIDEO ZOOPLANKTON ANALYSER (ViZA)

The full video system was not available for AMT 2 as the frame processor card was returned to the manufacturers for repair. In order that video data for this cruise should still be available, the video system was used with a video tape recorder, so that recorded data would be available for subsequent analysis.

The video system was used once each day for the whole cruise, coinciding with the collection of the in-line zooplankton sample during underway sampling. The duration of each day's video session was two hours. The video system was also used during the OPC processing of each day's vertical net samples. There is therefore about 64 hours of video data from which frames can be acquired for automated analysis of size and species distribution by the ViZA system. It is intended that this analysis should be completed during the winter of 1996/7. Concurrent data from the OPC, ViZA and microscopic analysis of taxonomy will be available for this two hour period each day.

4.15.4 RESULTS

Figure 22 shows the biovolume in parts per billion in each of the four JGOFS size classes for each daily 200 m. net cast throughout the cruise. Biovolume was generally low throughout the transect south of the equator, as might be expected in the late austral autumn. Some variability is evident around the Falkland Current/Brazil Current interface, and at about 28° south. There is a general increase as the equator is approached, with a peak at 4° north. After a fall from this level, the biovolume rises again through the West African upwelling area, between about 13 and 22° north. Biovolume then falls away, but to a level generally higher than that south of the equator, until the very large increase around 45° north, 16° west as a more coastal influence is felt in what is probably the tail of the northern spring bloom.

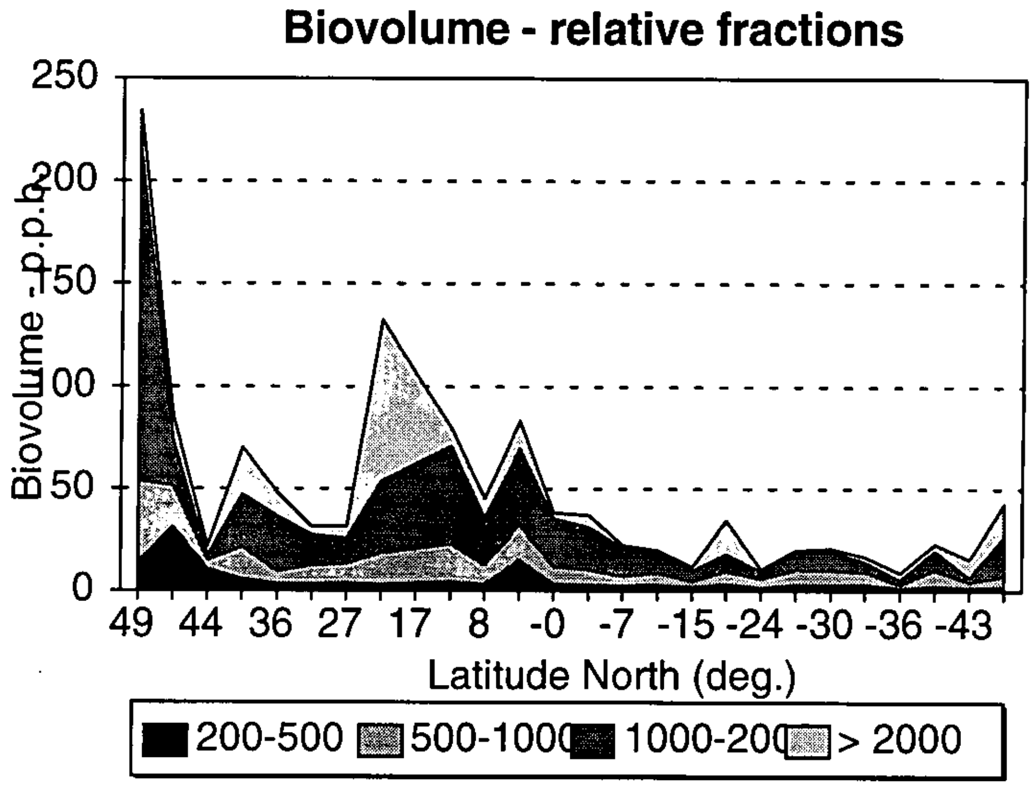


Figure 22. Estimated zooplankton OPC biovolume for daily integrated (200m) net hauls for the whole transect. Data are presented in the standard four JGOFS size fractions.

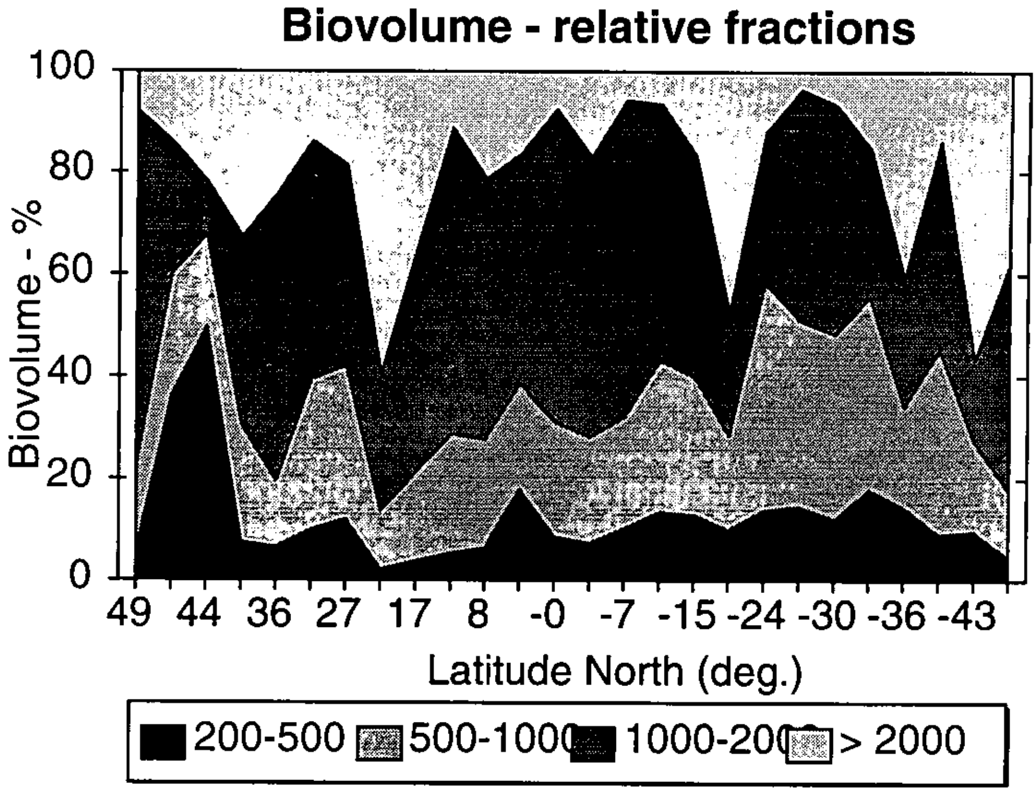


Figure 23. The OPC four biovolume fractions as a percentage of the total.

Figure 23 shows biovolume plotted as a single total value in parts per billion, with the same data for AMT-1 plotted for comparison. This shows the contrasts at the two extremes of the cruises, the first of which took place during the southern spring, and the second during the northern spring. Generally similar high values can be seen in each hemisphere during spring. The West African upwelling influence is more or less coincident for each transect, although AMT 2 shows higher values at the peak.

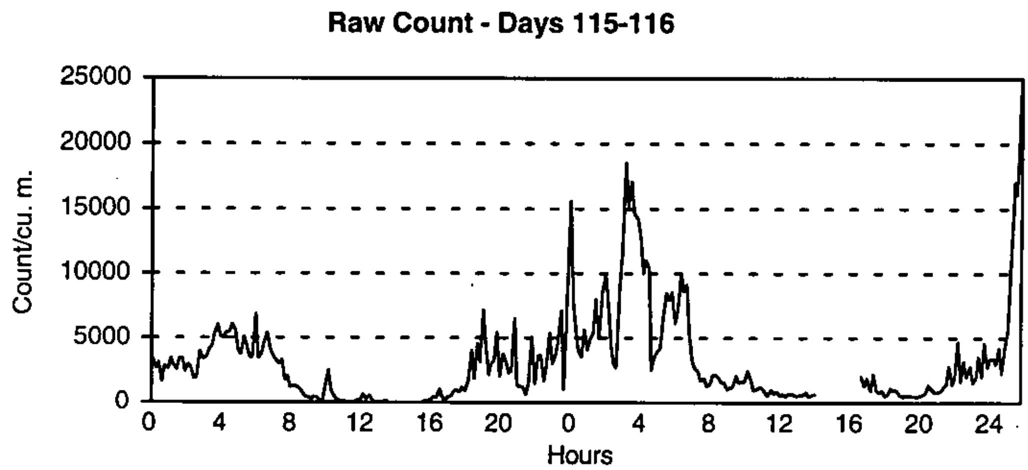
Figures 24 (series) show zooplankton abundance in counts per cubic metre in underway mode for the whole cruise. The high counts during days 115/116 show the effects of frontal activity in this area, where temperature fluctuated through 6° C. A sharp increase is evident at about 5° north, probably showing the influence of equatorial divergence. A frontal system is indicated at about 13° north, where temperature began falling and chlorophyll fluorescence increased. this position is coincident with the position indicated for the West African upwelling system by the net biovolume figures. Counts remain high for about 24 hours - to about 20° north, and are then lower until about 36° north. Between 36° north and 45° north counts are higher, and very much higher after this point.

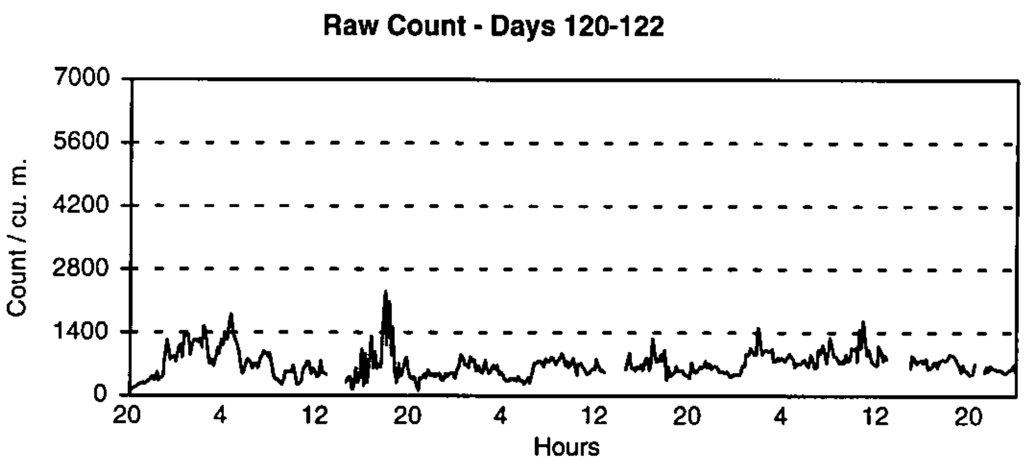
Two further points of interest are indicated by the raw counts shown on these figures.

(i) Diurnal cycles in numbers are evident throughout the transect, but are particularly evident in the higher latitudes at either extreme, as was also true of AMT-1. On days 115-116 in particular, surface counts are very high at night, and insignificant during the day.

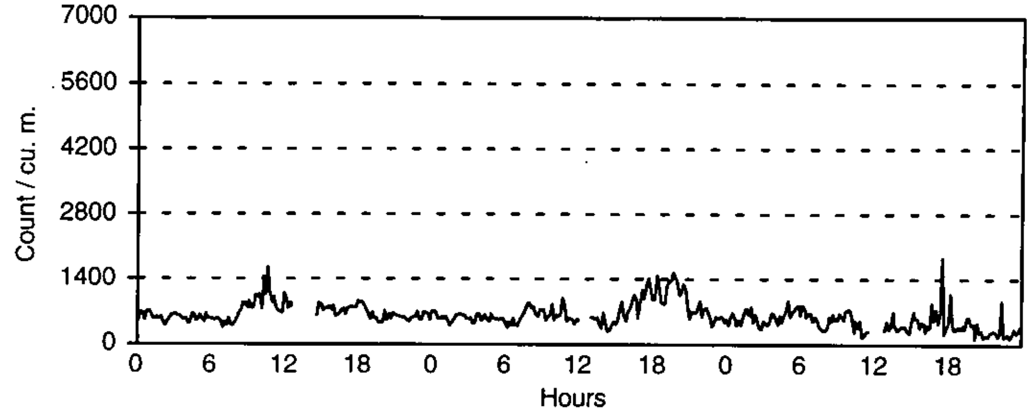
(ii) There is also evidence of large increases in counts at dusk and dawn, particularly between 20° south and 5° north (days 125 - 131). This phenomenon was also evident on AMT-1, particularly between about 7° north and 16° south, and seems to offer some support to the theory of 'midnight sinking'.

Figure 24 - series of underway OPC raw counts for the whole of AMT-2

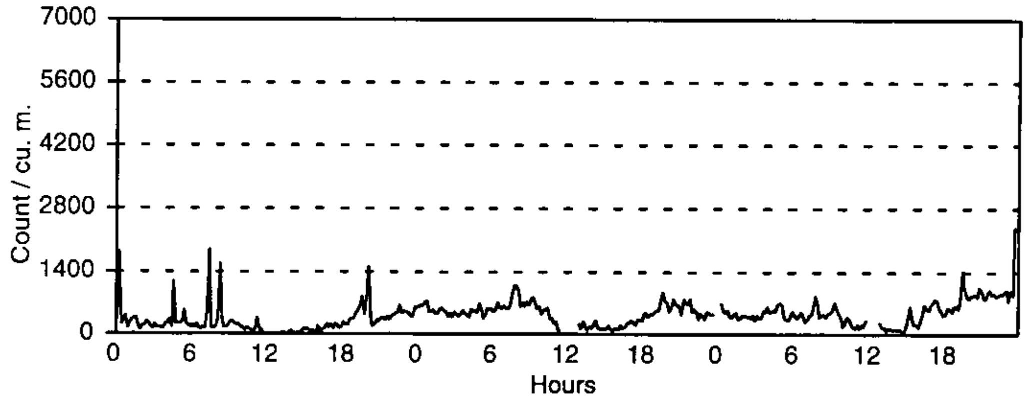




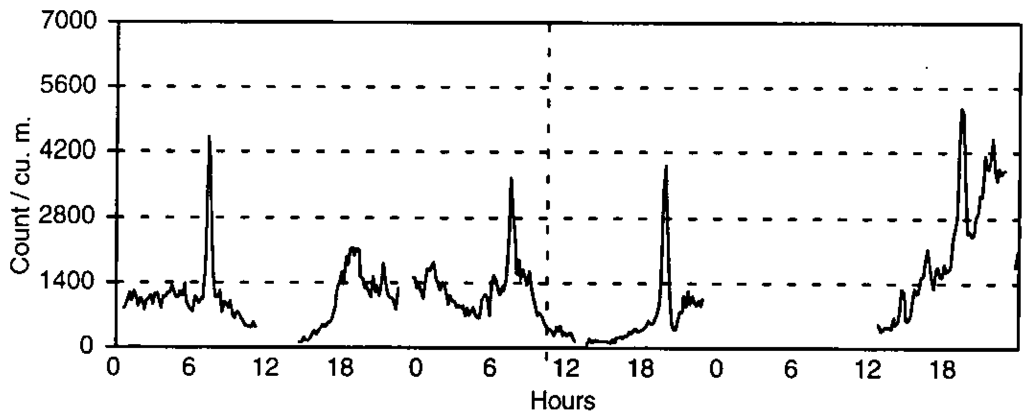
Raw Count - Days 123-125



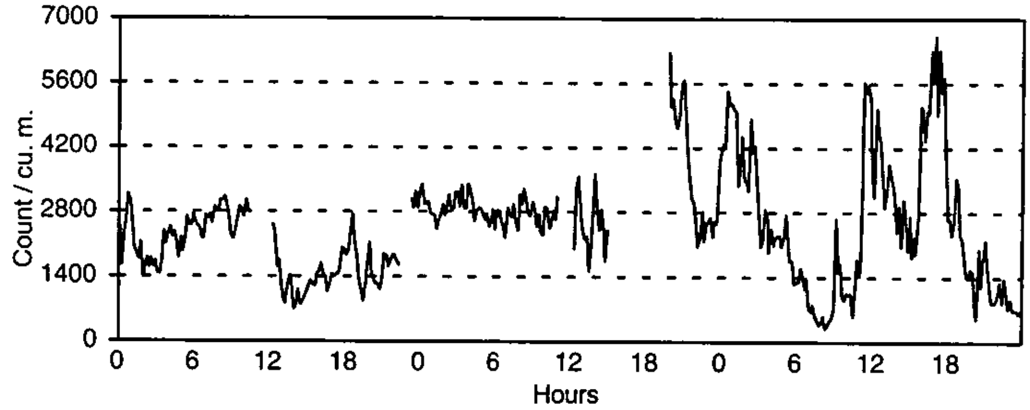
Raw Count - Days 126-128



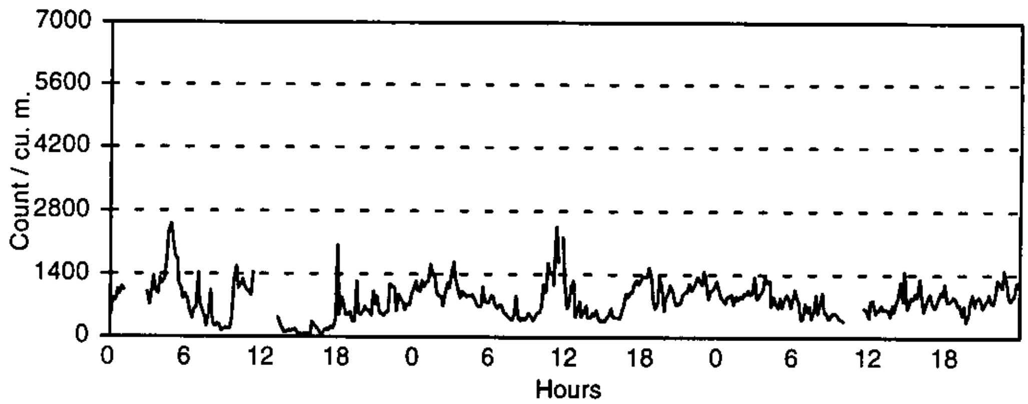
Raw Count - Days 129-131



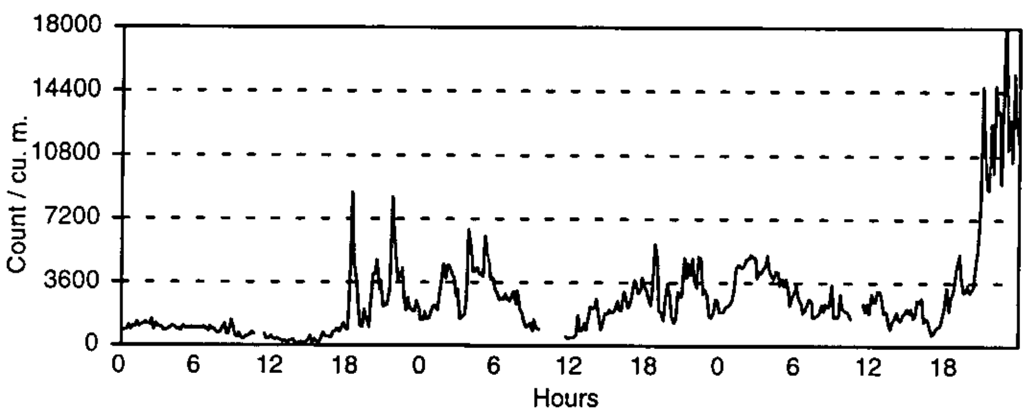
Raw Count - Days 132-134

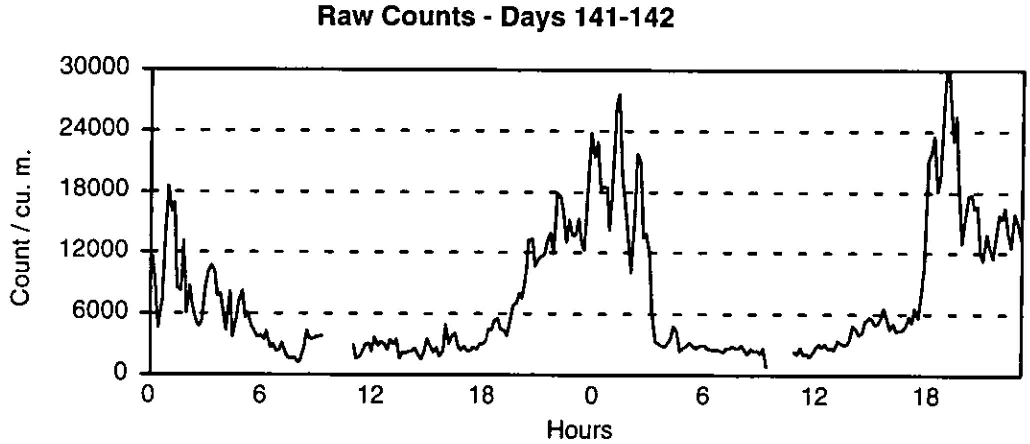


Raw Counts - Days 135-137



Raw Counts - Days 138-140





Midnight sinking:

A phenomenon associated with DVM is the appearance of peak abundance's at the surface at dawn and dusk, with midnight sinking apparent between these peaks. It has been suggested (Raymont, 1963) that this may be due to species seeking 'optimum' light levels. As light levels fall below this optimum, these species rise to the surface. Further reduction in light level to a point at which vertical position makes no difference results in the cessation of active swimming in response to light levels, and the natural tendency of zooplankton to sink passively takes over. As dawn approaches, and light levels again increase above this threshold, these species again rise in an attempt to reach this optimum light level. Shortly after dawn the surface light level exceeds this optimum, and the zooplankton again actively descend to deeper waters.

5.0 Cruise Synopsis

SECTION FIVE

5.1 Comparison of AMT-1 and AMT-2 surface salinity and temperature

One of the primary aims of the AMT programme is to provide a temporal data series of the Atlantic transect agianst which seasonal and yearly patters will be interpreted as well as identifying anomolous events. The data gathered on AMT-2 provided a comparison with AMT-1 which show clearly the seasonal difference of the two transects. AMT-1 started in the northern hemisphere in autumn and arrived in the Falklands in the austral spring, while AMT-2 started in the austral autumn and arrived at the northern end of the AMT in the Celtic Sea in late spring. The surface plot of temperature (figure 25) shows the seasonal warming from the northern end of the transect on AMT-1 and the warming of the southern end at the end of the austral summer on AMT-2. Salinity shows the seasonal variability (particulalry noticable in the equitorial region) which will be important for interpreting changes driven by pysical effects, for example the draw-down and release of CO_2 along the transect.

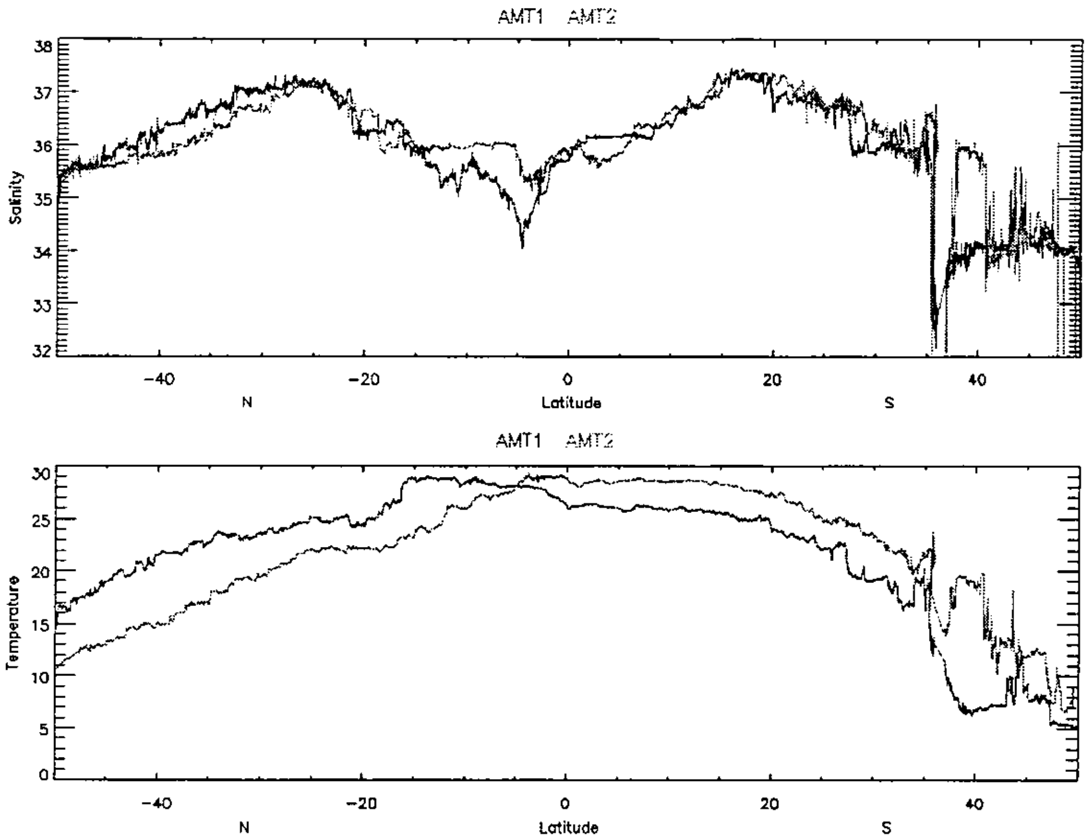
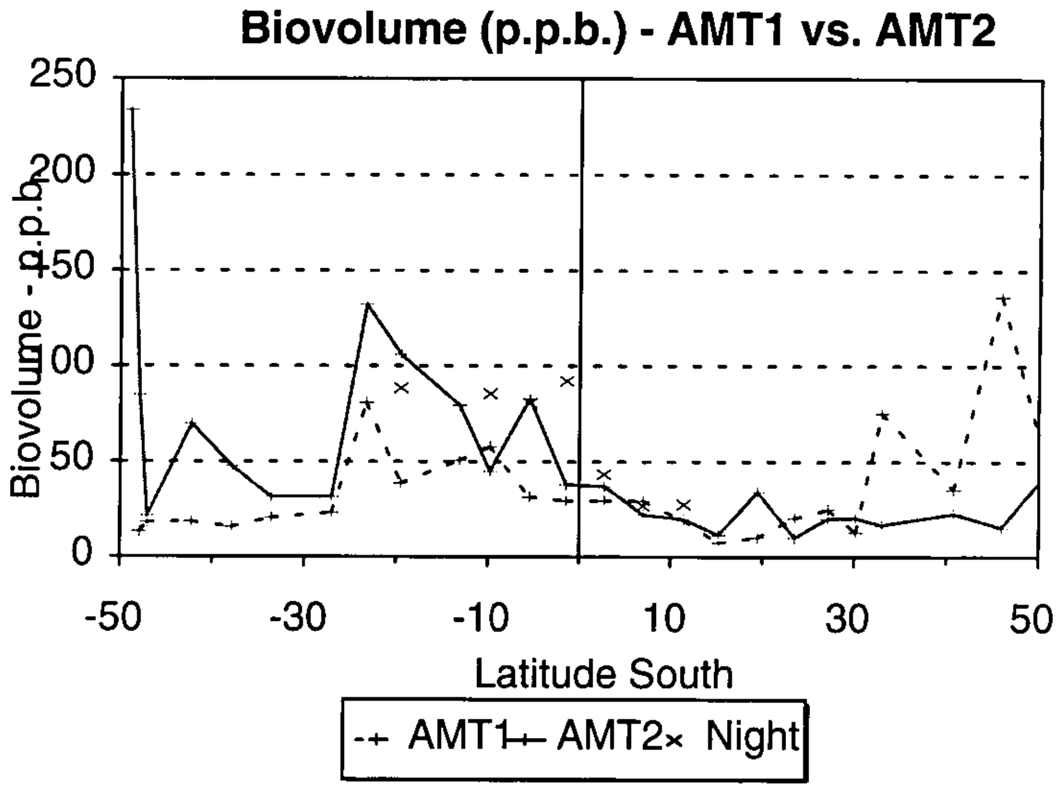


Figure 25. The seasonal shift and variability in salinty (top) and temperature (bottom) between AMT-1 (sampling late summer conditions in the north and spring in the south) and AMT-2 which sampled the late spring in the north and late summer at the southern end of the transect.

At the other end of the biological spectrum, the AMT provides similar comparisons into seasonal and yearly variability in plankton abundance and population structure. Figure 26 illustrates the changes in zooplankton bio-volume, measured with the OPC, from AMT-1 and AMT-2. This too shows the late summer influence in each hemishpere, in the north at the start of AMT-1 and in the south at the start of AMT-2.



Appendices

Cruise Logs

(i) Scientific Bridge Log

(ii) Navigation Log

(iii) Meteorological Log

(iv) CTD Bottle Depths & Digital Temperature Readings

(v) XBT Log

(vi) UOR Log

(vii) Optics Logs & Calibrations

(viii) PIC, Pigments & Chlorophyll Log

(ix) Summary Nutrient & Bacterial Log

(x) Synechococcus Log

(xi) Phytoplankton & Production Logs

(xii) Zooplankton and Particulate Log

(i) Scientific Bridge Log

Scientific Bridge Log for AMT-2

All times are in GMT

Date	*SDY*	*Latitude*	*Longitude*	*Time*	*Activity*
22/4/96	113			1400	Depart Stanley for Montevideo.
				1547	Test XBT launch.
		51° 15' S	57° 30' W	1630	"Uncontaminated SW" probe down to "full" position; pump on.
		50 36.3	57 16.6	1945	Stopped on station for test CTD cast. Wind: 245°, 30kn P: 990.7mb Cloud cover: 5/8
				2002	CTD deployed
				2008	CTD at 200m
				2014	Commence hauling of CTD
				2018	CTD at surface
		50 36.4	57 16.7	2034	Launch UOR. Head to sea 245°, 4kn
				2038	Increase to 8kn
				2100	Commence hauling in UOR. Speed 4kn
				2107	UOR out of water
23/4/96	114	49° 15.8' S	56° 20.4' W	0430	XBT launched. Depth: 777m
		48 24.1	55 56.4	0845	XBT launched. Depth: 1850m
				1010	Uncontaminated probe moved from mid to down position
		47 55.5	55 44.7	1127	XBT launched at 4700m
		47 50	55 42	1200	XBT launched at 4700m
		47 38	55 38	1305	XBT launched at 4700m
				1315	Setting up on station
				1331	CTD deployed. Cloud cover: 4/8
				1334	Plankton net deployed
				1355	CTD recovered
				1400	Plankton net recovered
				1420	CTD deployed
				1445	CTD recovered
				1520	UOR deployed. Turn to 008°, 10kn
				1654	UOR recovered (not diving properly)
				1700	Resume course: 008°, 12kn
		47 06.4	55 28.2	1810	XBT launched
				1855	UOR deployed
		46 59	55 24.4	1900	Resume course: 008°, 10kn
		46 58.1	55 24.1	1905	XBT launched. Depth: 5416m
				2005	UOR recovered
		46 49.1	55 20.4	2008	XBT launched. Depth: 5572m
		46 43.6	55 19.9	2015	Resume course 008°, 12kn
		46 39.6	55 17.2	2100	XBT launched. Depth: 5636m
		46 22.9	55 13	2230	XBT launched. Depth: 5641m
		46 08.4	55 10.9	2349	XBT launched. Depth: 5653m
24/4/96	115	45° 25.4' S	55° 06.4' W	0330	XBT launched. Depth: 5622m
		45 15	55 05.4	0420	XBT launched. Depth: 5654m
		45 00.2	55 03.1	0530	XBT launched. Depth: 5579m
		44 51.1	55 01.4	0610	XBT launched. Depth: 5568m
		44 34.2	54 58.6	0720	XBT launched. Depth: 5527m

		44 22.8	54 55.8	0825	XBT launched. Depth: 5503m
		44 15.4	54 54.2	0900	XBT launched. Depth: 5494m
		43 58.4	54 51.2	1020	XBT launched. Depth: 5449m
		43 47.6	54 48.7	1116	XBT launched. Depth: 5437m
		43 36.3	54 46.3	1216	XBT launched. Depth: 5424m
		43 29.7	54 44.4	1251	XBT launched. Depth: 5407m
		43 25.6	54 44.2	1330	Stopped on station. Cloud cover: 2/8 Wind speed: 5.4kn; direction: 180°
				1333	Optics unit deployed
				1335	Plankton net deployed
				1336	CTD deployed
				1337	Optics unit retrieved to check wire
				1346	CTD terminated and recovered
				1353	Plankton net recovered
				1355	Optics unit redeployed
				1358	Plankton net deployed
				1401	CTD deployed
				1421	Plankton net recovered
				1428	CTD recovered
				1445	Optics unit recovered
				1452	CTD redeployed
				1508	CTD recovered
		43 24.4	54 44.4	1528	UOR deployed at 4kn
				1531	Proceed 014°, 12kn
		43 02.9	54 39.2	1730	XBT launched. Depth: 5392m
		42 56.3	54 37.9	1812	UOR deployed
		42 45.2	54 33.9	1915	UOR recovered - still problems
		44 44.4	54 33.6	1925	XBT launched. Depth: 5336m
		42 36.5	54 30.3	2005	XBT launched. Depth: 5338m
		42 22.4	54 24.3	2120	XBT launched. Depth: 5372m
		42 02	54 15.6	2320	XBT launched. Depth: 5336m
25/4/96	116	41° 40.5' S	54° 08.3' W	0147	XBT launched. Depth: 5212m
		41 07.8	53 58.1	0530	XBT launched. Depth: 5078m
		41 04.2	53 56.8	0550	Uncontaminated SW probe up to "mid" position
		40 52.4	53 51.9	0700	XBT launched. Depth: 5059m
		40 40.7	53 47.1	0800	XBT launched. Depth: 5012m
		40 17	53 39.9	0950	XBT launched. Depth: 4858m
		39 53.6	53 33.4	1129	XBT launched. Depth: 4804m
		39 40.9	53 27.6	1228	XBT launched. Depth: 4665m
		39 24.3	53 19.5	1358	Stopped on station. Moderate sea. Cloud cover: 3/8
				1400	Optics unit deployed
				1403	Plankton net deployed
				1411	CTD deployed
				1423	Plankton net recovered
				1425	Plankton net redeployed
				1437	Optics unit recovered
				1444	CTD recovered
				1507	CTD deployed
				1512	Plankton net recovered
				1525	CTD recovered
		39 25.2	53 18.8	1536	Proceed 337°, 4000kW to Montevideo. Uncontaminated SW probe to "mid" position

29/4/96	120	36° 03.1' S	49° 48.7' W	1700	Stopped on station
				1702	Vertical net deployed
				1705	Optics unit deployed
				1708	Cloud cover: 7/8. Wind: 9.7 kn; 326°
				1710	CTD deployed
				1721	Vertical net recovered
				1737	CTD recovered
				1742	Plankton net recovered
				1746	Proceed at 6kn
				1747	XBT launched
				1756	UOR deployed. Increase to 11kn
		36 03.3	49 47.4	1800	
				2105	UOR recovered
				2250	XBT launched
30/4/96	121	35° 08.5' S	48° 36.9' W	0118	XBT launched
		34 00	47 22.1	0835	XBT launched
				0901	UOR deployed
		33 23.2	46 37.8	1303	UOR recovered
				1310	Cloud cover: 5/8. Wind: 2.1kn; 90°
		33 23	46 37.5	1313	Stopped on station
				1314	Plankton net and optics unit deployed
				1317	CTD deployed
				1330	Plankton net recovered
				1336	Plankton net deployed
				1341	Optics unit recovered
				1346	CTD recovered
				1400	CTD deployed
				1403	Plankton net recovered
				1430	CTD recovered
				1434	UOR deployed
				2103	UOR recovered
		32 20.1	45 29.2	2215	XBT launched
1/5/96	122	31° 46.9' S	44° 56.8' W	0200	XBT launched
		30 49	43 57.5	0845	XBT launched
				0903	UOR deployed
				1252	UOR recovered
		30 18	43 25.2	1307	Stopped on station
				1310	Optics unit and vertical net deployed Cloud cover: 2/8. Wind: 8kn; 92°
				1312	CTD deployed
				1325	Vertical net recovered
				1332	Plankton net deployed
				1336	Optics unit at surface, redeployed to 150m
				1340	CTD recovered
				1358	CTD deployed
				1406	Optics unit and plankton net recovered
				1414	CTD recovered
				1422	Off station, XBT launched
				1428	UOR deployed
				2020	UOR recovered
		29 30.7	42 38.6	2030	XBT launched
2/5/96	123			0913	UOR deployed
		27° 52.4' S	41° 05.3' W	0941	XBT launched

				1250	UOR recovered
		27 37.1	40 42.6	1300	Stopped on station
				1304	Optics unit deployed
				1306	Vertical net deployed
					Cloud cover: 8/8. Wind: 24.2kn; 100°
				1307	CTD deployed
				1322	Vertical net recovered
				1325	Plankton net deployed
				1331	CTD recovered
				1334	Optics unit recovered
				1347	CTD deployed
				1355	Plankton net recovered
				1404	CTD recovered
		27 37.2	40 43	1406	XBT launched
				1409	Off station
				1419	UOR deployed
		26 42.2	39 54.2	2047	XBT launched
3/5/96	124	26 00	39 16	0121	XBT launched
				0818	UOR deployed
		24 48.4	38 14.3	0850	XBT launched
				1150	UOR recovered
				1152	Begin figure of 8
				1210	End figure of 8
		24 21.2	37 51.9	1218	Stopped on station
				1222	Vertical net and optics unit deployed
					Cloud cover: 8/8. Wind: 19.2kn; 125°
				1224	CTD deployed
				1238	Vertical net recovered
				1244	Plankton net deployed
				1247	CTD recovered
				1249	Optics unit recovered
				1307	CTD deployed
				1314	Plankton net recovered
				1322	CTD recovered
				1326	Off station
		24 20.7	37 57.5	1329	XBT launched
				1922	UOR recovered
		22 58.7	37 10	2105	XBT launched
4/5/96	125	22° 14.8' S	36° 48' W	0032	XBT launched
		19 54.3	35 31.3	1159	Stopped on station
					Cloud cover: 2/8. Wind: 20.3kn; 249°
				1200	Vertical net and optics unit deployed
				1216	Vertical net recovered
				1225	CTD recovered. Plankton net deployed
				1234	Optics unit at surface, redeploy to 200m
				1246	CTD deployed
				1253	Plankton net recovered
				1255	Optics unit recovered
				1300	CTD recovered. Off station. XBT launched
				1310	UOR deployed
				1605	UOR recovered
5/5/96	126	17° 28.4' S	34° 23.4' W	0106	XBT launched
		15 32.9	33 28.8	1002	XBT launched

		15 10.3	33 18.4	1208	Stopped on station
				1210	Vertical net deployed
				1212	CTD and optics unit deployed
				1214	Cloud cover: 3/8. Wind: 13.3kn; 187°
				1225	Vertical net recovered
				1227	Optics unit recovered
				1231	Plankton net deployed
				1235	CTD recovered
				1242	Optics unit deployed
				1307	CTD and plankton net recovered
				1309	Optics unit recovered
				1310	Off station
		15 09.9	33 18.2	1315	XBT launched
				1319	UOR deployed
				1636	UOR recovered
		14 30.4	33 00	1707	XBT launched
		13 57.2	32 45.3	1947	XBT launched
		13 27	32 30.5	2211	XBT launched
		13 19.4	32 26.9	2300	Stopped on station
				2302	Vertical net and optics unit deployed
				2319	Vertical net recovered
				2328	Optics unit recovered. Off station
6/5/96	127	13° 09.4' S	32° 21.7' W	0040	XBT launched
		12 40.7	32 08.9	0323	XBT launched
		11 52.9	31 46.1	0600	XBT launched
		11 21.5	31 30.7	1106	XBT launched
				1157	UOR recovered
		11 14.7	31 27.7	1200	Stopped on station
				1205	Vertical net deployed
				1210	CTD and optics unit deployed
				1212	Cloud cover: 5/8. Wind: 11.7kn; 135°
				1223	Vertical net recovered
				1228	Plankton net deployed
				1235	CTD recovered
				1239	Optics unit recovered
				1252	CTD deployed
				1304	Plankton net recovered
				1309	CTD recovered. Off station
				1333	UOR deployed
		11 05.7	31 23.8	1416	XBT launched
		10 58.2	31 20.2	1500	XBT launched
		10 05	30 56.8	2003	XBT launched
				2240	UOR recovered
		9 38.6	30 44.6	2249	Stopped on station
				2251	Vertical net deployed to 200m
				2302	Optics unit deployed to 200m
				2309	Vertical net recovered
				2312	Optics unit recovered. Off station
		9 33.2	32 42.1	2349	XBT launched
7/5/96	128			0004	UOR deployed
		9° 08.9' S	30° 30' W	0219	XBT launched
		8 51.4	30 21.6	0400	XBT launched
		8 19.7	30 07.3	0700	XBT launched
				1149	UOR recovered
		7 28.8	29 45.3	1202	Stopped on station.

					Cloud cover: 1/8. Wind: 9.4kn; 110°
				1203	Vertical net and optics unit deployed
				1205	CTD deployed
				1220	Vertical net recovered
				1224	Plankton net deployed
				1229	Optics unit recovered
				1250	CTD deployed
				1258	Plankton net recovered
				1305	CTD recovered. Off station
		7 27.7	29 45.5	1315	XBT launched
		6 02.4	29 09.2	2133	XBT launched
		5 49.8	29 03.5	2259	Stopped on station
				2301	Optics unit and vertical net deployed to 200m
				2318	Vertical net recovered
				2321	Vertical net deployed to 20m
				2324	Vertical net recovered
				2328	Optics unit recovered
				2330	Off station
				2340	UOR deployed
8/4/96	129			0023	UOR recovered
		5° 34.3' S	26° 56.7' W	0109	XBT launched
		5 20.2	28 50.7	0208	XBT launched
		5 03.8	28 43.2	0405	XBT launched
		4 46.9	28 35.3	0545	XBT launched
		4 35.3	28 29.7	0655	XBT launched
		4 07.7	28 18.1	0933	XBT launched
				1040	UOR recovered
		3 55	28 12.6	1100	Stopped on station
				1103	Vertical net, optics unit and CTD deployed
				1110	Cloud cover: 1/8. Wind: 10.2kn; 132°
				1121	Vertical net recovered
				1124	Vertical net deployed to 20m
				1127	Vertical net recovered
				1133	Plankton net recovered ? dep ?
				1135	CTD recovered
				1137	Plankton net recovered
				1139	Optics unit recovered
				1142	Plankton net deployed
				1157	CTD deployed
				1206	CTD and plankton net recovered
				1209	Off station
				1217	UOR deployed
		3 50.4	28 10.8	1243	XBT launched
		3 35.3	28 03.8	1406	XBT launched
		2 58.8	27 46.6	1737	XBT launched
		2 45.8	27 40.3	1855	XBT launched
		2 28.2	27 31.5	2035	XBT launched
				2140	UOR recovered
		2 16.1	27 25.4	2204	Stopped on station
				2205	Vertical net and optics unit deployed
				2222	Vertical net recovered
				2225	Vertical net to 25m
				2229	Vertical net recovered
				2232	Optics recovered. Off station

		2 15.7	27 25.2	2236	XBT launched
				2240	UOR deployed
		2 03	27 18.9	2359	XBT launched
9/5/96	130	1° 54.4' S	27° 14.6' W	0051	XBT launched
		1 41.8	27 08.4	0206	XBT launched
		1 33.2	27 04.5	0258	XBT launched
		1 22.2	26 58.3	0402	XBT launched
		1 14	26 53.9	0451	XBT launched
		1 02.4	26 47.9	0600	XBT launched
		0 53.3	26 43.3	0652	XBT launched
		0 42.1	26 37.8	0756	XBT launched
		0 31	26 32.8	0900	XBT launched
		0 20.4	26 28	1000	XBT launched
				1040	UOR recovered
		0 11.7	26 24.1	1105	Stopped on station
				1106	Vertical net, optics unit and CTD deployed
				1107	Cloud: 3/8
				1116	Vertical net line snapped
				1125	Optics unit recovered, redeployed to 80m
				1136	CTD recovered
				1139	Plankton net deployed
				1151	Optics unit recovered
				1153	Plankton net recovered
				1201	Vertical net deployed
				1209	CTD deployed
				1219	Vertical net recovered
				1222	Vertical net deployed to 20m
				1225	CTD recovered
				1226	Vertical net recovered
				1227	Off station
		0 4	26 22.5	1240	XBT launched
				1247	UOR deployed
		0 07.7 N	26 13.8	1514	XBT launched
		0 26.8	26 05.5	1705	XBT launched
		0 37.3	26 01.2	1805	XBT launched
		0 47.3	25 57.1	1900	XBT launched
		0 58.7	25 52.7	2002	XBT launched
				2140	UOR recovered
		1 17.5	20 44.7	2200	Stopped on station
				2201	Optics unit and vertical net deployed
				2221	Vertical net recovered
				2224	Vertical net deployed to 20m
				2230	Optics unit and vertical net recovered. Off station. Calibrate Magtan
				2234	Start Mag calibration
				2258	Finish Mag calibration
				2304	UOR deployed
		1 21.2	25 42.5	2311	XBT launched
10/5/96	131	1° 30.9' N	25° 38.4' W	0011	XBT launched
		1 43.2	25 32.6	0120	XBT launched
		1 54.7	25 27	0226	XBT launched
		2 19.5	25 14.9	0445	XBT launched
		2 21.7	25 13.8	0457	XBT launched

		2 32.4	25 08.8	0558	XBT launched
		2 43.1	25 03.8	0659	XBT launched
		2 55	24 58.8	0807	XBT launched
		3 05.1	24 57.7	0902	XBT launched
		3 13.5	24 15.6	0958	XBT launched
				1040	UOR recovered
		3 24.1	24 47.7	1105	Stopped on station. Optics unit deployed
				1106	Cloud: 1/8
				1107	Vertical net and CTD deployed
				1124	Vertical net recovered
				1128	Certical net deployed to 20m
				1130	Vertical net recovered
				1132	Optics unit and CTD recovered
				1135	Plankton net deployed
				1148	CTD deployed
				1201	CTD and plankton net recovered
				1205	Off station
				1215	UOR deployed
		3 26.3	24 47.6	1224	XBT launched
		3 44.2	24 40.9	1403	XBT launched
		4 04.5	24 32.3	1600	XBT launched
				1704	UOR recovered
		4 25.8	24 23.1	1800	XBT launched
		4 58.3	24 09.4	2040	XBT launched
		5 05.9	24 05.9	2116	XBT launched
		5 12.1	24 03.1	2206	Stopped on station. Optics unit deployed
				2207	Vertical net deployed
				2226	Vertical net recovered
				2230	Vertical net deployed to 20m. Optics unit recovered
				2235	Vertical net recovered
		5 15.1	24 01.8	2240	Off station
11/5/96	132	5° 31.5' N	23° 54.2' W	0022	XBT launched
		5 56.3	23 43	0228	XBT launched
		7 13.8	23 07.1	0900	XBT launched
		7 34.6	22 56.6	1101	Stopped on station. Optics unit deployed Cloud: 7/8
				1102	Vertical net and CTD deployed
				1121	Vertical net recovered
				1125	Vertical net deployed to 20m
				1126	Vertical net and CTD recovered
				1128	Optics unit recovered
				1131	Plankton net deployed
				1138	Optics wire deployed to respool on drum
				1144	CTD deployed
				1151	Plankton net recovered
				1157	CTD recovered
				1200	Optics wire recovered. Off station
				1206	UOR deployed
		7 52	22 47.8	1351	XBT launched
				1501	UOR recovered
		8 44	22 22.3	1832	XBT launched

		9 21.6	22 04.9	2158	Stopped on station. Optics unit deployed
				2159	Vertical net deployed
				2217	Vertical net recovered
				2219	Vertical net deployed to 20m
				2224	Vertical net recovered
				2226	Optics unit recovered. Off station
		9 36.3	28 58.7	2340	XBT launched
12/5/96	133	11° 25.5' N	21° 11.6' W	0907	XBT launched
		11 44.4	21 03.1	1057	On station
				1059	Vertical net, optics unit and CTD deployed
				1100	Cloud cover: 0/8. Wind: 14.7 kn; 0.06°
				1116	Vertical net recovered
				1120	Vertical net deployed to 20m
				1121	CTD recovered
				1124	Vertical net recovered
				1126	Optics unit recovered
				1127	Plankton net deployed to 5m
				1135	CTD deployed
				1144	CTD and plankton net recovered
				1152	UOR deployed
				1457	UOR recovered
		13 05.3	20 53.5	1840	XBT launched
		14 09.1	20 57.2	2316	XBT launched
13/5/96	134	16° 21.8' N	24° 05' W	0929	XBT launched
		18 26.4	21 16.6	1907	XBT launched
		19 25.8	21 19.9	2327	XBT launched
14/5/96	135	19° 54.3' N	21° 19.2' W	0136	Stopped on station
				0138	Vertical net deployed
				0140	Hand net deployed
				0143	Optics unit deployed
				0159	Vertical net recovered
		19 54.4	21 19.3	0200	Vertical net deployed to 20m
				0203	Hand net recovered
				0205	Vertical net recovered
				0211	Optics unit recovered
				0212	Off station
		21 45.8	21 28.1	1057	Stopped on station. Optics unit deployed
				1059	Cloud cover: 2/8. Wind: 16 kn; 018°
				1102	Vertical net and CTD deployed
				1119	Vertical net recovered
				1121	Vertical net deployed to 20m
				1123	CTD and optics unit recovered
				1125	Vertical net recovered
				1129	Plankton net deployed
				1137	CTD deployed
				1151	Plankton net and CTD recovered
		21 46.1	21 28.5	1154	XBT launched
				1200	UOR deployed
				1503	UOR recovered
		22 29.8	21 31.0	1542	XBT launched
		23 00.9	21 32.6	1805	XBT launched

15/5/96 136	24° 48.6' N	21° 38.5' W	0205	XBT launched
	26 32.3	21 47.8	0956	Stopped on station. Optics unit deployed
			0959	CTD and vertical net deployed
			1016	Vertical net recovered
			1018	Vertical net deployed to 20m
			1022	Optics unit and vertical net recovered
			1026	Plankton net deployed
			1051	CTD recovered
			1105	CTD deployed
			1118	Plankton net recovered
			1122	CTD recovered
			1126	Start STCM turns
			1145	STCM turns complete
	26 56.9	21 50.3	1404	UOR recovered
	27 04.2	21 48.8	1447	XBT launched
	27 30.8	21 44.0	1650	XBT launched
	28 10.5	21 38.8	2000	XBT launched
	28 48.5	21 34	2304	XBT launched
16/5/96 137	30° 42.2' N	21° 17.8' W	0837	XBT launched
	30 55	21 16.3	0958	Stopped on station. Optics unit deployed
			1001	CTD and vertical net deployed
			1019	Vertical net recovered
			1023	Vertical net deployed to 20m
			1024	CTD recovered
			1026	Vertical net and optics unit recovered
			1030	Plankton net deployed
			1038	CTD deployed
			1052	CTD and plankton net recovered
	30 54.9	21 15.5	1053	Off station. XBT launched
			1101	UOR deployed
			1402	UOR recovered
	31 46.6	21 08.9	1522	XBT launched
	32 11.8	21 04.2	1732	XBT launched
	33 29.9	20 47.8	2345	XBT launched
17/5/96 138	35° 21.3' N	20° 27.9' W	0818	XBT launched
	35 39.9	20 25.1	0957	Stopped on station. Optics unit deployed Cloud cover: 5/8 Wind: 14.0 kn; 007°
			0959	CTD and vertical net deployed
			1016	Vertical net recovered
			1019	Vertical net deployed to 20m
			1022	CTD and vertical net recovered
			1026	Plankton net deployed
			1034	CTD deployed
			1042	Optics unit recovered
			1050	CTD and plankton net recovered
			1052	Off station
			1058	UOR deployed
			1150	XBT launched
			1358	UOR recovered
	36 21.3	20 17.7	1428	XBT launched
	36 48.1	20 13.2	1655	XBT launched

	37 12.6	20 08.7	1907	XBT launched
	37 50.2	20 02.2	2233	XBT launched
18/5/96 139	39° 44.1' N	20° 00.5' W	0855	XBT launched
	39 53.9	19 59.8	0957	Stopped on station. Optics unit deployed
				Cloud cover: 2/8 Wind: 16.0 kn; 003°
			0959	CTD and vertical net deployed
			1018	Vertical net recovered
			1019	CTD recovered. Vertical net deployed to 20m
			1023	Optics unit recovered
			1024	Vertical net recovered
			1027	Plankton net deployed
			1033	CTD deployed
			1046	CTD and plankton net recovered
			1048	Off station
			1056	UOR deployed
			1122	UOR recovered
	39 58.2	19 59.6	1125	XBT launched
	40 20.4	20 00.0	1327	XBT launched
	40 49.4	19 59.7	1553	XBT launched
	41 34.6	20 00.7	1939	XBT launched
19/5/96 140	44° 07.7' N	20° 00.9' W	0953	Stopped on station
			0958	Optics unit deployed
			1000	CTD and vertical net deployed
			1005	Cloud cover: 7/8 Wind: 18.9 kn; 351°
			1018	Vertical net recovered
			1020	Vertical net deployed to 20m
			1024	Vertical net recovered
			1026	Plankton net deployed
			1035	CTD recovered
			1037	Optics unit recovered
			1049	CTD deployed
			1102	CTD and plankton net recovered
	44 07.6	22 01.6	1106	XBT launched
			1112	UOR deployed
			1356	UOR recovered
	44 26.5	19 13.5	1437	XBT launched
	44 37.2	18 48.3	1614	XBT launched
	44 49.7	18 17.1	1806	XBT launched
	45 01.9	17 46.3	2002	XBT launched
	45 18.5	17 04.8	2227	XBT launched
20/5/96 141	46° 18.5' N	14° 31.5' W	0709	XBT launched
	46 29.7	14 03.7	0856	Stopped on station
			0900	Optics unit deployed
			0903	CTD and vertical net deployed
			0910	Cloud cover: 3/8 Wind: 13.6 kn; 146°
			0921	Vertical net recovered
			0923	Vertical net deployed to 20m
			0926	Optics unit and vertical net recovered
			0929	Plankton net deployed
			0947	CTD recovered
			1001	CTD deployed
			1012	Plankton net recovered

			1017	CTD recovered. Off station
			1025	UOR deployed
	46 40.9	13 32.8	1231	XBT launched
			1256	UOR recovered
	46 58.5	12 49.0	1514	XBT launched
	47 09.5	12 21.7	1651	XBT launched
	47 28.7	11 32.1	1945	XBT launched
			2050	UOR deployed
21/5/96 142			0614	UOR recovered
	48° 45.1' N	8° 06' W	0858	Stopped on station. Optics unit deployed
			0904	CTD and vertical net deployed
			0913	Vertical net recovered
			0917	Vertical net deployed to 20m
			0919	Vertical net recovered
			0924	Optics unit recovered. Plankton net deployed
			0932	CTD recovered
			0946	CTD deployed
			0956	Plankton net recovered
			1003	CTD recovered
			1005	Off station
	49 04.3	7 19.6	1312	Stopped on station
			1322	Optics unit deployed
			1400	Off station
	49 09.3	7 04.0	1454	Stopped on station
			1501	Optics unit deployed
			1517	Optics unit recovered
			1525	Off station
	49 15.2	6 52.3	1615	Stopped on station
			1621	Optics unit deployed
			1639	Optics unit recovered
			1644	Off station
	49 20.5	6 45.0	1717	Stopped on station
			1724	Optics unit deployed
			1739	Optics unit recovered. Off station

(ii) Navigation Log

Navigation Log Summary for AMT-2 Cruise

All times are in GMT

Date	*SDY*	*Time*	*Latitude*	*Longitude*
22/4/96	113	1600	51° 22.1' S	57° 33.3' W
		1700	51 08.6	57 28.8
		1800	50 56.3	57 24.1
		1900	50 44.8	57 19.6
		2000	50 36.2	57 16.3
		2200	50 29.1	57 18.3
		2320	50 20.0	57 08.3
23/4/96	114	0000	50° 09.9' S	56° 58.4' W
		0200	49 46.6	56 39.6
		0400	49 21.3	56 23.8
		0600	49 08.9	56 16.1
		0700	48 55.7	56 10.0
		0800	48 43.8	56 04.3
		0900	48 33.1	55 59.8
		1000	48 21.9	55 55.5
		1100	48 11.5	55 51.1
		1200	48 00.7	55 46.7
		1300	47 50.0	55 42.0
		1405	47 38.0	55 37.5
		1500	47 35.2	55 35.7
		1600	47 35.2	55 35.6
		1700	47 27.6	55 35.7
		1800	47 20.0	55 31.9
		1900	47 08.5	55 28.8
		2000	46 59.0	55 24.4
		2100	46 49.9	55 21.3
		2200	46 39.6	55 17.2
		2330	46 29.2	55 15.3
24/4/96	115	0000	46° 17.7' S	55° 12.2' W
		0100	46 06.7	55 10.7
		0200	45 55.2	55 09.5
		0300	45 30.6	55 06.9
		0400	45 18.8	55 05.8
		0500	45 05.3	55 04.1
		0600	44 53.1	55 01.8
		0700	44 39.9	54 59.4
		0800	44 26.8	54 56.8
		0900	44 14.8	54 54.0
		1000	44 02.7	54 52.0
		1100	43 51.0	54 49.7
		1200	43 39.8	54 46.9
		1300	43 28.2	54 43.9
		1400	43 25.6	54 44.2
		1500	43 25.4	54 44.7
		1600	43 18.4	54 42.9
		1700	43 08.8	54 40.6
		1830	42 57.2	54 38.2
		1900	42 46.8	54 34.6
		2000	42 37.5	54 30.4
		2100	42 26.1	54 25.9
		2230	42 15.4	54 21.4

		2300	42 05.5	54 17.1
25/4/96	116	0000	41° 56.3' S	54° 13.4' W
		0100	41 47.5	54 10.4
		0200	41 38.9	54 07.8
		0400	41 21.7	54 02.4
		0500	41 12.6	53 59.7
		0600	41 03.3	53 56.4
		0700	40 52.4	53 51.9
		0800	40 40.7	53 47.1
		0900	40 27.9	53 42.9
		1000	40 14.5	53 39.4
		1100	40 00.5	53 35.8
		1300	39 33.9	53 24.8
		1400	39 24.3	53 19.5
		1500	39 24.3	53 19.5
		1600	39 21.2	53 21.5
		1700	39 07.3	53 29.5
		1800	38 54.7	53 36.6
		1900	38 40.4	53 45.3
		2000	38 28.1	53 52.2
		2100	38 15.2	53 59.7
		2200	38 02.2	54 06.5
		2300	37 48.6	54 12.7
26/4/96	117	0000	37° 34.6' S	54° 18.9' W
		0100	37 21.0	54 24.5
		0200	37 06.4	54 31.0
		0300	36 52.0	54 32.9
		0400	36 38.7	54 44.6
		0500	36 24.6	54 52.5
		0600	36 11.0	55 00.4
		0700	35 57.8	55 08.0
		0800	35 44.2	55 15.5
		0900	35 30.7	55 23.0
		1038	35 17.2	55 30.3
28/4/96	119	2200	35° 07.6' S	55° 26.2' W
		2300	35 09.8	55 10.5
29/4/96	120	0000	35° 12.3' S	54° 54.0' W
		0100	35 15.6	54 37.1
		0200	35 18.8	54 18.1
		0300	35 21.3	53 54.4
		0400	35 23.6	53 40.5
		0500	35 27.0	53 22.4
		0600	35 30.2	53 04.2
		0700	35 33.3	52 45.4
		0800	35 38.8	52 23.1
		0900	35 41.6	52 09.8
		1000	35 45.0	51 49.1
		1100	35 46.9	51 33.4
		1200	35 49.0	51 15.5
		1300	35 51.4	50 58.2
		1400	35 53.6	50 40.8
		1500	35 56.2	50 23.5
		1600	35 59.7	50 05.7
		1700	36 03.2	49 48.7
		1800	36 03.4	49 47.6
		1900	35 57.0	49 38.7
		2000	35 49.5	49 28.7
		2100	35 42.4	49 19.1

		2200	35 35.6	49 09.6
		2300	35 27.5	48 58.8
30/5/96	121	0000	35° 19.3' S	48° 49.0' W
		0100	35 10.9	48 39.4
		0200	35 01.9	48 38.7
		0300	34 52.4	48 22.1
		0400	34 43.0	48 12.4
		0500	34 33.3	48 02.2
		0600	34 23.8	47 51.4
		0700	34 14.4	47 40.2
		0800	34 05.4	47 29.1
		0900	33 56.7	47 17.8
		1000	33 48.8	47 07.4
		1100	33 40.3	46 57.0
		1200	33 31.6	46 47.1
		1300	33 23.3	46 38.0
		1400	33 23.5	46 37.0
		1500	33 20.5	46 32.4
		1600	33 12.2	46 22.8
		1700	33 03.7	46 13.4
		1800	32 55.1	46 04.7
		1900	32 46.5	45 56.8
		2000	32 38.3	45 48.2
		2100	32 29.2	45 39.0
		2200	32 22.4	45 31.5
		2300	32 13.6	45 22.7
1/5/96	122	0000	32° 04.7' S	45° 13.8' W
		0100	31 55.9	45 05.3
		0200	31 47.0	44 56.9
		0300	31 38.2	44 48.4
		0400	31 29.6	44 39.5
		0500	31 21.1	44 30.7
		0600	31 12.7	44 21.8
		0700	31 04.1	44 12.9
		0800	30 55.5	44 04.1
		0900	30 47.4	43 55.9
		1000	30 39.6	43 47.4
		1100	30 31.9	43 39.3
		1200	30 24.0	43 31.0
		1300	30 17.9	43 25.1
		1400	30 18.5	43 25.6
		1500	30 14.3	43 21.9
		1600	30 06.1	43 13.9
		1700	29 58.1	43 05.8
		1800	29 50.0	42 57.7
		1900	29 41.9	42 50.0
		2000	29 34.0	42 41.7
		2100	29 26.5	42 34.4
		2200	29 18.3	42 26.0
		2300	29 14.3	42 21.9
2/5/96	123	0000	29° 02.1' S	42° 09.8' W
		0100	28 54.6	42 02.2
		0200	28 47.6	41 54.7
		0300	28 40.7	41 47.2
		0400	28 34.0	41 40.1
		0500	28 27.5	41 33.6
		0600	28 21.4	41 27.6
		0700	28 15.2	41 21.4

		0800	28 09.1	41 15.1
		0900	28 03.2	41 09.2
		1000	27 57.3	41 03.2
		1100	27 50.4	40 56.0
		1200	27 42.9	40 48.4
		1300	27 37.1	40 42.6
		1400	27 37.2	40 43.0
		1500	27 30.7	40 38.1
		1600	27 22.0	40 31.0
		1700	27 13.4	40 23.4
		1800	27 06.1	40 16.6
		1900	26 57.9	40 08.7
		2000	26 49.1	40 00.7
		2100	26 40.6	39 52.7
		2200	26 31.7	39 44.3
		2300	26 22.4	39 36.0
3/5/96	124	0000	26° 12.9' S	39° 27.4' W
		0100	26 03.4	39 18.9
		0200	25 53.8	39 10.7
		0300	25 43.9	39 02.3
		0400	25 34.1	38 53.8
		0500	25 24.4	38 45.3
		0600	25 14.4	38 36.7
		0700	25 04.6	38 28.1
		0800	24 54.8	38 19.6
		0900	24 46.7	38 12.8
		1000	24 37.5	38 05.0
		1100	24 28.5	37 57.8
		1200	24 21.5	37 52.3
		1300	24 21.1	37 51.9
		1400	24 14.5	37 48.9
		1500	24 02.9	37 43.0
		1600	23 53.4	37 38.1
		1700	23 42.9	37 32.6
		1800	23 32.6	37 27.4
		1900	23 22.3	37 22.3
		2000	23 11.7	37 16.9
		2100	22 59.6	37 10.5
		2200	22 47.3	37 04.1
		2300	22 34.7	36 57.9
4/5/96	125	0000	22° 21.9' S	36° 51.6' W
		0100	22 09.2	36 45.2
		0200	21 56.9	36 38.1
		0300	21 44.3	36 30.7
		0400	21 31.7	36 23.6
		0500	21 19.3	36 16.2
		0600	21 07.3	36 08.5
		0700	20 55.4	36 00.7
		0800	20 43.4	35 52.7
		0900	20 30.5	35 46.7
		1000	20 17.7	35 41.0
		1100	20 05.1	35 35.5
		1200	19 54.4	35 31.3
		1300	19 54.6	35 32.0
		1400	19 45.5	35 28.7
		1500	19 35.6	35 24.2
		1600	19 26.3	35 19.5
		1700	19 14.8	35 13.8

		0400	8 51.5	30 21.7
		0500	8 41.0	30 16.9
		0600	8 30.3	30 12.1
		0700	8 19.7	30 07.3
		0800	8 09.1	30 02.5
		0900	7 58.5	29 57.8
		1000	7 47.8	29 53.2
		1100	7 37.3	29 48.7
		1200	7 28.9	29 45.3
		1300	7 28.6	29 45.8
		1400	7 20.9	29 42.7
		1500	7 10.4	29 38.4
		1600	7 00.0	29 34.1
		1700	6 49.6	29 30.0
		1800	6 39.3	29 25.5
		1900	6 29.0	29 21.1
		2000	6 18.5	29 16.6
		2100	6 08.1	29 11.8
		2200	5 57.7	29 07.1
		2300	5 49.8	29 03.5
8/5/96	129	0000	5° 46.0' S	29° 02.0' W
		0100	5 36.0	28 57.5
		0200	5 25.5	28 53.0
		0300	5 15.1	28 48.4
		0400	5 05.0	28 43.8
		0500	4 54.8	28 39.0
		0600	4 44.7	28 34.3
		0700	4 34.5	28 29.4
		0800	4 23.9	28 25.2
		0900	4 13.4	28 20.8
		1000	4 03.2	28 16.1
		1100	3 55.1	28 12.5
		1200	3 55.0	28 12.7
		1300	3 47.6	28 09.4
		1400	3 37.0	28 04.5
		1500	3 26.3	27 59.5
		1600	3 16.0	27 54.7
		1700	3 05.5	27 49.8
		1800	2 55.1	27 44.8
		1900	2 44.6	27 39.7
		2000	2 34.3	27 34.7
		2100	2 24.1	27 29.5
		2200	2 16.0	27 25.5
		2300	2 13.0	27 23.9
9/5/96	130	0000	2° 03.1' S	27° 18.9' W
		0100	1 53.2	27 14.0
		0200	1 42.9	27 09.0
		0300	1 32.9	27 03.7
		0400	1 22.7	26 58.5
		0500	1 12.6	26 53.1
		0600	1 02.2	26 47.8
		0700	0 51.9	26 42.6
		0800	0 41.4	26 37.5
		0900	0 30.9	26 32.7
		1000	0 20.2	26 27.9
		1100	0 11.7	26 24.2
		1200	0 11.7	26 23.4
		1300	0 09.0	26 21.5

		1800	19 01.8	35 07.2
		1900	18 48.7	35 00.1
		2000	18 35.6	34 54.9
		2100	18 22.5	34 48.9
		2200	18 09.5	34 42.9
		2300	17 56.4	34 35.9
5/5/96	126	0000	17° 46.3' S	34° 30.7' W
		0100	17 30.3	34 24.4
		0200	17 17.1	34 18.1
		0300	17 04.1	34 11.8
		0400	16 51.1	34 05.6
		0500	16 38.0	33 59.4
		0600	16 25.1	33 53.5
		0700	16 12.3	33 47.5
		0800	16 59.5	33 41.4
		0900	16 46.7	33 35.4
		1000	15 33.8	33 29.2
		1100	15 21.0	33 23.2
		1200	15 10.3	33 18.3
		1300	15 10.3	33 18.3
		1400	15 01.8	33 14.5
		1500	14 52.0	33 10.1
		1600	14 41.6	33 05.3
		1700	14 32.0	33 00.9
		1800	14 19.4	32 55.3
		1900	14 06.9	32 49.9
		2000	13 54.5	32 44.1
		2100	13 42.0	32 38.0
		2200	13 29.4	32 31.8
		2300	13 19.4	32 26.9
6/5/96	127	0000	13° 16.4' S	32° 25.3' W
		0100	13 06.1	32 20.2
		0200	12 55.5	32 15.3
		0300	12 44.8	32 10.3
		0400	12 34.2	32 05.4
		0500	12 23.8	32 00.5
		0600	12 13.5	31 55.8
		0700	12 03.2	31 51.0
		0800	11 52.8	31 46.1
		0900	11 42.6	31 41.1
		1000	11 32.7	31 36.2
		1100	11 22.7	31 31.3
		1200	11 14.7	31 27.7
		1300	11 14.8	31 27.9
		1400	11 08.6	31 25.1
		1500	10 58.3	31 20.2
		1600	10 47.8	31 15.4
		1700	10 37.3	31 10.8
		1800	10 26.9	31 06.2
		1900	10 16.3	31 01.7
		2000	10 05.7	30 57.1
		2100	9 55.0	60 52.4
		2200	9 44.5	30 47.5
		2300	9 38.5	30 44.6
7/5/96	128	0000	9° 32.4' S	30° 41.7' W
		0100	9 22.5	30 36.9
		0200	9 12.2	30 31.7
		0300	9 02.0	30 26.6

	1400	0 01.8	26 18.1
	1500	0° 05.3' N	26 14.8
	1600	0 15.6	26 10.4
	1700	0 26.1	26 05.9
	1800	0 36.6	26 01.5
	1900	0 47.4	25 57.1
	2000	0 58.3	25 52.8
	2100	1 09.1	25 48.4
	2200	1 17.5	25 44.7
	2300	1 18.5	25 43.6
10/5/96 131	0000	1° 28.7' N	25° 39.4' W
	0100	1 39.5	25 34.4
	0200	1 50.1	25 29.3
	0300	2 00.7	25 24.0
	0400	2 11.3	25 18.6
	0500	2 22.1	25 13.7
	0600	2 32.8	25 08.6
	0700	2 43.3	25 03.7
	0800	2 54.0	24 59.2
	0900	3 04.8	24 54.8
	1000	3 15.6	24 50.5
	1100	3 24.2	24 47.6
	1200	3 24.1	24 48.4
	1300	3 32.9	24 45.2
	1400	3 43.6	24 41.1
	1500	3 54.1	24 36.6
	1600	4 04.6	24 32.3
	1700	4 14.3	24 28.1
	1800	4 25.9	24 23.1
	1900	4 38.1	24 17.8
	2000	4 50.5	24 12.8
	2100	5 02.5	24 07.5
	2200	5 12.2	24 03.1
	2300	5 15.2	24 01.8
11/5/96 132	0000	5° 26.9' N	23° 56.3' W
	0100	5 38.6	23 51.0
	0200	5 50.5	23 45.5
	0300	6 02.6	23 40.2
	0400	6 14.3	23 34.7
	0500	6 26.1	23 29.2
	0600	6 38.1	23 23.8
	0700	6 49.9	23 18.3
	0800	7 01.8	23 12.8
	0900	7 13.7	23 07.1
	1000	7 25.8	23 01.0
	1100	7 35.6	22 56.1
	1200	7 34.8	22 56.8
	1300	7 43.4	22 52.4
	1400	7 53.5	22 47.0
	1500	8 03.1	22 42.4
	1600	8 14.2	22 37.1
	1700	8 26.2	22 31.5
	1800	8 37.7	22 25.5
	1900	8 49.2	22 19.7
	2000	9 01.0	22 14.4
	2100	9 12.6	22 09.1
	2200	9 21.6	22 04.9
	2300	9 27.6	22 02.0

12/5/96	133	0000	9° 31.1' N	21° 56.9' W
		0100	9 50.6	21 52.2
		0200	10 02.1	21 47.7
		0300	10 13.7	21 43.3
		0400	10 25.4	21 38.3
		0500	10 36.9	21 33.1
		0600	10 48.5	21 28.2
		0700	11 00.4	21 22.9
		0800	11 12.3	21 17.8
		0900	11 24.0	21 12.4
		1000	11 36.2	21 06.6
		1100	11 44.3	21 03.3
		1200	11 45.8	21 03.0
		1300	11 55.5	20 58.9
		1400	12 05.7	20 54.3
		1500	12 15.4	20 50.2
		1600	12 28.9	20 50.4
		1700	12 42.5	20 51.3
		1800	12 56.1	20 52.7
		1900	13 09.9	20 53.9
		2000	13 23.8	20 54.9
		2100	13 37.6	20 55.7
		2200	13 51.5	20 56.5
		2300	14 05.3	20 57.0
13/5/96	134	0000	14° 19.0' N	20° 57.7' W
		0100	14 32.2	20 58.3
		0200	14 45.5	20 58.7
		0300	14 58.5	20 59.5
		0400	15 11.4	21 00.7
		0500	15 23.9	21 01.4
		0600	15 36.6	21 02.0
		0700	15 49.7	21 02.9
		0800	16 02.5	21 03.8
		0900	16 15.5	21 04.6
		1100	16 39.1	21 06.1
		1200	16 52.2	21 07.1
		1300	17 04.9	21 08.4
		1400	17 17.5	21 09.6
		1900	18 25.8	21 16.6
		2000	18 39.3	21 17.4
		2100	18 52.9	21 18.3
		2200	19 06.6	21 19.3
		2300	19 20.3	21 19.7
14/5/96	135	0000	19° 34.0' N	21° 20.0' W
		0100	19 47.9	21 19.8
		0200	19 54.4	21 19.3
		0300	20 04.7	21 19.7
		0400	20 17.4	21 20.5
		0600	20 42.2	21 22.2
		0700	20 55.4	21 23.6
		0800	21 08.6	21 24.7
		0900	21 21.7	21 25.8
		1000	21 35.1	21 26.9
		1100	21 45.7	21 28.0
		1200	21 46.4	21 28.6
		1300	21 58.2	21 29.4
		1400	22 10.0	21 30.2
		1500	22 20.9	21 30.7

		1600	22 33.5	21 31.2
		1700	22 46.7	21 31.6
		1800	22 59.8	21 32.5
		1900	23 13.1	21 33.4
		2000	23 26.4	21 34.3
		2100	23 39.5	21 34.9
		2200	23 52.8	21 35.3
		2300	24 06.2	21 35.8
15/5/96	136	0000	24° 19.8' N	21° 36.3' W
		0100	24 33.3	21 37.1
		0200	24 47.1	21 38.3
		0300	25 00.7	21 39.8
		0400	25 14.5	21 40.8
		0500	25 28.2	21 41.9
		0600	25 41.7	21 43.1
		0700	25 55.3	21 44.5
		0800	26 08.9	21 45.6
		0900	26 22.4	21 47.1
		1000	26 32.3	21 47.7
		1100	26 32.4	21 47.7
		1200	26 34.9	21 47.3
		1300	26 45.5	21 48.8
		1400	26 55.7	21 50.4
		1500	27 07.4	21 48.1
		1600	27 20.2	21 45.6
		1700	27 33.0	21 43.6
		1800	27 45.7	21 42.0
		1900	27 58.0	21 40.3
		2000	28 10.3	21 38.8
		2100	28 22.5	21 37.3
		2200	28 34.4	21 35.7
		2300	28 46.4	21 34.2
16/5/96	137	0000	28° 58.5' N	21° 32.5' W
		0100	29 10.5	21 30.6
		0200	29 22.4	21 28.7
		0300	29 34.3	21 26.9
		0400	29 46.2	21 25.2
		0500	29 58.0	21 23.6
		0600	30 10.0	21 22.3
		0700	30 22.0	21 20.8
		0800	30 33.9	21 19.0
		0900	30 46.1	21 17.2
		1000	30 55.0	21 16.3
		1100	30 55.0	21 15.4
		1200	31 05.8	21 13.5
		1300	31 17.1	21 11.8
		1400	31 28.0	21 10.6
		1500	31 39.8	21 09.6
		1600	31 52.3	21 07.7
		1700	32 04.9	21 05.5
		1800	32 17.6	21 03.1
		1900	32 30.2	21 00.5
		2000	32 42.6	20 57.9
		2100	32 55.1	20 55.1
		2200	33 07.8	20 52.4
		2300	33 20.6	20 49.6
17/5/96	138	0000	33° 32.7' N	20° 47.4' W
		0100	33 45.5	20 45.2

	1200	44 11.8	19 50.0
	1300	44 17.2	19 36.0
	1400	44 22.5	19 23.1
	1500	44 29.0	19 07.8
	1600	44 35.6	18 52.3
	1700	44 42.0	18 36.4
	1800	44 48.6	18 20.1
	1900	44 55.0	18 03.7
	2000	45 01.6	17 47.0
	2100	45 08.2	17 30.2
	2200	45 15.1	17 12.9
	2300	45 22.4	16 55.5
20/5/96 141	0000	45° 29.5' N	16° 37.8' W
	0100	45 36.7	16 20.7
	0200	45 43.4	16 03.2
	0300	45 50.2	15 45.5
	0400	45 57.0	15 27.7
	0500	46 03.6	15 09.8
	0600	46 10.2	14 51.9
	0700	46 17.3	14 34.4
	0800	46 24.2	14 17.0
	0900	49 29.6	14 03.7
	1000	46 29.4	14 03.8
	1100	46 32.4	13 55.1
	1200	46 37.9	13 40.5
	1300	46 43.4	13 26.9
	1400	46 51.0	13 09.7
	1500	46 56.9	12 53.2
	1600	47 03.5	12 35.7
	1700	47 10.6	12 19.2
	1800	47 17.6	12 02.7
	1900	47 23.9	11 45.4
	2000	47 30.2	11 28.0
	2100	47 36.1	11 11.6
	2200	47 41.8	10 57.4
	2300	47 47.6	10 42.5
21/5/96 142	0000	47° 53.3' N	10° 27.2' W
	0100	47 59.0	10 11.7
	0200	48 04.5	09 55.8
	0300	48 10.0	09 40.1
	0400	48 16.5	09 25.5
	0500	48 22.7	09 10.0
	0600	48 27.9	08 53.0
	0700	48 33.7	08 36.3
	0800	48 40.0	08 18.6
	0900	48 45.1	08 06.0
	1000	48 44.8	08 06.0
	1100	48 50.0	07 52.2
	1200	48 47.6	07 39.6
	1300	49 03.4	07 23.5
	1400	49 09.4	07 18.8
	1500	49 09.3	07 04.1
	1600	49 14.0	06 54.5
	1700	49 18.0	06 47.8
	1800	49 23.1	06 40.2
	1900	49 31.6	06 24.8
	2000	49 33.2	06 05.3
	2100	49 35.7	05 49.5

		0200	33 58.7	20 43.2
		0300	34 11.8	20 40.7
		0400	34 25.0	20 38.3
		0500	34 38.2	20 36.1
		0600	34 51.3	20 33.8
		0700	35 04.4	20 31.4
		0800	35 17.2	20 28.8
		0900	35 30.0	20 26.3
		1000	35 40.0	20 25.2
		1100	35 40.6	20 25.5
		1200	35 52.0	20 23.8
		1300	36 03.3	20 21.9
		1400	36 13.5	20 19.4
		1500	36 25.5	20 16.9
		1600	36 37.4	20 14.9
		1700	36 48.9	20 13.1
		1800	37 00.0	20 11.0
		1900	37 11.2	20 09.0
		2000	37 22.4	20 07.1
		2100	37 33.5	20 05.1
		2200	37 44.0	20 03.3
		2300	37 54.9	20 01.6
18/5/96	139	0000	38° 05.6' N	20° 00.8' W
		0100	38 16.8	20 00.1
		0200	38 27.5	20 00.0
		0300	38 38.6	20 00.2
		0400	38 49.0	19 59.8
		0500	38 59.7	19 59.6
		0600	39 10.7	19 59.6
		0700	39 21.8	20 00.0
		0800	39 33.3	20 00.6
		0900	39 45.0	20 00.4
		1000	39 53.9	19 59.8
		1100	39 54.7	19 59.7
		1200	40 04.1	19 59.4
		1300	40 14.7	20 00.0
		1400	40 26.8	19 59.4
		1500	40 38.8	19 59.4
		1600	40 50.6	19 59.7
		1700	41 02.4	19 59.8
		1800	41 14.3	19 59.7
		1900	41 26.4	20 00.5
		2000	41 39.0	20 00.7
		2100	41 51.5	20 01.0
		2200	42 04.0	20 00.6
		2300	42 10.6	20 00.2
19/5/96	140	0000	42° 29.2' N	19° 59.0' W
		0100	42 41.6	19 58.3
		0200	42 53.5	19 59.0
		0300	43 04.5	19 59.2
		0400	43 15.6	19 59.7
		0500	43 25.6	19 59.9
		0600	43 35.3	20 00.6
		0700	43 43.8	20 00.9
		0800	43 52.3	20 01.2
		0900	44 01.4	20 01.1
		1000	44 07.7	20 01.2
		1100	44 07.6	20 01.5

		2200	49 40.4	05 36.8
		2300	49 44.9	05 24.7
22/5/96	143	0000	49° 49.1' N	05° 14.3' W
		0100	49 52.6	05 04.3
		0200	49 55.0	04 53.2
		0300	49 59.7	04 44.4
		0400	50 03.2	04 35.8
		0500	50 06.4	04 26.7

(iii) Meteorological Log

Meteorology summary for AMT-2

All times are in GMT

Day	*Time*	*Visibility*	*Wind*		*Pressure,*	*Temp, °C*		*Condition*	
			Direction	*Force*	*mb*	*Air*	*Sea*	*Sea*	*Sky*
113	0700	Mod.	WxN	3	989.2	7.2	8.8		
	1200	Good	WxS	3/4	987.5	7.1	8.7	Mod.	Bright, 7/8
	1600	Good	WSW	8	990.7	5.8	8.2	Rough	Cloudy
	2000	Good	WxS	7	993.9	6.2	7.9	Rough	Fine & clear
114	0000	Mod	WSW	6/7	996.7	5.9	7.7	Large 1/4 swell	Clear, showers
	0400	Good	WSW	8	998.3	5.8	7.3	1/4 sea & swell	Cloudy, clear
	0800	Good	SWxW	8	1000.6	7.0	8.1	1/4 sea & swell	Fine, 3/8
	1200	Good	WSW	7/8	1008.7	7.5	7.9	Rough, large swell	
	1600	Good	SWxW	7	1005.6	8.7	10.1	Mod/rough	Cloudy, clear
	2000	Good	WxS	4	1008.4	9.1	12.3	Reduced sea	Fine, 3/8
115	0000	Good	SW	4	1011.0	9.0	12.7	Falling sea & swell	4/8
	0400	Good	WSW	4	1012.2	9.5	12.3	Sl't sea, low swell	Fine & clear
	0800	Good	WxS	3	1012.8	10.3	12.5	Sl't sea, low swell	Fine & clear
	1200	Good	S	2	1014.0	14.6	13.4	Mod. swell, calm	Sunny, 3/8
	1600	Good	SxW	3	1014.1	13.0	13.6	Sl't sea, low swell	Fine & clear
	2000	Good	SxE	3	1015.6	11.7	11.4	Sl't sea & swell	Fine & clear
116	0000	Good	SxE	4/5	1016.8	13.7	14.2		Clear
	0700	Good	SExS	6	1017.5	14.6	18.7	Mod. sea & swell	Cloudy, clear
	1100	Good	SE	6	1019.0	14.9	18.5	Mod. sea & swell	Fine, 4/8
	1500	Good	SE	5	1020.8	15.1	19.2	Mod. sea	Cloudy
	1900	Good	SE	5	1023.2	15.8	19.5	Mod. sea & swell	Cloudy, clear
	2300	Good	ENE	3	1025.6	15.6	17.6	Sl't sea, low swell	Fine, 4/8
117	0300	Good	SE	4	1026.5	14.3	15.1	Following sea	Clear
	0700	Good	SE	4	1026.4	14.8	18.0	Mod sea, low swell	Cloudy, clear
	1038	Good	E	3	1028.0	15.3	17.9	Sl't sea	Fine, 4/8
119	2300	Good	NExE	3	1021.1	19.7	18.8	Sl't sea, low swell	Fine, cloudy
120	0300	Good	NE	3	1023.4	18.6	18.5		
	1100	Good	NE	3/4	1025.0	20.0	23.0	Sl't sea, low swell	O/C, showers
	1500	Good	NxW	2	1026.5	19.6	20.6	Low sea & swell	Showers
	1900	Good	NxE	4	1024.9	19.8	21.6	Mod. sea & swell	Showers
	2300	Good	NxE	4	1025.9	19.4	20.9	Mod. sea & swell	Heavy showers
121	0300	Good	NE	4/5	1026.4	20.0	21.5	Mod. sea & swell	O/C, clear
	0700	Good	NE	4	1025.2	19.5	20.0	Confused swell	O/C, clear
	1100	Good	NExE	3	1026.9	19.9	20.1	Sl't sea, low swell	Fine & clear
	1500	Good	E	2	1027.5	21.3	20.7	Low sea & swell	Fine & clear
	1900	Good	ENE	3/4	1025.9	19.9	20.9	Low sea & swell	Cloudy
	2300	Good	ENE	4	1026.4	20.2	21.7	Sl't sea, low swell	Fine & clear
122	0300	Good	ENE	5/6	1026.4	19.9	21.9	Building sea & swell	
	0700	Good	ExS	4/5	1023.9	20.0	22.3	Mod. sea & swell	Cloudy, clear
	1100	Good	ESE	5	1024.8	20.2	22.9	Mod. sea & swell	Showers
	1500	Good	ExN	4	1024.6	22.4	23.9	Mod. sea & swell	Sunny, 3/8
	1900	Good	E	4	1021.9	21.3	23.3	Mod. sea & swell	Cloudy
	2300	Good	E	5	1021.5	21.8	23.4	Mod. sea & swell	O/C
123	0300	Mod.	E	5/6	1021.9	20.8	23.9	Building sea	Showers
	0700	Good	ExS	5	1019.4	21.9	24.3	Mod. sea & swell	O/C, rain
	1100	Good	ExS	6/7	1021.1	22.3	24.5	Rough, heavy swell	O/C
	1500	Good	ExS	6	1018.9	22.9	24.6	Mod. sea & swell	O/C, clear
	1900	Good	ESE	6	1018.2	22.8	24.8	Heavy sea & swell	O/C, clear
	2300	Good	SExE	5	1018.0	22.7	24.9	Mod. sea & swell	O/C, clear
124	0300	Good	SExE	4	1017.0	22.9	24.5		
	0700	Good	SE	5	1014.4	22.1	24.8		
	1100	Good	SSE	5	1014.8	22.6	25.1	Mod. sea & swell	O/C
	1500	Good	ESE	4/5	1014.1	23.3	25.1	Heavy sea & swell	O/C
	1900	Good	ESE	4	1011.0	23.4	25.6	Heavy swell	Cloudy, clear

	2300	Good	S	3	1011.7	22.8	26.5	Mod. sea & swell	Cloudy, clear
125	0200	Good	SSW	3	1011.8	23.8	26.4	Sl't sea & swell	Moonlight, 4/8
	0600	Good	WSW	4	1010.7	23.5	27.0	Mod. sea & swell	Cloudy
	1000	Good	SW	5/6	1012.6	23.4	26.9	Mod. sea & swell	Showers
	1400	Good	SW	4/5	1013.0	28.5	27.0	Following sea	Sunny, 3/8
	1800	Good	SW	5	1011.6	28.0	27.3	Mod. sea	Cloudy
	2200	Good	SSW	5	1013.5	25.6	27.6	Following sea	Fine & clear
126	0200	Good	SSW	4	1014.3	25.8	27.6	Following sea	Showers, 4/8
	0600	Good	SxE	4	1013.2	25.5	28.0	Mod. sea & swell	Cloudy, clear
	1000	Good	S	4	1013.9	27.0	28.2	Mod. sea & swell	Fine & clear
	1400	Good	SxW	3	1014.5	30.4	23.1	Following sea	Little cloud
	1800	Good	S	3/4	1012.3	28.4	28.4	Sl't sea & swell	Cloudy, clear
	2200	Good	S	4	1013.2	26.7	28.4	Sl't sea & swell	Cloudy, clear
127	0200	Good	SxW	3	1014.3	26.1	28.6	Following sea	Fine & clear
	0600	Good	S	3/4	1012.6	26.4	28.5	Sl't sea, low swell	O/C, clear
	1000	Good	SExS	4	1013.4	27.3	28.6	Sl't sea, low swell	O/C
	1400	Good	SE	2/3	1013.9	30.1	28.5	Following sea	Cloudy
	1800	Good	SSE	3	1011.9	28.7	28.6	Sl't sea, low swell	Cloudy, clear
	2200	Good	SE	3	1013.2	26.9	28.5	Sl't sea, low swell	Fine & clear
128	0200	Good	SE	2/3	1013.4	26.9	28.5	Sl't sea, low swell	Clear, 2/8
	0600	Good	SE	4	1011.8	26.7	28.6	Sl't sea, low swell	Fine & clear
	1000	Good	ESE	3	1012.8	27.1	28.6	Sl't sea, low swell	Showers
	1400	Good	ESE	3	1012.7	30.1	28.7	Sl't sea & swell	Sunny, 2/8
	1800	Good	SE	3	1010.8	28.7	28.8	Sl't sea, low swell	Fine, 2/8
	2200	Good	SE	3	1012.7	27.3	28.7	Sl't sea, low swell	Fine & clear
129	0200	Good	SE	3	1013.1	27.1	28.7		Moonlight, 2/8
	0500	Good	SE	3	1011.6	26.4	28.6	Sl't sea, low swell	Fine & clear
	0900	Good	SE	3	1012.6	27.8	28.4	Sl't sea, low swell	Fine & clear
	1300	Good	SE	3	1011.7	30.7	28.5	Sl't sea, low swell	Fine & clear
	1700	Good	ESE	3	1011.5	29.3	28.7	Sl't sea, low swell	Cloudy
	2100	Good	SSE	3	1012.7	26.3	28.6	Sl't sea, low swell	Showers
130	0100	Mod.	SE	3	1013.3	26.1	28.4	Confused swell	Showers
	0500	Good	SE	3/4	1011.6	26.8	28.1	Sl't sea, low swell	Fine & clear
	0900	Good	SExE	3/4	1012.7	27.8	28.4	Sl't sea, low swell	Fine & clear
	1300	Good	SE	2/3	1013.1	30.8	28.7	Sl't sea, low swell	Sunny, 2/8
	1700	Good	SE	3	1010.9	30.0	29.1	Sl't sea, low swell	Fine & clear
	2100	Good	SE	3	1012.0	27.5	29.0	Sl't sea, low swell	Fine & clear
131	0100	Good	ESE	3/4	1012.7	27.4	28.9	Head swell	Clear
	0500	Good	SSE	3	1010.1	27.2	28.9	Sl't sea, low swell	Cloudy
	0900	Good	ENE	3	1012.0	26.9	28.9	Sl't sea, low swell	Cloudy
	1300	Good	NNE	2	1012.0	28.4	28.9	Sl't sea, head swell	Cloudy
	1700	Good	NNE	3	1009.5	28.0	28.9	Sl't sea, head swell	Cloudy
	2100	Good	NE	4	1010.8	26.8	28.2	Sl't sea, mod swell	Fine & clear
132	0100	Good	NE	4/5	1011.7	26.6	27.6	Head sea & swell	Showers, 4/8
	0500	Good	NE	4	1010.4	26.1	27.5	Mod. sea & swell	Showers
	0900	Good	NExN	4	1012.3	26.5	27.3	Sl't sea, mod swell	Fine & clear
	1300	Good	NNE	4	1012.5	26.8	27.0	Mod. sea & swell	O/C
	1700	Good	NNE	4	1010.1	26.2	27.3	Mod. sea & swell	Cloudy, clear
	2100	Good	NE	2/3	1012.0	25.0	26.9	Sl't sea, mod swell	Cloudy, hazy
133	0100	Mod.	NxW	3	1013.1	24.6	26.9	Head sea & swell	Clear, hazy
	0500	Good	NxE	4	1011.6	24.4	26.9	Mod. sea & swell	Cloudy, clear
	0900	Good	N	4	1013.1	24.4	26.3	Sl't sea, mod swell	O/C, hazy
	1300	Good	N	4	1013.4	25.4	25.9	Head sea & swell	O/C, bright
	1700	Mod.	N	4	1010.8	24.0	24.5	Mod. sea & swell	O/C, hazy
	2100	Good	N	5	1012.1	23.2	24.0	Mod sea & swell	Hazy
134	0100	Good	N	5/6		22.7	24.4	Head sea & swell	Clear, hazy
	0500	Good	N	4/5	1012.5	22.0	23.5	Mod. sea & swell	Cloudy, clear
	0900	Good	NxE	5	1015.0	22.5	23.4	Mod. sea & swell	Light haze
	1300	Good	NxE	5	1016.6	22.7	22.6		Thin 8/8, hazy
	1700	Good	NNE	5	1015.6	22.1	22.6	Mod. sea & swell	Cloudy & hazy
	2100	Good	NExN	5	1016.2	21.4	22.4	Mod. sea & swell	Cloudy & hazy
135	0100	Good	NNE	5/6	1017.2	21.1	24.4	Head sea	Clear

	0500	Good	NExN	5	1015.4	20.8	22.3	Mod. sea & swell	Fine & clear
	0900	Good	NNE	5	1016.6	21.4	22.4	Mod. sea & swell	Fine & clear
	1300	Good	NxE	5	1016.9	22.0	22.0	Mod. sea & swell	Clear
	1700	Good	NxE	4/5	1015.8	21.0	22.2	Mod. sea & swell	Fine & clear
	2100	Good	NxW	4	1016.0	20.2	22.3	Sl't sea, mod swell	Fine & clear
136	0100	Good	NNW	3/4	1016.4	20.1	22.0	Decreasing swells	2/8, clear
	0400	Good	W	3	1013.8	20.1	22.1	Mod. sea & swell	Fine & clear
	0800	Good	NWxW	3	1013.6	19.7	21.8	Sl't sea, mod swell	Fine & clear
	1200	Good	NW	3	1013.6	20.4	21.5	Sl't sea, mod swell	O/C, bright
	1600	Good	NW	4	1010.9	21.4	20.9	Mod. sea & swell	Fine & clear
	2000	Good	W	5	1009.4	19.0	20.7	Mod. sea & swell	Fine & clear
137	0000	Good	W	4	1008.3	18.9	20.4	Mod sea, l'ge swell	Thinly O/C
	0400	Good	WxN	4/5	1005.9	18.2	19.8	Heavy sea & swell	Fine & clear
	0800	Good	W	6	1006.0	17.6	19.4	Heavy sea & swell	Fine & clear
	1200	Good	W	5/6	1007.2	19.6	19.4		Distant rain
	1600	Good	WxS	5	1006.4	19.3	19.2	Rough sea & swell	Cloudy & rain
	2000	Good	W	5/6	1006.0	17.9	18.9	Rough sea & swell	Fine & clear
138	0000	Good	W	4/5	1007.5	16.8	18.2	Falling seas	Clear
	0400	Good	W	4	1007.1	16.3	18.1	Mod. sea & swell	Part cloudy
	0800	Good	WxN	4/5	1008.2	15.8	17.3	Mod. sea & swell	Part cloudy
	1200	Good	NW	4	1010.9	17.1	16.6	Mod. sea & swell	Clear & sunny
	1600	Good	N	4	1011.9	16.5	17.0	Mod. sea & swell	Cloudy, clear
	2000	Good	N	5	1013.4	14.9	16.8	Mod. sea & swell	Cloudy, clear
139	0000	Good	N	5	1015.8	14.0	16.2	Head sea & swell	Clear
	0400	Good	N	5	1015.3	13.2	15.9	Heavy sea & swell	Showers
	0800	Good	N	5	1017.6	12.7	15.3	Mod. sea & swell	Cloudy, clear
	1200	Good	NxW	4/5	1019.7	13.7	15.3	Head sea & swell	4/8, sunny
	1600	Good	NNW	4/5	1019.6	13.9	15.2	Mod. sea & swell	Cloudy, clear
	2000	Good	NW	4/5	1019.1	13.1	15.1	Mod. sea & swell	Showers
140	0000	Good	NW	5/6	1017.1	12.5	14.9	Head sea & swell	Clear
	0400	Good	NW	6	1013.4	12.3	13.9	Rough sea & swell	O/C & rain
	0800	Good	NW	7	1012.8	12.4	13.8	Rough sea & swell	O/C, showers
	1200	Good	WNW	5/6	1015.5	12.4	13.8	Beam sea & swell	5/8, showers
	1600	Good	NWxW	5	1015.1	13.0	13.4	Rough sea & swell	Cloudy, clear
	2000	Good	NWxW	4	1015.5	12.1	13.2	Mod. sea & swell	Cloudy, clear
141	0000	Good	WNW	4	1015.8	11.6	13.0	1/4 swell	Clear
	0300	Good	WxN	4/5	1015.0	11.5	13.2	Mod. sea & swell	Part cloudy
	0700	Good	WxN	5	1014.9	12.1	12.9	Mod. sea & swell	Cloudy, clear
	1100	Good	WNW	3/4	1016.9	12.3	12.6	1/4 sea & swell	Light showers
	1500	Good	WNW	5	1017.3	13.1	12.9	Mod. sea & swell	Cloudy, clear
	1900	Good	WxN	5	1017.6	12.2	12.8	Mod. sea & swell	Showers
	2300	Good	WNW	5	1019.5	11.5	12.5	1/4 swell	2/8, showers
142	0300	Good	WxN	5	1019.9	11.6	12.2	1/4 sea & swell	Rain near
	0700	Good	W	4	1020.2	11.9	12.0	Mod. sea & swell	Cloudy, clear
	1100	Mod.	WNW	4/5	1021.7	11.8	11.8	Following sea	Light rain
	1500	Good	SWxW	5	1020.4	14.4	11.5	Following sea	Cloudy, hazy
	1900	Mod.	SW	4/5	1020.5	12.5	11.3	Mod. sea & swell	O/C, thin mist
	2300	Mod.	SW	6	1020.1	11.3	10.9	Following sea	
143	0300	Mod.	SSW	5/6	1017.4	10.7	11.0	Mod./rough sea	O/C, rain

Abbreviations:
O/C: overcast; Sl't: slight; Mod.: moderate; 1/4: quartering; Fractions /8: cloud cover; L'ge: large

(iv) CTD Bottle Depths & Digital Temperature Readings

CTD Rosette water bottle Log:

Station	114	115	116	120	121
CTD (a)	7	7	7		7
Depth (m)	20	20	20		20
	30	30	30		30
	40	40	40		40
	50	50	50		50
	60	60	60		60
	70	70	70		70
	80	80	80		80
	90	90	100		90
	120	100	120		120
CTD (b)	7*	7*	7*	7*	7*
Depth (m)	20	20	30	30	30
	40	30*	50*	50	50
	60*	40	70	80*	70*
	90	50	100	110	120

Station	122	123	124	125	126
CTD (a)	7	7	7	7	7
Depth (m)	20	30	30	30	20
	40	50	50	40	40
	60	60	70	50	60
	80	70	80	60	80
	90	80	90	70	100
	100	90	100	80	120
	110	100	110	90	150
	120	110	120	100	170
	150	150	150	150	200
CTD (b)	7*	7*	7*	7*	7*
Depth (m)	40	30	30	30	60
	60	60	80	60	100
	110*	90*	100*	80*	150*
	150	150	150	150	170

Station	127	128	129	130	131
CTD (a)	7	misfire	7	7	7
Depth (m)	30	30	20	20	20
	50	50	30	40	40
	60	60	40	50	50
	70	70	50	60	60
	80	90	60	70	70
	90	100	70	80	80
	110	110	80	100	90
	130	120	100	120	100
	170	150	150	150	120
CTD (b)	7*	7*	7*	7*	7*
Depth (m)	70	30	20	30	20
	90	70	40	40	40
	130*	100*	60*	70*	60*
	170	150	150	150	120

Station	132	133	135	136	137
CTD (a)	7	7	7	7	7
Depth (m)	20	20	20	30	30
	30	30	30	50	50
	40	40	40	70	60
	50	50	50	80	70
	60	60	60	90	80
	70	70	70	100	90
	80	80	80	110	100
	100	100	100	120	120
	120	120	130	150	150
CTD (b)	7*	7*	7*	7*	7*
Depth (m)	20	20	20	30	30
	40	30	50	70	50
	50*	40*	70*	90*	80*
	120	80	130	150	150

Station	138	139	140	141	142
CTD (a)	7	7	7	7	7
Depth (m)	30	20	20	20	20
	40	30	30	30	30
	50	40	40	40	40
	60	50	50	50	50
	70	60	60	60	60
	80	70	70	70	70
	100	80	80	80	80
	120	90	100	100	100
	150	120	120	120	120
CTD (b)	7*	7*	7*	7*	7*
Depth (m)	30	20	20	20*	20
	60*	30	30	30	30*
	120	40*	50*	50	50
	150	120	120	120	100

CTD Digital Thermometer Readings

Station	Depth (m)	Temperature (°C)
114	7	7.336
	90	5.524
	120	3.409
115	7	12.765
	50	9.426
116	7	19.097
	120	19.053
120	7	20.72
	110	18.048
121	7	20.45
	120	16.267
122	7	23.27
	150	16.845
123	7	24.52
	150	18.172
124	7	25.17
	150	19.17
125	7	not reset
	150	20.00
126	7	28.13
	200	20.47
127	7	28.47
	170	18.853
128	7	28.56
	150	bottle misfire
129	7	28.35
	150	12.612
130	7	28.45
	150	13.942

CTD Thermometer readings, continued........

Station	Depth (m)	Temperature (°C)
130	7	28.45
	150	13.942
131	7	28.55
	120	15.146
132	7	26.74
	120	14.210
133	7	26.11
	120	13.40
135	7	21.83
	130	18.801
136	7	21.32
	150	18.078
137	7	19.055
	150	17.205
138	7	16.95
	150	14.183
139	7	15.111
	120	13.793
140	7	13.603
	120	12.255
141	7	12.366
	120	11.517
142	7	11.576
	120	11.122

(v) XBT Log

XBT Log

(-latitude: denotes south)
(Date as month, day, year)

Date	Time	Latitude	Longitude
04-23-1996	04:37:29	-49.251667	56.330002
04-23-1996	08:44:12	-48.441666	55.958332
04-23-1996	11:29:20	-47.928333	55.746666
04-23-1996	12:01:32	-47.830002	55.706665
04-23-1996	13:05:06	-47.641666	55.630001
04-23-1996	18:12:46	-47.111668	55.473331
04-23-1996	19:18:24	-46.946667	55.395000
04-23-1996	20:09:42	-46.820000	55.343334
04-23-1996	21:01:59	-46.671665	55.291668
04-23-1996	22:32:36	-46.388332	55.218334
04-23-1996	23:51:34	-46.150002	55.181667
04-24-1996	03:34:31	-45.433334	55.099998
04-24-1996	04:09:34	-45.295502	55.095001
04-24-1996	05:32:37	-45.001667	55.055000
04-24-1996	06:10:58	-44.862835	55.025002
04-24-1996	07:19:15	-44.630001	54.983334
04-24-1996	08:22:17	-44.391666	54.933334
04-24-1996	08:56:57	-44.271667	54.904999
04-24-1996	10:20:33	-43.988335	54.856667
04-24-1996	11:17:56	-43.796665	54.813332
04-24-1996	12:18:36	-43.608334	54.771667
04-24-1996	12:53:05	-43.498333	54.741665
04-24-1996	16:41:14	-43.186668	54.683334
04-24-1996	17:34:04	-43.051666	54.654999
04-24-1996	19:25:16	-42.744999	54.561668
04-24-1996	19:59:29	-42.638332	54.518333
04-24-1996	21:22:16	-42.376667	54.406666
04-24-1996	23:26:09	-42.037498	54.262333
04-25-1996	01:49:30	-41.681667	54.139999
04-25-1996	05:28:32	-41.153332	53.976665
04-25-1996	06:54:31	-40.904999	53.879166
04-25-1996	07:55:13	-40.701332	53.798332
04-25-1996	09:05:16	-40.467667	53.715332
04-25-1996	09:48:47	-40.296333	53.669498
04-25-1996	11:31:40	-39.901665	53.560001
04-25-1996	12:29:28	-39.688332	53.463333
04-25-1996	13:48:33	-39.400002	53.325001
04-29-1996	17:48:01	-36.058334	49.811668
04-29-1996	22:51:05	-35.492500	49.017166
04-30-1996	01:18:46	-35.146667	48.621666
04-30-1996	08:37:23	-34.009167	47.377998
04-30-1996	14:32:04	-33.386166	46.622334
04-30-1996	22:16:21	-32.338333	45.490002

Date	Time	Latitude	Longitude
05-01-1996	02:02:37	-31.783333	44.950001
05-01-1996	08:44:35	-30.829834	43.969833
05-01-1996	14:25:03	-30.313334	43.430000
05-01-1996	20:30:33	-29.514999	42.646667
05-02-1996	09:43:18	-27.983833	41.092667
05-02-1996	14:16:10	-27.616667	40.700001
05-03-1996	01:22:49	-26.000000	39.266666
05-03-1996	08:49:44	-24.633333	38.299999
05-03-1996	13:29:47	-24.350000	37.863335
05-03-1996	21:04:59	-22.983334	37.169998
05-04-1996	00:33:44	-22.251667	36.803333
05-04-1996	13:07:52	-19.908333	35.533333
05-05-1996	01:07:58	-17.498333	34.393333
05-05-1996	10:02:15	-15.561666	33.486668
05-05-1996	13:16:11	-15.165000	33.303333
05-05-1996	17:08:45	-14.506666	33.003334
05-05-1996	19:47:54	-13.956667	32.756668
05-05-1996	22:12:45	-13.453333	32.509998
05-06-1996	00:40:57	-13.161667	32.365002
05-06-1996	03:24:05	-12.680000	32.141666
05-06-1996	08:00:22	-11.550000	31.766666
05-06-1996	11:08:53	-11.365833	31.515667
05-06-1996	15:03:44	-10.966666	31.333334
05-06-1996	20:03:55	-10.086667	30.948334
05-06-1996	23:50:40	-9.553333	30.701666
05-07-1996	02:17:19	-9.158334	30.504999
05-07-1996	04:06:16	-8.843333	30.355000
05-07-1996	07:01:15	-8.333333	30.116667
05-07-1996	13:16:34	-7.467834	29.761168
05-07-1996	15:12:36	-7.141667	29.626667
05-07-1996	17:07:57	-6.811666	29.493000
05-07-1996	18:53:34	-6.505000	29.361668
05-07-1996	21:33:26	-6.045000	29.155001
05-07-1996	23:33:26	-5.830000	29.058332
05-08-1996	01:12:18	-5.576167	28.947334
05-08-1996	02:28:38	-5.356500	28.853333
05-08-1996	04:06:37	-5.073333	28.716667
05-08-1996	05:47:42	-4.833333	29.504999
05-08-1996	06:56:10	-4.596667	28.500000
05-08-1996	09:36:36	-4.135500	28.305000
05-08-1996	12:43:47	-3.848167	28.176332
05-08-1996	14:07:22	-3.601667	28.068333
05-08-1996	15:21:33	-3.380000	27.965000
05-08-1996	17:38:22	-2.985000	27.778334
05-08-1996	18:53:31	-2.766667	22.671667
05-08-1996	20:36:53	-2.476667	27.520000
05-08-1996	22:37:33	-2.268333	27.423334

Date	Time	Latitude	Longitude
05-09-1996	00:01:31	-2.056500	27.317333
05-09-1996	00:53:01	-1.910000	27.245001
05-09-1996	02:07:10	-1.700000	27.141666
05-09-1996	02:56:37	-1.561667	27.070000
05-09-1996	04:03:09	-1.375000	26.973333
05-09-1996	04:52:34	-1.235000	26.900000
05-09-1996	05:59:19	-1.050000	26.799999
05-09-1996	06:51:58	-0.903333	26.716667
05-09-1996	07:56:21	-0.708333	26.633333
05-09-1996	08:59:42	-0.521667	26.548334
05-09-1996	09:59:45	-0.346667	26.469334
05-09-1996	12:41:14	-0.188333	26.377666
05-09-1996	15:15:05	0.117167	26.234167
05-09-1996	17:04:12	0.438333	26.096666
05-09-1996	18:04:53	0.610000	26.025000
05-09-1996	19:00:09	0.780000	25.956667
05-09-1996	20:02:29	0.971667	25.879999
05-09-1996	23:21:26	1.347500	25.710501
05-10-1996	00:14:38	1.516667	25.639668
05-10-1996	01:18:16	1.706667	25.548334
05-10-1996	02:26:22	1.908333	25.453333
05-10-1996	04:46:05	2.321667	25.246666
05-10-1996	04:58:37	2.356667	25.231667
05-10-1996	05:57:44	2.533333	25.146667
05-10-1996	06:59:57	2.713333	25.065001
05-10-1996	08:01:14	2.895000	24.988333
05-10-1996	09:01:38	3.076667	24.915001
05-10-1996	09:59:20	3.250333	24.846001
05-10-1996	12:32:42	3.456833	24.786333
05-10-1996	14:02:42	3.730000	24.683332
05-10-1996	16:00:58	4.071667	24.540001
05-10-1996	17:59:53	4.421667	24.388332
05-10-1996	20:39:49	4.968333	24.160000
05-10-1996	21:18:15	5.091500	24.102167
05-11-1996	00:23:48	5.515666	23.907667
05-11-1996	02:38:35	5.863333	23.703333
05-11-1996	09:01:05	7.226666	23.118334
05-11-1996	13:51:59	7.866667	22.799999
05-11-1996	18:32:58	8.725000	22.376667
05-11-1996	23:45:38	9.590000	21.975000
05-12-1996	09:08:03	11.420000	21.196667
05-12-1996	12:39:43	11.865000	21.006666
05-12-1996	18:40:13	13.083333	20.891666
05-12-1996	23:24:01	14.173333	20.953333
05-13-1996	09:30:14	16.361668	21.081667
05-13-1996	13:13:51	17.166666	21.146667
05-13-1996	19:06:57	18.436666	21.276667

Date	Time	Latitude	Longitude
05-13-1996	23:28:39	19.426666	21.330000
05-14-1996	02:15:53	19.906666	21.321667
05-14-1996	11:56:09	21.763332	21.468334
05-14-1996	15:43:30	22.495001	21.514999
05-14-1996	18:04:59	23.010000	21.543333
05-15-1996	02:05:59	24.803333	21.639999
05-15-1996	11:47:19	26.541666	21.793333
05-15-1996	14:45:23	27.066668	21.813334
05-15-1996	16:50:13	27.511667	21.733334
05-15-1996	20:02:40	28.171667	21.646667
05-15-1996	23:11:23	28.805000	21.566668
05-16-1996	08:41:05	30.698334	21.296667
05-16-1996	11:58:07	31.086666	21.226667
05-16-1996	15:23:21	31.740000	21.150000
05-16-1996	17:32:53	32.191666	21.071667
05-16-1996	23:47:05	33.494999	20.798334
05-17-1996	08:19:48	35.349998	20.466667
05-17-1996	10:56:29	35.668335	20.424999
05-17-1996	12:58:18	36.040001	20.366667
05-17-1996	14:40:13	36.351665	20.295000
05-17-1996	16:54:59	36.793335	20.221666
05-17-1996	19:08:04	37.206665	20.145000
05-17-1996	22:34:25	37.833332	20.038334
05-18-1996	08:55:58	39.728333	20.038334
05-18-1996	11:26:44	39.968334	19.993334
05-18-1996	13:28:39	40.336666	19.995001
05-18-1996	15:54:37	40.821667	19.993334
05-18-1996	19:39:59	41.575001	20.000000
05-18-1996	23:11:27	42.311668	19.983334
05-19-1996	11:08:08	44.128334	20.018333
05-19-1996	14:38:17	44.439999	19.230000
05-19-1996	16:15:45	44.618332	18.811666
05-19-1996	18:06:45	44.816666	18.311666
05-19-1996	20:03:01	45.029999	17.778334
05-19-1996	22:28:42	45.305000	17.088333
05-20-1996	07:27:08	46.310001	14.541667
05-20-1996	12:32:09	46.680000	13.555000
05-20-1996	19:46:45	47.481667	11.548333

(vi) UOR Log

Tow	Julian day	Start time GMT	start Lat	start Lon	depth range	sensor	logger	servo	tow time	wire m	notes	
1	114	15:15	S47 35.4	W55 36.2	no data	JA5	JA6	004		400	servo failed,alt over voltage,	802
1A	114	18:59	S46 59.0	W55 25.0	no data	JA5	JA6	002		400	servo failed,alt over voltage	802
2	115	15:30	S43 24.2	W54 44.5	no data	JA5	JA6	001		400	3 unds and failed; may be burnt	802
3	115	18:15	S42 56.0	W54 37.0	no data	JA5	JA6	001	1.0	400	not undulating , servo Hz = secs!:	802
4	120	17:56	S36 03.0	W49 48.0	18-78	JA5	JA6	004	6.0	400	SERV5.COE; AMT25N.COE,	801/704alt
5	121	09:02	S33 56.0	W47 17.6	15-75	JA5	JA6	004	4.0	400		
6	121	14:36	S33 23.3	W46 35.8	15-75	JA5	JA6	004	6.5	400		
7	122	09:03	S30 47.0	W43 55.0	14-70	JA5	JA6	004	4.0	400		
8	122	14:29	S30 18.3	W43 25.6	12-70	JA5	JA6	004	6.0	400		
9	123	09:07	S28 02.0	W41 08.0	12-70	JA5	JA6	004	3.6	400	slight leak JA5 (spoonful)	
10	123	14:16	S27 36.8	W40 42.7	12-70	JA5	JA6	004	3.3	400*	JA5 leak; batts JA3; 04 card us: *winch to 300m	
11	124	08:16	S24 25.0	W38 18.0	15-80	JA3	JA6	004	3.3	400	replace 04ps card; AMT26N.COE,	801/704alt
12	124	15:06	S23 59.6	W37 41.4	12-80	JA3	JA6	004	4.3	400	short pm tows only	
13	125	13:09	S19 53.5	W35 31.9	12-80	JA3	JA6	004	3.0	400		
14	126	13:19	S15 09.9	W33 18.2	10-80	JA3	JA6	004	3.3	400		
15	126/127	23:38	S1318.2	W32 26.2	10-80	JA3	JA6	004	12(4)	400	1st continuous tow app. equator; only 1/3log file	
16	127	13:27	S11 13.5	W31 27.3	10-80	JA3	JA6	004	9.0	400	2nd	
17	127/128	23:58	S09 32.4	W30 41.7	10-80	JA3	JA6	004	12	400	3rd	
18	128	13:15	S07 25.2	W29 44.5	10-80	JA3	JA6	004	9.6	400	4th	
19	128/129	23:40	S05 49.1	W29 03.3	10-80	JA3	JA6	004	11.3	400	5th	
20	129	12:17	S03 54.6	W28 12.6	10-80	JA3	JA6	004	9.7	400	6th	
21	129/130	22:43	S02 15.4	W27 25.0		JA3	JA6	004	12.0	400	7th [no data: write protection on]	
22	130	12:56	S00 08.1	W26 21.6	15-75	JA3	JA6	004	9.0	400	8th:1st 2hrs at 8kts - 25-85m	
23	130/131	23:06	N01 19.2	W25 43.3	18-78	JA3	JA6	004	12.0	400	9th	
24	131	12:09	N03 24.5	W24 48.3	18-78	JA3	JA6	004	5.0	400	10th	
25	132	12:08	N07 35.3	W22 56.5	18-78	JA3	JA6	004	3.0	400	noon only, clamp not gripping.	
26	133	11:52	N11 44.9	W21 03.4	18-80	JA3	JA6	004	3.0	400	FLUOR dead	
27	135	11:59	N21 46.6	W21 28.6	15-80	JA3	JA6	004	3.0	400	using fluor from JA5-but did not work	
28	136	11:51	N26 33.5	W21 47.1	18-80	JA3	JA6	004	3.0	400	fluorometer now 'tuned' OK; COE =AMT27N	
29	137	11:02	N30 55.6	W21 15.2	15-80	JA3	JA6	004	3.0	400		
30	138	10:59	N35 40.7	W20 25.5	15-80	JA3	JA6	004	3.0	400	instrument struck rear of vessel on recovery	
31	139	10:56	N39 54.4	W19 59.7		JA3	JA6	004		400	did not undulate - crank arm bent!	
32	140					JA3	JA6	002			Switch to 802 body with 002 servo & 704 alt	

(vii) Optics Logs & Calibrations

Optics Cast Log

Ser. Day	Date	Time(GMT)	Time(Local)	Latitude	Longitude	Cast

Cast Type

Cast Details
Downcast Start
Upcast Start
Upcast End
Depth
Comments

Observations					
Wire Angle	(from water normal)	[deg]	:		
Sun Position	(from starboard normal)	[points]	:		
Cloud Cover	(n/8 of hemisphere)	[parts]	:		
Wind Speed / Direction	(absolute)	[kts - deg]	:		
Baro Pressure	(sea surface)	[mb]	:		
Air, Dry and Wet bulb	(temperatures)	[°C]	:	:	:
Sun Photometry Obs.	(at station)	YES [ ]	NO [ ]		
Photos Film - upcast	(sun, sea, wires state)	[film, photo n.]	:		
Photos Digital - upcast	(sun, sea, wires state)	[disk, still n.]	:		
Comments					

Data Files / Formats
Satlantic(PC)
Pre-Cast U/W Light
PostCast U/W Light
CTDF(PC)
Satlantic Logger

Pressure Tare	Charge	Logger

Clocks	Mac	Proview PC	CTDF PC	Logger

Radios	Charge	Power	Channels	Comms Check

Satlanic Deck Cell Dark Calibrations

Date	Es413	Es442	Es490	Es509	Es555	Es665	Es683	Temp
Sat	32777.3	32781.9	32787.2	32781.8	32786.7	32783.6	32784.9	-
121	32777.8	32782.6	32788.0	32781.9	32786.0	32783.7	32785.4	20.25
122	32778.0	32783.1	32787.4	32782.0	32785.9	32783.8	32785.1	21.89
123	32778.1	32783.2	32787.4	32781.5	32785.9	32783.4	32785.1	23.17
124	32778.1	32783.6	32787.5	32781.3	32786.1	32783.2	32785.0	24.01
126	32778.2	32784.0	32786.9	32780.8	32785.4	32782.8	32784.5	27.21
127	32778.2	32784.6	32787.0	32780.9	32785.5	32783.0	32784.6	27.34
128	32778.4	32784.0	32784.0?	32787.0	32781.0	32785.3	32784.5	27.49
129	32778.3	32783.9	32787.1	32781.0	32782.7	32782.9	32789.0	26.89
130	32778.3	32784.2	32787.0	32781.0	32785.7	32783.3	32785.1	27.92
131	32778.2	32783.7	32787.4	32781.1	32785.8	32783.0	32785.0	26.17
132	32778.0	32783.6	32787.1	32781.0	32785.6	32782.8	32784.9	25.61
134	32777.9	32782.7	32787.8	32781.6	32786.0	32783.6	32785.2	21.42
136	32777.6	32782.2	32788.0	32781.7	32786.2	32783.8	32785.4	17.58
138								

CTDF Transmissometer Cals

Date	Obscure	Air	Span	Comment
114	-1.0129	3.17	4.1829	Condensation??
121	-1.0129	3.459	4.4719	Warm (Good Cal)
122	-1.0128	3.4968	4.5226	Humid (?Spray)
123	-1.0128	3.4880	4.5008	Humid (?Spray)
124	-0.9775	3.5400	4.5175	Humid
125	-0.9769	3.5260	4.5029	Clear Dry
126	-0.9809	3.5278	4.5087	Cloudy Dry
127	-0.9783	3.5804	4.5587	Clear Dry
128	-0.9807	3.5452	4.5249	Clear Dry
129	-1.0126	3.5057	4.5183	Clear Dry
130	-0.9774	3.5270	4.5044	Clear Dry
131	-1.0131	3.3610	4.3741	Clear Dry
132	-1.0132	3.4501	4.4633	Clear Dry
133				
135	-0.9790	3.5130	4.4940	Spray ?
136	-0.9787	3.5180	4.4967	Dry
137	-0.9796	3.5240	4.5036	Spary ?

N.B. Assume 92.3% from manual

New Logger Darks

Day	Ed412	Ed443	Ed490	Ed510	Ed555	Ed670
120	-1.4	-0.6	-4.3	-5.9	-0.9	0.4
121	**10.9**	**11.7**	**14.1**	**12.3**	**11.1**	**15.4**
122	1.3	1.1	0.7	0.2	1.1	1.8
123	-8.2	-7.4	-7.4	-8.6	-5.3	-8.2
124	-21.8	-22.9	-25.7	-22.6	-22.0	-25.3
127	6.4	5.6	5.6	7.4	11.6	7.8
128	13.5	14.1	11.0	10.7	12.8	12.1
129	4.1	2.1	3.7	2.4	3.8	1.9
130	7.4	7.5	6.1	5.3	6.7	5.6
131	12.0	11.7	10.8	10.5	12.1	9.2
132	13.2	12.6	10.7	10.1	11.6	10.4
133	11.0	10.0	8.5	10.3	11.0	7.9
135	4.8	3.8	1.5	1.7	4.1	5.5
136	-0.9	3.5	-0.2	-1.6	0.6	-0.9
137	11.7	12.2	13.1	10.8	12.1	12.0
138	12.6	11.6	11.7	10.1	11.2	10.2

Day	Lu412	Lu443	Lu490	Lu510	Lu555	Lu683
120	-0.1	2.9	-4.2	-0.3	-2.0	-4.4
121	**9.6**	**8.9**	**14.2**	**11.4**	**14.8**	**10.8**
122	0.1	-0.5	-2.2	-0.5	0.6	-1.0
123	-6.7	-7.9	-9.7	-7.5	-8.3	-8.7
124	-19.9	-18.0	-26.3	-27.9	-23.4	-18.9
127	16.3	21.4	13.0	14.1	12.7	13.8
128	17.4	16.8	12.9	16.1	13.8	16.5
129	9.2	9.3	4.7	7.2	3.5	6.1
130	13.8	12.5	9.7	11.8	10.3	9.7
131	15.5	15.6	11.9	13.9	12.6	14.4
132	16.7	15.4	11.5	13.8	12.0	15.2
133	16.7	14.9	10.3	11.5	9.8	12.6
135	9.7	6.8	3.2	7.4	4.7	6.7
136	1.1	1.7	-0.3	2.7	-0.9	-0.8
137	15.5	174	17.6	16.4	16.3	15.7
138	17.1	15.5	11.9	15.1	12.1	14.8

NB System Cals set relative to Day 121

Logger Pressure / Records

Day	Poff(log)	Pmax(log)	Start (dn)	End(dn)	Start(up)	End(up)
120A	-1.560	189	271	503	761	1748
121A	-0.671	182	851	1112	1301	2275
122A	-1.194	192	701	959	1198	2254
122B	-1.194	153	2337	3136	3209	4024
123A	-1.179	189	588	865	1051	2040
124A	-1.290	199	224	480	726	1784
127A	-1.376	195	310	554	729	1907
128A	-1.543	186	546	820	945	1939
129A	-1.202	190/210	285	559	1239	2393
130A	-1.101	195	613	1021	1165	2221
130B	-1.080	103	2441	2612	2745	3276
131A	-1.068	194	595	852	990	2025
132A	-0.760	195	399	660	853	1890
133A	-0.582	185	572	812	943	1919
135A	-0.124	188	271	535	676	1698
135V	na	na	2334	2371	na	na
136A	-0.168	187	348	595	728	1741
137A	-0.037	187	477	712	926	1796
138A	+0.015	189	388	636	781	1795
138B	+0.219	107	1940	2015	2337	2970
138B	Cloud		2560	2644		
139A						

CTDF Pressure / Records

Day	Poff(log)	Pmax(log)	Start (dn)	End(dn)	Start(up)	End(up)
115A	1.704	184	130	1566	79	1143
116A	0.309	170	87	964	13	918
120A	-0.674	188	348	591	160	1163
121A (U/D)	-0.704	182	543	804	29	1002
122A(U/D)	-1.299	192	467	738	43	1102
122B(U/D)	-1.299	153	49	863	23	847
123A	-1.132	188	273	547	64	1061
124A	-1.190	199	172	423	45	1136
125A	-1.382	190	99	353	850	1624
125B	-1.382	150	36	194	25	824
126A	-1.338	196	864	1122	85	400
126B	-1.326	192	198	444	45	1084
126X	-1.170	201	296	End	Start	1133
127A	-1.207	195	104	353	32	1089
127X	-1.251	199	118	401	410	672
128A	-1.469	187	91	366	25	1020
128X	-1.146	200	307	754	27	1120
129A	-1.097	190/210	191	470	462	1559
129X	-1.052	203	266	524	170	1285
130A	-1.026	196	235	649	38	1094
130B	-0.969	103	78	248	44	574
130X	-0.772	201	187	519	15	1124
131A	-0.853	194	81	348	66	1105
131X	-0.613	200	569	End	Start	1104
132A	-0.602	195	78	340	112	1161
132X	-0.442	202	48	418	Start	1109
133A	-0.467	184	338	585	18	1014
135X	-0.018	203	65	380	14	1152
135A	+0.015	188	131	396	46	1074
135V	na	na	120	324	na	na
136A	+0.086	188	202	459	45	1058
137A	+0.235	189	12	256	Start	913
138A	+0.294	190	359	608	26	1049
138B	+0.413	107	55	223	660	792

Deck Cell Files / Time Errors

Day	File	Period	FE	Pc Drift	Time Error
122	BS122UX	AC	3	2.5(-)	1.5
122	BS122UY	PC	4	1.0(-)	2.83
123	BS123UX	AC	5	2.0(-)	2.67
123	BS123UY	PC	2	1.6(-)	2.33
124	BS124UY	PC	9	1.0(-)	2.33
125	BS125UY	PC	2	2.0(-)	1.5
126	BS126UY	PC	-	1.0(-)	2.5
127	BS127UX	AC	-	50min slow	2.5
127	BS127UY	PC	-	2.0(-)	3.33
128	BS128UX	AC	-	1.5(-)	1.83
128	BS128UY	PC	-	2.0(-)	2.83
129	BS129UX	AC	3	1.0(-)	2.67
129	BS129UY	PC	NO DATA	na	na
130	BS130UX	AC	-	1.5(-)	3.33
130	BS130UY	PC	-	1.0(-)	2.67
131	BS131UX	AC	-	2.0(-)	28.67
131	BS131UY	PC	-	2.0(-)	3.17
132	BS132UY	PC	-	2.0(-)	2.83
133	BS133UY	PC	-		
135	BS135UY	PC			
136	BS136UY	PC	NO DATA	na	na
137	BS137UY	PC	4	1.5(-)	2.5

Logger Voltage Test

Channel	0.0	1000mv	2000mv	3000mv	4000mv
16 (lu)	10-16	6545	13090	19630	26170
15 (lu)	10-20	6550	13090	19630	26165
14 (lu)	3-13	6550	13091	19630	26166
13 (lu)	3-11	6550	13090	19630	26170
12 (lu)	3-30	6550	13090	19630	26160
11 (lu)	17-30				26160
10 (ed)	3-13				26160
9 (ed)	3-12				26175
8 (ed)	6-14				26160
7 (ed)	3-12				26170
6 (ed)	9-26				26170
5 (ed)	2-10				26160
4	10-30				26170
3	14-36				26160
2	2-10				26160
1 (Press)	6-11				26160

AMT-2

Aerosol Optical Thickness by Sun-Photometry Measurements

John P. Doyle

<u>Data Log</u>

JDAY:	GMT:
113	-
114	-
115	13.10
	14.15
	16.41
116	-
117	12.03
	13.25
118	-
119	-
120	-
121	11.07
	11.20
	11.30
	11.40
	12.00
	12.30
	13.40
	14.25
	15.00
	15.30
	16.32
	17.45
	18.15
	18.30
122	13.23
	13.35
	13.50
	15.22
	16.05
	16.15
	16.31
	16.45
	18.40
	19.00
123	-
124	17.57
125	10.38
	10.46
	10.53
	11.00
	11.20

	12.04
	12.26
	12.40
	13.14
	13.32
	13.47
	14.12
	15.06
	15.28
	15.42
	16.00
	17.25
	17.35
	17.46
126	12.45
127	-
128	11.10
	11.25
	11.35
	12.00
	12.06
	12.23
	12.25
	12.42
	13.00
	13.53
	14.16
	14.32
	14.35
	15.47
	15.55
	16.05
	16.15
	16.25
	16.46
	16.55
	17.02
	17.05
	17.15
	17.25
	17.35
	17.48
	17.55
	18.05
	18.15
	18.26
	18.35
	18.40
	18.45
129	11.10
	11.51

	12.15
	14.08
	14.15
	14.31
	14.39
	14.45
	15.01
	15.35
	15.40
	15.46
	16.0
130	10.06
	10.15
	10.25
	11.00
	11.35
	12.05
	12.23
	12.47
	13.02
	13.07
	13.25
	15.56
	16.02
	16.15
	16.26
	16.29
	16.45
	17.03
	17.16
	17.26
	18.00
	18.30
	18.35
	18.47
	18.58
	19.12
131	11.00
	11.10
	11.36
	11.54
	12.10
	12.36
	12.38
	12.55
	17.15
	17.40
132	-
133	11.03
	11.07
	11.17

	11.36
	11.45
	12.00
	12.15
	12.29
	12.46
	13.01
	13.05
134	14.15
	14.19
	14.30
	14.45
	15.00
135	09.20
	09.27
	10.13
	10.26
	10.35
	10.45
	11.03
	11.15
	11.35
	11.53
	12.27
	12.38
	12.50
	13.00
	13.10
	13.25
	14.00
	14.35
	14.50
	15.05
	15.16
	15.42
	16.10
	16.20
	16.32
	17.15
	17.30
	17.45
	18.00
	18.10
	18.29
136	15.40
	15.52
	16.06
	16.17
	16.30
	16.47
	16.59

(viii) PIC, Pigments & Chlorophyll Log

AMT-2						
POC/PIC SAMPLE LOG			2.1 l filtered for each sample unless stated otherwise			
CHL NO	JUL DAY	GMT	DEPTH	Pc SAMPLE NOS	FL VAL	
1	113	2002	6	UPOC 1 (x2)		
2	114	3	6	UPOC 1 (x2)		
3	114	357	6	UPOC 2 (x2)		
4	114	800	6	UPOC 3 (x2)		
5	114	1222	6	UPOC 4 (x2)		
6	114	1500	6	PPOC 1 (x2)		
7	114	1500	7	PPOC 2 (x2)		
8	114	1500	20	PPOC 3 (x2)		
9	114	1500	40	PPOC 4 (x2)		
10	114	1500	60	PPOC 5 (x2)		
11	114	1500	90	PPOC 6 (x2)		
12	114	1850	6	UPOC 5 (x2)	32	
13	114	2330	6	UPOC 6 (x2)	30	
14	115	141	6	UP1 (x2)	28	
20	115	1500	50	PPOC5 (x2)		
21	115	1500	40	PPOC4 (x2)		
22	115	1500	30	PPOC3 (x2)		
23	115	1500	20	PPOC2 (x2)		
24	115	1500	7	PPOC1 (x2)		
25	115	1500	6	PPOC6 (x2)	33	
34	116	1500	100	PPOC5 (x2)		
35	116	1500	70	PPOC4 (x2)		
36	116	1500	50	PPOC3 (x2)		
37	116	1500	30	PPOC2 (x2)		
38	116	1500	7	PPOC1 (x2)		
39	116	1500	6	PPOC6 (x2)		
103	120	1730	110	100, 101		
104	120	1730	80	102, 103		
105	120	1730	50	104, 105		
106	120	1730	30	106, 107		no 107 - 1.5l only
107	120	1730	7	108, 109		
108	120	1730	6	110, 111	39	
119	121	1400	120	112, 113		
120	121	1400	70	114, 115		
121	121	1400	50	116, 117		
122	121	1400	30	118, 119		1 filter slightly damaged
123	121	1400	7	120, 121		
124	121	1400	6	122, 123	38	
141	122	1400	150	124, 125		
142	122	1400	110	126, 127		
143	122	1400	60	128, 129		
144	122	1400	40	130, 131		
145	122	1400	7	132, 133		
146	122	1400	6	134, 135	32	

158	123	1400	150	136, 137		
159	123	1400	90	138, 139		
160	123	1400	60	140, 141		
161	123	1400	30	142, 143		
162	123	1400	7	144, 145		
163	123	1400	6	146, 147	37	
174	124	1300	150	148, 149		
175	124	1300	100	150, 151		
176	124	1300	80	152, 153		
177	124	1300	30	154, 155		
178	124	1300	7	156, 157		
179	124	1300	6	158, 159	34	
191	125	1300	150	160, 161		
192	125	1300	80	162, 163		
193	125	1300	60	164, 165		
194	125	1300	30	166, 167		
195	125	1300	7	168, 169		
196	125	1300	6	170, 171	32	
208	126	1300	170	172, 173		
209	126	1300	150	174, 175		
210	126	1300	100	176, 177		
211	126	1300	60	178, 179		
212	126	1300	7	180, 181	28	
223	127	1300	170	182, 183		
224	127	1300	130	184, 185		
225	127	1300	90	186, 187		
226	127	1300	70	188, 189		
227	127	1300	7	190, 191		
248	128	1300	150	192, 193		
249	128	1300	100	194, 195		
250	128	1300	70	196, 197		
251	128	1300	30	198, 199		
252	128	1300	7	200, 201	28	
263	129	1200	150	202, 203		
264	129	1200	60	204, 205		
265	129	1200	40	206, 207		
266	129	1200	20	208, 209		
267	129	1200	7	210, 211	29	
279	130	1200	150	212, 213		
280	130	1200	70	214, 215		
281	130	1200	40	216, 217		
282	130	1200	20	218, 219		
283	130	1200	7	220, 221	29	
295	131	1200	120	222, 223		
296	131	1200	60	224, 225		
297	131	1200	40	226, 227		
298	131	1200	20	228, 229		

POC

299	131	1200	7	230, 231	31	
310	132	1200	120	232, 233		
311	132	1200	50	234, 235		
312	132	1200	40	236, 237		
313	132	1200	20	238, 239		
314	132	1200	7	240, 241	32	
325	133	1200	80	242, 243		
326	133	1200	40	244, 245		
327	133	1200	30	246, 247		
328	133	1200	20	248, 249		
329	133	1200	7	250, 251		
353	135	1200	130	252, 253		
354	135	1200	70	254, 255		
355	135	1200	50	256, 257		
356	135	1200	20	258, 259		
357	135	1200	7	260, 261	10.6	
369	136	1100	150	262, 263		
371	136	1100	90	264, 265		
373	136	1100	70	266, 267		
375	136	1100	30	268, 269		
377	136	1100	7	270, 271		
391	137	1100	150	272, 273		
392	137	1100	80	274, 275		
393	137	1100	50	276, 277		
394	137	1100	30	278, 279		
395	137	1100	7	280, 281	9.8	
408	138	1100	150	282, 283		
409	138	1100	120	284, 285		
410	138	1100	60	286, 287		
411	138	1100	30	288, 289		
412	138	1100	7	290, 291	13.1	
425	139	1100	120	292, 293		
426	139	1100	40	294, 295		
427	139	1100	30	296, 297		
428	139	1100	20	298, 299		
429	139	1100	7	300, 301	22.5	
440	140	1100	120	302, 303		
441	140	1100	50	304, 305		
442	140	1100	30	306, 307		
443	140	1100	20	308, 309		
444	140	1100	7	310, 311	~30	
458	141		120	312, 313		
459	141		50	314, 315		
460	141		30	316, 317		1000 ml
461	141		20	318, 319		1000 ml
462	141		7	320, 321	~17	1000 ml

POC

480	142	1000	100	322, 323		
481	142	1000	50	324, 325		
482	142	1000	30	326, 327		1000 ml
483	142	1000	20	328, 329		1000 ml
484	142	1000	7	330, 331	11.7	1000 ml
486	142	1348	6	332, 333	11	1000 ml
	142	1500	sw blanks	334, 335		
487	142	1511	6	336, 337	14	1000 ml
488	142	1625	6	338, 339	19.4	1000 ml
489	142	1729	6	340, 341	28	1000 ml

AMT-2						
HPLC SAMPLE LOG		2.1 l filtered for each sample unless stated otherwise				
CHL NO	JUL DAY	GMT	DEPTH	HPLC SAMPLE NOS	FL VAL	
1	113	2002	6	UP1		
2	114	3	6	UP1		
3	114	357	6	UP2		
4	114	800	6	UP3 (x2)		
5	114	1222	6	UP4		
6	114	1500	6	PP1 (x2)		Station 114
7	114	1500	7	PP2 (x2)		
8	114	1500	20	PP3 (x2)		
9	114	1500	40	PP4 (x2)		
10	114	1500	60	PP5 (x2)		
11	114	1500	90	PP6 (x2)		
12	114	1850	6	UP5	32	
13	114	2330	6	UP6	30	
14	115	141	6	UP1 (x2)	28	
15	115	400	6	UP2 (x2)	37	
16	115	600	6	UP3 (x2)		
17	115	800	6	UP4 (x2)		
18	115	1027	6	UP5 (x2)		
19	115	1235	6	UP6 (x2)	37	
20	115	1500	50	PP5 (x2)		Station 115
21	115	1500	40	PP4 (x2)		
22	115	1500	30	PP3 (x2)		
23	115	1500	20	PP2 (x2)		
24	115	1500	7	PP1 (x2)		
25	115	1500	6	PP6 (x2)	33	
26	115	1730	6	UP7 (x2)	27	
27	115	1930	6	UP8 (x2)	50	
28	115	2225	6	UP9 (x2)	46	
29	116	45	6	UP1 (x2)	50	
30	116	539	6	UP2		2nd sample lost
31	116	800	6	UP3 (x2)		
32	116	1000	6	3116P3 (x2)		UP4 mislabelled as indicated
33	116	1148	6	UP5 (x2)	16	
34	116	1500	100	PP5 (x2)		Station 116
35	116	1500	70	PP4 (x2)		
36	116	1500	50	PP3 (x2)		
37	116	1500	30	PP2 (x2)		
38	116	1500	7	PP1 (x2)		
39	116	1500	6	PP6 (x2)		
40	116	1750	6	UP6 (x2)	18	
41	116	2009	6	UP7 (x2)	17	
42	116	2214	6	UP8 (x2)	27	
43	117	29	6	UP9 (x2)	20	
	Montevideo					
100	120	1131	6	100, 101	12	
101	120	1400	6	102, 103	12	
102	120	1603	6	104, 105	13	
Fluorometer scale changed from x10 to x31.6						
103	120	1730	110	106, 107		Station 120
104	120	1730	80	108, 109		
105	120	1730	50	110, 111		

106	120	1730	30	112, 113		
107	120	1730	7	114, 115		
108	120	1730	6	116, 117	39	
109	120	2001	6	118, 119	38	
110	120	2208	6	120, 121	36	
111	121	1	6	122, 123	41	
113	121	200	6	124, 125	58	
114	121	400	6	126, 127	44	
115	121	600	6	128, 129	46	
116	121	800	6	130, 131	44	
117	121	1000	6	132, 133	43	
118	121	1200	6	134, 135	39	
119	121	1400	120	136, 137		Station 121
120	121	1400	70	138, 139		
121	121	1400	50	140, 141		
122	121	1400	30	142, 143		
123	121	1400	7	144, 145		
124	121	1400	6	146, 147	38	
125	121	1600	6	148, 149	38	
126	121	1800	6	150, 151	38	
127	121	2000	6	152, 153	33	
133	121	2210	6	154, 155	33	
134	122	0	6	156, 157	33	
135	122	202	6	158, 159	37	
136	122	401	6	160, 161	31	
137	122	602	6	162, 163	33	
138	122	801	6	164, 165	33	
139	122	1000	6	166, 167	33	
140	122	1203	6	168, 169	33	
141	122	1400	150	170, 171		Station 122
142	122	1400	110	172, 173		
143	122	1400	60	174, 175		
144	122	1400	40	176, 177		
145	122	1400	7	178, 179		
146	122	1400	6	180, 181	32	filter 180 not centred - some loss
147	122	1606	6	182, 183	32	
148	122	1800	6	184, 185	33	
149	122	2000	6	186, 187	32	
150	122	2208	6	188, 189	32	
151	123	0	6	190, 191	31	
152	123	200	6	192, 193	33	
153	123	400	6	194, 195	33	
154	123	600	6	196, 197	33	
155	123	800	6	198, 199	34	
156	123	1000	6	200, 201	36	
157	123	1201	6	202, 203	36	
158	123	1400	150	204, 205		Station 123
159	123	1400	90	206, 207		
160	123	1400	60	208, 209		
161	123	1400	30	210, 211		
162	123	1400	7	212, 213		
163	123	1400	6	214, 215	37	
164	123	1607	6	216, 217	38	
165	123	1800	6	218, 219	39	
166	123	2000	6	220, 221	36	
167	123	2210	6	222, 223	34	

168	124	0	6	224, 225	34	
169	124	200	6	226, 227	34	
170	124	400	6	228, 229	33	
171	124	600	6	230, 231	32	
172	124	800	6	232, 233	36	
173	124	1100	6	234, 235	36	
174	124	1300	150	236, 237		Station 124
175	124	1300	100	238, 239		
176	124	1300	80	240, 241		
177	124	1300	30	242, 243		
178	124	1300	7	244, 245		
179	124	1300	6	246, 247	34	
180	124	1513	6	248, 249	34	
181	124	1713	6	250, 251	36	
182	124	1900	6	252, 253	36	
183	124	2102	6	254, 255	35	
184	124	2303	6	256, 257	35	
185	125	100	6	258, 259	34	
186	125	300	6	260, 261	32	
187	125	500	6	262, 263	32	
188	125	702	6	264, 265	38	
189	125	900	6	266, 267	35	
190	125	1103	6	268, 269	34	
191	125	1300	150	270, 271		Station 125
192	125	1300	80	272, 273		
193	125	1300	60	274, 275		
194	125	1300	30	276, 277		
195	125	1300	7	278, 279		
196	125	1300	6	280, 281	32	
197	125	1500	6	282, 283	33	
198	125	1710	6	284, 285	32	
199	125	1904	6	286, 287	31	
200	125	2100	6	288, 289	29	
201	125	2300	6	290, 291	29	
202	126	100	6	292, 293	30	
203	126	300	6	294, 295	29	
204	126	507	6	296, 297	29	
205	126	700	6	298, 299	28	
206	126	915	6	300, 301	28	
207	126	1100	6	302, 303	28	
208	126	1300	170	304, 305		Station 126
209	126	1300	150	306, 307		
210	126	1300	100	308, 309		
211	126	1300	60	310, 311		
212	126	1300	7	312, 313	28	
213	126	1516	6	314, 315	28	
214	126	1700	6	316, 317	28	
215	126	1900	6	318, 319	29	
216	126	2111	6	320, 321	29	
217	126	2338	6	322, 323	29	
218	127	200	6	324, 325	30	
219	127	400	6	326, 327	29	
220	127	600	6	328, 329	29	
221	127	830	6	330, 331	30	
222	127	1100	6	332, 333	29	
223	127	1300	170	334, 335		Station 127

224	127	1300	130	336, 337		
225	127	1300	90	338, 339		
226	127	1300	70	340, 341		
227	127	1300	7	342, 343		
228	127	1513	6	344, 345	28	
229	127	1700	6	346, 347	28	
230	127	1920	6	348, 349	28	
231	127	2120	6	350, 351	29	
232	127	2313	6	352, 353	29	
233	128	101	6	354, 355	29	
234	128	302	6	356, 357	29	
235	128	501	6	358, 359	29	
236	128	700	6	360, 361	29	
237	128	900	6	362, 363	29	
247	128	1100	6	364, 365	29	
248	128	1300	150	366, 367		Station 128
249	128	1300	100	368, 369		
250	128	1300	70	370, 371		
251	128	1300	30	372, 373		
252	128	1300	7	374, 375	28	
253	128	1500	6	376, 377	28	
254	128	1704	6	378, 379	28	
255	128	1908	6	380, 381	28	
256	128	2130	6	382, 383	29	
257	128	2313	6	384, 385	29	
258	129	100	6	386, 387	30	
259	129	300	6	388, 389	31	
260	129	500	6	390, 391	30	
261	129	700	6	392, 393	31	
262	129	930	6	394, 395	30	
263	129	1200	150	396, 397		Station 129
264	129	1200	60	398, 399		
265	129	1200	40	400, 401		
266	129	1200	20	402, 403		
267	129	1200	7	404, 405	29	
268	129	1410	6	406, 407	29	
269	129	1600	6	408, 409	29	
270	129	1800	6	410. 411	31	
271	129	2012	6	412, 413	31	
272	129	2230	6	414, 415	30	
273	130	0	6	416, 417	30	
274	130	200	6	418, 419	30	
275	130	400	6	420, 421	30	
276	130	600	6	422. 423	30	
277	130	800	6	424, 425	30	
278	130	1000	6	426, 427	30	
279	130	1200	150	428, 429		Station 130
280	130	1200	70	430, 431		
281	130	1200	40	432, 433		
282	130	1200	20	434, 435		
283	130	1200	7	436, 437	29	
284	130	1400	6	438, 439	29	
285	130	1618	6	440, 441	28	
286	130	1819	6	442, 443	29	
287	130	2010	6	444, 445	29	
288	130	2218	6	446, 447	29	

289	131	0	6	448, 449	29	
290	131	200	6	450, 451	30	
291	131	400	6	452, 453	30	
292	131	600	6	454, 455	32	
293	131	800	6	456, 457	32	
294	131	1000	6	458, 459	32.2	
295	131	1200	120	460, 461		Station 131
296	131	1200	60	462, 463		
297	131	1200	40	464, 465		
298	131	1200	20	466, 467		
299	131	1200	7	468, 469		
300	131	1410	6	470, 471	31.2	
301	131	1600	6	472, 473	31.8	
302	131	1802	6	474, 475	33.4	
303	131	2008	6	476, 477	34.6	
304	131	2206	6	478, 479	32.7	
305	132	0	6	480, 481	32.7	
306	132	205	6	482, 483	33.3	
307	132	400	6	484, 485	34.2	
308	132	600	6	486, 487	35	
309	132	1004	6	488, 489	34.5	
310	132	1200	120	490, 491		Station 132
311	132	1200	50	492, 493		
312	132	1200	40	494, 495		
313	132	1200	20	496, 497		
314	132	1200	7	498, 499	32	
315	132	1401	6	500, 501	31.5	
316	132	1600	6	502, 503	31.2	
317	132	1800	6	504, 505	31.6	
318	132	2008	6	506, 507	30.8	
318A	132	2213	6	508, 509	31.7	
319	133	0	6	510, 511	34.3	
320	133	200	6	512, 513	35.2	
321	133	400	6	514, 515	37.4	
322	133	600	6	516, 517	36.9	
323	133	800	6	518, 519	39.5	
324	133	1001	6	520, 521	38.2	
325	133	1200	80	522, 523		Station 133
326	133	1200	40	524, 525		
327	133	1200	30	526, 527		
328	133	1200	20	528, 529		
329	133	1200	7	530, 531		
330	133	1423	6	532, 533	33.7	
331	133	1611	6	534, 535	39.4	
332	133	1800	6	536, 537	51.3	
333	133	2000	6	538, 539	51.6	
Fluorometer scale changed from x31.6 to x10						
334	133	2200	6	540, 541	17	
335	134	0	6	542, 543	18.3	1000 ml each
336	134	204	6	544, 545	21.1	1000 ml each
337	134	400	6	546, 547	18.2	1000 ml each
338	134	600	6	548, 549	13.4	1000 ml each
339	134	800	6	550, 551	11.5	
340	134	1000	6	552, 553	12.8	
341	134	1207	6	554, 555	41.5	1000 ml each
342	134	1400	6	556, 557	28	

HPLC

343	134	1600	6	558, 559	18	
344	134	1808	6	560, 561	37.7	1000 ml each. Filters orangey
345	134	2017	6	562, 563	23.9	1000 ml each. Filters orangey
346	134	2203	6	564,565	12.1	
347	135	2	6	566,567	11.1	
348	135	201	6	568,569	11.8	
349	135	401	6	570,571	11.9	
350	135	600	6	572,573	12.3	
351	135	800	6	574,575	10.9	
352	135	1000	6	576,577	12.9	
353	135	1200	130	578,579		Station 135
354	135	1200	70	580,581		
355	135	1200	50	582,583		
356	135	1200	20	584,585		
357	135	1200	7	586,587	10.6	
358	135	1400	6	588,589	9.7	
359	135	1606	6	590,591	9.6	
360	135	1809	6	592, 593	10.1	
361	135	2024	6	594, 595	9.9	
362	135	2200	6	596, 597	10	
363	136	0	6	598, 599	10.2	
364	136	200	6	600, 601	10.2	
365	136	400	6	602, 603	10.2	
366	136	600	6	604, 605	10.2	
367	136	819	6	606, 607	10	
369	136	1100	150	608, 609		Station 136
371	136	1100	90	610, 611		
373	136	1100	70	612, 613		
375	136	1100	30	614, 615		
377	136	1100	7	616, 617		
379	136	1302	6	618, 619	9.1	
380	136	1500	6	620, 621	9.2	
381	136	1700	6	622, 623	9.3	
382	136	1919	6	624, 625	9.8	
383	136	2102	6	626, 627	9.8	
384	136	2302	6	628, 629	9.6	
385	137	100	6	630, 631	9.6	
386	137	300	6	632, 633	9.6	
387	137	500	6	634, 635	9.8	
388	137	700	6	636, 637	10.2	
389	137	900	6	638, 639	10.1	
391	137	1100	150	640, 641		Station 137
392	137	1100	80	642, 643		
393	137	1100	50	644, 645		
394	137	1100	30	646, 647		
395	137	1100	7	648, 649	9.8	
396	137	1313	6	650, 651	10.1	
397	137	1500	6	652, 653	9.8	
398	137	1700	6	654, 655	10.4	
399	137	1904	6	656, 657	10.7	
400	137	2101	6	658, 659	11.1	
401	137	2300	6	660. 661	13.1	
402	138	100	6	662, 663	12	
403	138	300	6	664, 665	13.4	
404	138	500	6	666, 667		
405	138	702	6	668, 669	18.7	

406	138	911	6	670, 671	12.2	
408	138	1100	150	672, 673		Station 138
409	138	1100	120	674, 675		
410	138	1100	60	676, 677		
411	138	1100	30	678, 679		
412	138	1100	7	680, 681	13.1	
413	138	1300	6	682, 683	11.6	
414	138	1506	6	684, 685	11.6	
415	138	1704	6	686, 687	10.9	
416	138	1911	6	688, 689	17.4	
	138		60	690		St 138, 60m, >2u (memb), 2000ml
	138		60	691		St 138, 60m, <2u, 2000ml
	138		7	692		St 138, 7m, >2u (memb), 2000ml
	138		7	693		St 138, 7m, <2u, 2000ml
417	138	2100	6	694, 695	21	
418	138	2304	6	696, 697	26.4	
419	139	102	6	698, 699	37	
420	139	302	6	700, 701	43.8	
421	139	500	6	702, 703	59.8	
422	139	720	6	704, 705	49.5	
423	139	904	6	706, 707	24.6	
425	139	1100	120	708, 709		Station 139
426	139	1100	40	710, 711		
427	139	1100	30	712, 713		? some material lost from 713
428	139	1100	20	714, 715		
429	139	1100	7	716, 717	22.5	
430	139	1311	6	718, 719	34.7	
431	139	1503	6	720, 721	28.8	
	139		20	722		St 139, 20m, >2u (memb), 1000ml
	139		20	723		St 139, 20m, <2u, 1000ml
432	139	1701	6	724, 725	34	1000 ml
433	139	1910	6	726, 727	56	
434	139	2102	6	728, 729	60.3	
433A	139	2300	6	730, 731	66.8	1000 ml
434A	140	100	6	732, 733	78.3	1000 ml
435	140	300	6	734, 735	70.9	1000 ml
436	140	500	6	736, 737	44.3	
437	140	700	6	738, 739	56.8	1000 ml
438	140	900	6	740, 741	29	
440	140	1100	120	742, 743		Station 140
441	140	1100	50	744, 745		
442	140	1100	30	746, 747		
443	140	1100	20	748, 749		
444	140	1100	7	750, 751	~30	
445	140	1354	6	752, 753	35	
446	140	1500	6	754, 755	38	
447	140	1717	6	756, 757	46.2	
448	140	1908	6	758, 759	87.5	1000 ml
Fluorometer scale changed from x10 to x3.16						
450	140	2100	6	760. 761	29.2	1000 ml
451	140	2300	6	762, 763	31.6	1000 ml
452	141	100	6	764, 765	28.3	1000 ml
453	141	300	6	766, 767	19	
454	141	500	6	768, 769	33.3	1000 ml
455	141	630	6	770, 771	23.6	
456	141	800	6	772, 773	13.7	

HPLC

458	141		120	774, 775		Station 141
459	141		50	776, 777		
460	141		30	778, 779		1000 ml
461	141		20	780, 781		1000 ml
462	141		7	782, 783	~17	1000 ml
463	141	1222	6	784, 785	14	1000 ml
464	141	1406	6	786, 787	14.1	1000 ml
465	141	1605	6	788, 789	20	1000 ml
466	141	1758	6	790, 791	30.5	1000 ml
467	141	2000	6	792, 793	39.2	1000 ml
469	141	2200	6	794, 795	31.2	1000 ml
471	142	0	6	796, 797	38.1	1000 ml
473	142	200	6	798, 799	22.7	1000 ml
475	142	400	6	800, 801	14.6	
477	142	600	6	802, 803	12	
478	142	802	6	804, 805	9.5	
480	142	1000	100	806, 807		Station 142
481	142	1000	50	808. 809		
482	142	1000	30	810, 811		1000 ml
483	142	1000	20	812, 813		1000 ml
484	142	1000	7	814, 815	11.7	1000 ml
485	142	1200	6	816, 817	8	
486	142	1348	6	818, 819	11	1000 ml. Station 142A
487	142	1511	6	820, 821	14	1000 ml. Station 142B
488	142	1625	6	822, 823	19.4	1000 ml. Station 142C
489	142	1729	6	824, 825	28	1000 ml. Station 142D

AMT-2		CHLOROPHYLL LOG AND DATA											
SAMPLE	JUL DAY	GMT	DEPTH	FL VAL	V FILT	V EXT	Rb	Ra	Rb/Ra	Rb-Ra	CHL A	PHAEO	
											mg/m3	mg/m3	
1	113	2002	6	29	250	10	4.17	2.71	1.54	1.46	0.86	1.49	
2	114	3	6	26	250	10	3.64	2.42	1.50	1.22	0.72	1.38	
3	114	357	6	24	250	10	1.76	1.18	1.49	0.58	0.34	0.68	
4	114	800	6	22	250	10	2.14	1.33	1.61	0.81	0.48	0.68	
5	114	1222	6	49	250	10	3.38	1.99	1.70	1.39	0.82	0.91	
6	114	1500	6	38	250	10	3.6	2.26	1.59	1.34	0.79	1.17	
7	114	1500	7		250	10	3.62	2.3	1.57	1.32	0.77	1.22	tation 114
8	114	1500	20		250	10	3.71	2.36	1.57	1.35	0.79	1.25	
9	114	1500	40		250	10	3.69	2.37	1.56	1.32	0.77	1.28	
10	114	1500	60		250	10	0.77	0.5	1.54	0.27	0.16	0.27	
11	114	1500	90		250	10	0.4	0.27	1.48	0.13	0.08	0.16	
12	114	1850	6	32	250	10	3.06	2.05	1.49	1.01	0.59	1.18	
13	114	2330	6	30	250	10	4.57	2.85	1.60	1.72	1.01	1.46	
14	115	141	6	28	250	10	3.63	2.3	1.58	1.33	0.78	1.21	
15	115	400	6	37	250	10	4.95	3.12	1.59	1.83	1.07	1.63	
16	115	600	6	33	250	10	4.44	3.06	1.45	1.38	0.81	1.84	
17	115	800	6	30	250	10	3.63	2.16	1.68	1.47	0.86	1.01	
18	115	1027	6	43	250	10	5.34	3.3	1.62	2.04	1.20	1.66	
19	115	1235	6	37	250	10	6.61	3.98	1.66	2.63	1.54	1.91	
20	115	1500	50		250	10	1.44	1.11	1.30	0.33	0.19	0.76	tation 115
21	115	1500	40		250	10	1.97	1.39	1.42	0.58	0.34	0.86	
22	115	1500	30		250	10	3.26	2.12	1.54	1.14	0.67	1.17	
23	115	1500	20		250	10	3.41	2.2	1.55	1.21	0.71	1.20	
24	115	1500	7		250	10	3.17	2.27	1.40	0.9	0.53	1.43	
25	115	1500	6	33	250	10	3.31	2.15	1.54	1.16	0.68	1.18	
26	115	1730	6	27	250	10	3.53	2.18	1.62	1.35	0.79	1.10	
27	115	1930	6	50	250	10	4.13	2.61	1.58	1.52	0.89	1.37	
28	115	2225	6	46	250	10	4.7	2.99	1.57	1.71	1.00	1.59	
29	116	45	6	50	250	10	5.45	3.24	1.68	2.21	1.30	1.52	
30	116	539	6	40	250	10	4.73	3.1	1.53	1.63	0.96	1.73	
31	116	800	6	19	250	10	1.79	1.16	1.54	0.63	0.37	0.63	
32	116	1000	6	22	250	10	4.02	2.64	1.52	1.38	0.81	1.48	
33	116	1148	6	16	250	10	1.94	1.41	1.38	0.53	0.31	0.91	
34	116	1500	100		250	10	2.38	1.69	1.41	0.69	0.40	1.06	tation 116
35	116	1500	70		250	10	2.48	1.64	1.51	0.84	0.49	0.93	
36	116	1500	50		250	10	2.22	1.61	1.38	0.61	0.36	1.03	
37	116	1500	30		250	10	2.43	1.71	1.42	0.72	0.42	1.06	
38	116	1500	7		250	10	2.44	1.61	1.52	0.83	0.49	0.91	
39	116	1500	6	17	250	10	2.32	1.73	1.34	0.59	0.35	1.15	
40	116	1750	6	18	250	10	2.2	1.5	1.47	0.7	0.41	0.89	
41	116	2009	6	17	250	10	2.14	1.41	1.52	0.73	0.43	0.79	
42	116	2214	6	27	250	10	3.78	2.56	1.48	1.22	0.72	1.50	
43	117	29	6	20	250	10	2.65	1.74	1.52	0.91	0.53	0.97	
	Montevideo. Filters romoved from fluorometer for extract readings												
100	120	1131	6	12.2	100	10	3.01	1.92	1.57	1.09	0.22		
101	120	1400	6	12.5	100	10	3.91	2.5	1.56	1.41	0.29		
102	120	1603	6	12.3	100	10	3.3	2.13	1.55	1.17	0.24		
Turner fluorometer scale change from x10 to x31.6													
103	120	1730	110		100	10	2.57	1.86	1.38	0.71	0.15		Station 120
104	120	1730	80		100	10	4.28	2.7	1.59	1.58	0.33		
105	120	1730	50		100	10	4.12	2.67	1.54	1.45	0.30		
106	120	1730	30		100	10	3.55	2.36	1.50	1.19	0.25		
107	120	1730	7		100	10	3.4	2.2	1.55	1.2	0.25		
108	120	1730	6	39	100	10	3.55	2.31	1.54	1.24	0.26		
109	120	2001	6	38.1	100	10	3.06	1.98	1.55	1.08	0.22		
110	120	2208	6	36.3	100	10	2.62	1.68	1.56	0.94	0.19		
111	121	1	6	41	100	10	3.69	2.37	1.56	1.32	0.27		
113	121	200	6	57.9	100	20	3.71	2.47	1.50	1.24	0.51		
114	121	400	6	43.5	100	10	3.03	1.95	1.55	1.08	0.22		
115	121	600	6	45.9	100	10	4.3	2.73	1.58	1.57	0.32		
116	121	800	6	44.3	100	10	4.46	2.86	1.56	1.6	0.33		
117	121	1000	6	42.7	100	10	3.82	2.44	1.57	1.38	0.28		
118	121	1200	6	39	100	10	3.2	2.05	1.56	1.15	0.24		
119	121	1400	120		100	10	1.14	0.96	1.19	0.18	0.04		Station 121
120	121	1400	70		100	10	3.25	2.31	1.41	0.94	0.19		
121	121	1400	50		100	10	5.05	3.22	1.57	1.83	0.38		
122	121	1400	30		100	10	4.17	2.68	1.56	1.49	0.31		
123	121	1400	7		100	10	2.82	1.81	1.56	1.01	0.21		
124	121	1400	6	38	100	10	2.91	1.92	1.52	0.99	0.20		
125	121	1600	6	38	100	10	3.17	2.07	1.53	1.1	0.23		
126	121	1800	6	38.1	100	10	3.04	2.05	1.48	0.99	0.20		
127	121	2000	6	32.8	100	10	1.67	0.91	1.84	0.76	0.16		
128	121	2000	6		74	10	1.53	1	1.53	0.53	0.15		
129	121	2000	6		54	10	1.13	0.61	1.85	0.52	0.20		
130	121	2000	6		25	10	0.73	0.51	1.43	0.22	0.18		
131	121	2000	6		10	10	0.41	0.38	1.08	0.03	0.06		

132	121	2000	6		0	10	0.35	0.33	1.06	0.02	#DIV/0!	acetone blank
133	121	2210	6	33.2	100	10	1.94	1.27	1.53	0.67	0.14	
134	122	0	6	32.7	100	10	1.56	1.03	1.51	0.53	0.11	
135	122	202	6	36.5	100	10	2.85	1.82	1.57	1.03	0.21	
136	122	401	6	31.3	100	10	1.81	0.99	1.83	0.82	0.17	
137	122	602	6	33	100	10	1.85	1.23	1.50	0.62	0.13	
138	122	801	6	32.6	100	10	1.87	1.22	1.53	0.65	0.13	
139	122	1000	6	33.4	100	10	2.12	1.48	1.43	0.64	0.13	
140	122	1203	6	33.4	100	10	2.25	1.54	1.46	0.71	0.15	
141	122	1400	150		100	10	1.96	1.52	1.29	0.44	0.09	Station 122
142	122	1400	110		100	10	4.61	3.1	1.49	1.51	0.31	
143	122	1400	60		100	10	2.06	1.36	1.51	0.7	0.14	
144	122	1400	40		100	10	2.11	1.43	1.48	0.68	0.14	
145	122	1400	7		100	10	2.09	1.37	1.53	0.72	0.15	
146	122	1400	6	32	100	10	2.04	1.36	1.50	0.68	0.14	
147	122	1606	6	32	100	10	2.07	1.46	1.42	0.61	0.13	
148	122	1800	6	33.4	100	10	2.09	1.43	1.46	0.66	0.14	
149	122	2000	6	32.3	100	10	1.69	1.19	1.42	0.5	0.10	
150	122	2208	6	31.5	100	10	1.75	1.27	1.38	0.48	0.10	
151	123	0	6	31.4	100	10	1.72	1.16	1.48	0.56	0.12	
152	123	200	6	33.4	100	10	2.2	1.47	1.50	0.73	0.15	
153	123	400	6	32.8	100	10	2.2	1.34	1.64	0.86	0.18	
154	123	600	6	32.8	100	10	2.13	1.37	1.55	0.76	0.16	
155	123	800	6	34.1	100	10	2.66	1.76	1.51	0.9	0.19	
156	123	1000	6	35.8	100	10	3.19	2.01	1.59	1.18	0.24	
157	123	1201	6	36.3	150	10	4.69	3.09	1.52	1.6	0.22	Station 123
158	123	1400	150		150	10	1.54	1.17	1.32	0.37	0.05	
159	123	1400	90		150	20	4.02	2.81	1.43	1.21	0.33	
160	123	1400	60		150	10	5.4	3.46	1.56	1.94	0.27	
161	123	1400	30		150	10	5.17	3.15	1.64	2.02	0.28	
162	123	1400	7		150	10	5.42	3.39	1.60	2.03	0.28	
163	123	1400	6	36.7	150	10	5.58	3.58	1.56	2	0.27	
164	123	1607	6	37.8	150	10	5.52	3.49	1.58	2.03	0.28	
165	123	1800	6	39.1	150	10	6.14	3.94	1.56	2.2	0.30	
166	123	2000	6	36.1	150	10	5.04	3.07	1.64	1.97	0.27	
167	123	2210	6	33.6	150	10	3.54	2.28	1.55	1.26	0.17	
168	124	0	6	33.9	150	10	3.97	2.55	1.56	1.42	0.19	
169	124	200	6	33.5	150	10	3.62	2.32	1.56	1.3	0.18	
170	124	400	6	33.3	150	10	4.29	2.74	1.57	1.55	0.21	
171	124	600	6	31.5	150	10	2.83	1.82	1.55	1.01	0.14	
172	124	800	6	35.7	150	10	5.5	3.56	1.54	1.94	0.27	
173	124	1100	6	35.6	150	10	5.04	3.03	1.66	2.01	0.28	
174	124	1300	150		150	10	2.75	1.99	1.38	0.76	0.10	Station 124
175	124	1300	100		150	10	6.36	4.38	1.45	1.98	0.27	
176	124	1300	80		150	10	6.34	4.1	1.55	2.24	0.31	
177	124	1300	30		150	10	4.14	2.69	1.54	1.45	0.20	
178	124	1300	7		150	10	3.83	2.49	1.54	1.34	0.18	
179	124	1300	6	34.3	150	10	4.21	2.67	1.58	1.54	0.21	
180	124	1513	6	33.9	150	10	4.08	2.55	1.60	1.53	0.21	
181	124	1713	6	35.7	150	10	4.51	2.84	1.59	1.67	0.23	
182	124	1900	6	35.5	150	10	3.71	2.38	1.56	1.33	0.18	
183	124	2102	6	34.5	150	10	4.36	2.8	1.56	1.56	0.21	
184	124	2303	6	34.9	150	10	5.34	3.34	1.60	2	0.27	
185	125	100	6	33.5	150	10	3.3	2.13	1.55	1.17	0.16	
186	125	300	6	31.6	150	10	2.52	1.66	1.52	0.86	0.12	
187	125	500	6	31.5	150	10	2.63	1.73	1.52	0.9	0.12	
188	125	702	6	38.2	150	10	6.05	3.88	1.56	2.17	0.30	
189	125	900	6	34.8	150	10	4.22	2.72	1.55	1.5	0.21	
190	125	1103	6	33.9	150	10	4.33	2.67	1.62	1.66	0.23	
191	125	1300	150		150	10	2.27	1.6	1.42	0.67	0.09	Station 125
192	125	1300	80		150	40	3.71	2.41	1.54	1.3	0.71	
193	125	1300	60		150	10	3.41	2.14	1.59	1.27	0.17	
194	125	1300	30		150	10	3	1.9	1.58	1.1	0.15	
195	125	1300	7		150	10	3.06	1.83	1.67	1.23	0.17	
196	125	1300	6	31.8	150	10	2.84	1.78	1.60	1.06	0.15	
197	125	1500	6	32.2	150	10	3.21	2.03	1.58	1.18	0.16	
198	125	1710	6	31.8	150	10	2.88	1.91	1.51	0.97	0.13	
199	125	1904	6	31.2	150	10	2.1	1.37	1.53	0.73	0.10	
200	125	2100	6	29.3	150	10	1.75	1.26	1.39	0.49	0.07	
201	125	2300	6	28.9	150	10	1.49	0.96	1.55	0.53	0.07	
202	126	100	6	29.5	150	10	1.85	1.21	1.53	0.64	0.09	
203	126	300	6	28.5	150	10	1.12	0.85	1.32	0.27	0.04	
204	126	507	6	28.4	150	10	1.17	0.77	1.52	0.4	0.05	
205	126	700	6	27.8	150	10	1.04	0.77	1.35	0.27	0.04	
206	126	915	6	28	150	10	1.29	0.87	1.48	0.42	0.06	
207	126	1100	6	28	150	10	1.12	0.79	1.42	0.33	0.05	
208	126	1300	170		150	10	4.57	2.9	1.58	1.67	0.23	Station 126
209	126	1300	150		150	10	6.28	4.25	1.48	2.03	0.28	
210	126	1300	100		150	10	2.64	1.63	1.62	1.01	0.14	
211	126	1300	60		150	10	1.32	0.84	1.57	0.48	0.07	
212	126	1300	7	27.5	150	10	1	0.64	1.56	0.36	0.05	
213	126	1516	6	28.3	150	10	1.23	0.81	1.52	0.42	0.06	

214	126	1700	6	28.1	150	10	1.25	0.77	1.62	0.48	0.07	
215	126	1900	6	28.6	150	10	1.31	0.87	1.51	0.44	0.06	
216	126	2111	6	28.6	150	10	1.23	0.8	1.54	0.43	0.06	
217	126	2338	6	29.4	150	10	1.45	0.9	1.61	0.55	0.08	Station 126A
218	127	200	6	29.5	150	10	1.55	0.92	1.68	0.63	0.09	
219	127	400	6	29	150	10	1.42	0.94	1.51	0.48	0.07	
220	127	600	6	28.8	150	10	1.49	0.93	1.60	0.56	0.08	
221	127	830	6	29.5	150	10	1.94	1.25	1.55	0.69	0.09	
222	127	1100	6	29.3	150	10	1.64	1.08	1.52	0.56	0.08	
223	127	1300	170		150	10	3.05	2.1	1.45	0.95	0.13	Station 127
224	127	1300	130		150	10	6.44	4.29	1.50	2.15	0.30	
225	127	1300	90		150	10	3.75	2.25	1.67	1.5	0.21	
226	127	1300	70		150	10	2.93	1.87	1.57	1.06	0.15	
227	127	1300	7		150	10	1.62	1.01	1.60	0.61	0.08	
228	127	1513	6	28.2	150	10	1.13	0.76	1.49	0.37	0.05	
229	127	1700	6	28.2	150	10	1.08	0.72	1.50	0.36	0.05	
230	127	1920	6	28.2	150	10	1.19	0.79	1.51	0.4	0.05	
231	127	2120	6	29	150	10	1.27	0.83	1.53	0.44	0.06	
232	127	2313	6	29.3	150	10	1.31	0.86	1.52	0.45	0.06	Station 127A
233	128	101	6	28.8	150	10	1.3	0.84	1.55	0.46	0.06	
234	128	302	6	29.1	150	10	1.54	0.91	1.69	0.63	0.09	
235	128	501	6	29.4	150	10	1.59	1.04	1.53	0.55	0.08	
236	128	700	6	29.3	150	10	1.66	1.1	1.51	0.56	0.08	
237	128	900	6	29	150	10	1.78	1.14	1.56	0.64	0.09	Replicates
238	128	900	6		150	10	1.72	1.08	1.59	0.64	0.09	
239	128	900	6		150	10	1.76	1.11	1.59	0.65	0.09	
240	128	900	6		150	10	1.71	1.11	1.54	0.6	0.08	
241	128	900	6		150	10	1.74	1.14	1.53	0.6	0.08	
242	128	900	6		150	10	1.72	1.04	1.65	0.68	0.09	
243	128	900	6		150	10	1.7	1.1	1.55	0.6	0.08	
244	128	900	6		150	10	1.69	1.05	1.61	0.64	0.09	
245	128	900	6		150	10	1.65	1.12	1.47	0.53	0.07	
246	128	900	6		150	10	1.65	1.08	1.53	0.57	0.08	
247	128	1100	6	28.6	150	10	1.53	0.96	1.59	0.57	0.08	
248	128	1300	150		150	10	2.25	1.61	1.40	0.64	0.09	Station 128
249	128	1300	100		150	20	5.71	3.81	1.50	1.9	0.52	
250	128	1300	70		150	10	3.9	2.45	1.59	1.45	0.20	
251	128	1300	30		150	10	1.62	1.03	1.57	0.59	0.08	
252	128	1300	7	28.4	150	10	1.51	0.94	1.61	0.57	0.08	
253	128	1500	6	27.9	150	10	1.34	0.88	1.52	0.46	0.06	
254	128	1704	6	28.4	150	10	1.5	0.94	1.60	0.56	0.08	
255	128	1908	6	28.4	150	10	1.37	0.9	1.52	0.47	0.06	
256	128	2130	6	28.8	150	10	2.52	1.81	1.39	0.71	0.10	
257	128	2313	6	29	150	10	1.55	0.97	1.60	0.58	0.08	Station 128A
258	129	100	6	29.5	150	10	1.68	1.14	1.47	0.54	0.07	
259	129	300	6	30.5	150	10	1.83	1.21	1.51	0.62	0.09	
260	129	500	6	30.2	150	10	1.98	1.3	1.52	0.68	0.09	
261	129	700	6	30.5	150	10	2.04	1.34	1.52	0.7	0.10	
262	129	930	6	30.3	150	10	2.2	1.4	1.57	0.8	0.11	
263	129	1200	150		150	10	0.94	0.75	1.25	0.19	0.03	Station 129
264	129	1200	60		150	20	5.42	3.59	1.51	1.83	0.50	
265	129	1200	40		150	10	4.04	2.64	1.53	1.4	0.19	
266	129	1200	20		150	10	2.6	1.68	1.55	0.92	0.13	
267	129	1200	7	28.5	150	10	2.57	1.71	1.50	0.86	0.12	
268	129	1410	6	28.5	150	10	2.23	1.38	1.62	0.85	0.12	
269	129	1600	6	29.2	150	10	2.15	1.41	1.52	0.74	0.10	
270	129	1800	6	30.5	150	10	2.36	1.52	1.55	0.84	0.12	
271	129	2012	6	30.7	150	10	2.61	1.66	1.57	0.95	0.13	
272	129	2230	6	30.2	150	10	2.19	1.48	1.48	0.71	0.10	Station 129A
273	130	0	6	29.8	150	10	2.15	1.42	1.51	0.73	0.10	
274	130	200	6	30.1	150	10	2.15	1.39	1.55	0.76	0.10	
275	130	400	6	30	150	10	2.07	1.27	1.63	0.8	0.11	
276	130	600	6	29.6	150	10	2.26	1.49	1.52	0.77	0.11	
277	130	800	6	30	150	10	2.49	1.66	1.50	0.83	0.11	
278	130	1000	6	30.1	150	10	2.54	1.69	1.50	0.85	0.12	
279	130	1200	150		150	10	1.44	1.12	1.29	0.32	0.04	Station 130
280	130	1200	70		150	40	3.75	2.5	1.50	1.25	0.69	
281	130	1200	40		150	10	6.19	3.96	1.56	2.23	0.31	
282	130	1200	20		150	10	2.67	1.68	1.59	0.99	0.14	
283	130	1200	7	29.4	150	10	2.36	1.5	1.57	0.86	0.12	
284	130	1400	6	28.6	150	10	2.48	1.55	1.60	0.93	0.13	Equator
285	130	1618	6	28.2	150	10	2.03	1.26	1.61	0.77	0.11	
286	130	1819	6	29	150	10	1.9	1.23	1.54	0.67	0.09	
287	130	2010	6	28.7	150	10	1.85	1.22	1.52	0.63	0.09	
288	130	2218	6	29.2	200	10	2.44	1.62	1.51	0.82	0.08	Station 130A
289	131	0	6	29.3	200	10	2.11	1.4	1.51	0.71	0.07	not in acetone
290	131	200	6	29.6	200	10	2.4	1.58	1.52	0.82	0.08	not in acetone
291	131	400	6	30.2	200	10	2.83	1.81	1.56	1.02	0.11	not in acetone
292	131	600	6	32.2	200	10	4.55	2.97	1.53	1.58	0.16	
293	131	800	6	31.7	150	10	3.07	2	1.54	1.07	0.15	
294	131	1000	6	32.2	150	10	3.96	2.59	1.53	1.37	0.19	
295	131	1200	120		150	10	2.02	1.65	1.22	0.37	0.05	Station 131

296	131	1200	60		150	40	2.89	2	1.45	0.89	0.49	
297	131	1200	40		150	20	3.81	2.52	1.51	1.29	0.35	
298	131	1200	20		150	10	5.68	3.62	1.57	2.06	0.28	
299	131	1200	7		150	10	4.23	2.7	1.57	1.53	0.21	Trichodesmium
300	131	1400	6	31.2	150	10	4.16	2.64	1.58	1.52	0.21	
301	131	1600	6	31.8	150	10	5.17	3.4	1.52	1.77	0.24	Filter left out
302	131	1802	6	33.4	150	10	3.73	2.37	1.57	1.36	0.19	
303	131	2008	6	34.6	150	10	5.09	3.2	1.59	1.89	0.26	
304	131	2206	6	34.6	150	10	4.03	2.66	1.52	1.37	0.19	
305	132	0	6	32.7	150	10	3.45	2.25	1.53	1.2	0.16	
306	132	205	6	33.3	150	10	3.53	2.27	1.56	1.26	0.17	
307	132	400	6	34.2	150	10	3.97	2.54	1.56	1.43	0.20	
308	132	600	6	35	150	10	4.24	2.73	1.55	1.51	0.21	
309	132	1004	6	34.5	150	10	4.61	3.05	1.51	1.56	0.21	
310	132	1200	120		150	10	1.13	0.86	1.31	0.27	0.04	Station 132
311	132	1200	50		150	40	4.2	3.03	1.39	1.17	0.64	
312	132	1200	40		150	40	4.24	2.76	1.54	1.48	0.81	
313	132	1200	20		150	10	5.36	3.4	1.58	1.96	0.27	
314	132	1200	7	32	150	10	4.41	2.83	1.56	1.58	0.22	
315	132	1401	6	31.5	150	10	3.28	2.14	1.53	1.14	0.16	
316	132	1600	6	31.2	150	10	2.89	1.88	1.54	1.01	0.14	
317	132	1800	6	31.6	150	10	2.55	1.66	1.54	0.89	0.12	
318	132	2008	6	30.8	150	10	2.58	1.67	1.54	0.91	0.12	
318A	132	2213	6	31.7	150	10	2.74	1.73	1.58	1.01	0.14	
319	133	0	6	34.3	150	10	3.02	1.92	1.57	1.1	0.15	
320	133	200	6	35.2	150	10	3.88	2.5	1.55	1.38	0.19	
321	133	400	6	37.4	150	10	5.37	3.41	1.57	1.96	0.27	
322	133	600	6	36.9	150	10	4.87	3.15	1.55	1.72	0.24	
323	133	800	6	39.5	150	10	6.15	3.93	1.56	2.22	0.30	
324	133	1001	6	38.2	150	10	6.86	4.36	1.57	2.5	0.34	
325	133	1200	80		150	10	1.12	0.97	1.15	0.15	0.02	Station 133
326	133	1200	40		150	80	4.47	2.98	1.50	1.49	1.64	
327	133	1200	30		150	40	6.32	4.13	1.53	2.19	1.20	
328	133	1200	20		150	20	4.06	2.6	1.56	1.46	0.40	
329	133	1200	7		150	10	5.76	3.74	1.54	2.02	0.28	
330	133	1423	6	33.7	150	10	4.54	2.89	1.57	1.65	0.23	
331	133	1611	6	39.4	150	10	4.96	3.14	1.58	1.82	0.25	
332	133	1800	6	51.3	100	10	4.42	2.86	1.55	1.56	0.32	
333	133	2000	6	51.6	100	10	4.48	2.88	1.56	1.6	0.33	
Fluorometer scale changed from x31.6 to x10.												
334	133	2200	6	17	80	10	3.93	2.56	1.54	1.37	0.35	
335	134	0	6	18.3	80	10	5.67	3.62	1.57	2.05	0.53	
336	134	204	6	21.1	60	10	4.05	2.69	1.51	1.36	0.47	
337	134	400	6	18.2	80	10	3.79	2.36	1.61	1.43	0.37	
338	134	600	6	13.4	100	10	3.09	2.03	1.52	1.06	0.22	
339	134	800	6	11.5	150	10	3.72	2.44	1.52	1.28	0.18	
340	134	1000	6	12.8	150	10	4.57	2.95	1.55	1.62	0.22	
341	134	1207	6	41.5	50	20	4.06	2.56	1.59	1.5	1.24	
342	134	1400	6	28	60	10	6.29	3.87	1.63	2.42	0.83	
343	134	1600	6	18	100	10	5.04	3.2	1.58	1.84	0.38	
344	134	1808	6	37.7	50	10	6.3	3.89	1.62	2.41	0.99	Synechococcus
345	134	2017	6	23.9	60	10	2.52	1.58	1.59	0.94	0.32	Synechococcus
346	134	2203	6	12.1	150	10	2.88	1.83	1.57	1.05	0.14	
347	135	2	6	11.1	150	10	3.21	2.08	1.54	1.13	0.16	
348	135	201	6	11.8	150	10	1.68	1.13	1.49	0.55	0.08	
349	135	401	6	11.9	150	10	3.69	2.29	1.61	1.4	0.19	
350	135	600	6	12.3	150	10	2.88	1.87	1.54	1.01	0.14	
351	135	800	6	10.9	150	10	2.37	1.49	1.59	0.88	0.12	
352	135	1000	6	12.9	150	10	3.26	2.05	1.59	1.21	0.17	
352A	135	1200	70		150	10	5.54	3.59	1.54	1.95	0.27	1st CTD cast
353	135	1200	130		150	40	0.59	0.44	1.34	0.15	0.08	Station 135
354	135	1200	70		150	20	5.99	3.87	1.55	2.12	0.58	
355	135	1200	50		150	10	4.17	2.64	1.58	1.53	0.21	
356	135	1200	20		150	10	2.49	1.55	1.61	0.94	0.13	
357	135	1200	7	10.6	150	10	2.48	1.55	1.60	0.93	0.13	
358	135	1400	6	9.7	150	10	2.02	1.38	1.46	0.64	0.09	
359	135	1606	6	9.6	150	10	1.63	1.15	1.42	0.48	0.07	
360	135	1809	6	10.1	150	10	2.4	1.45	1.66	0.95	0.13	
361	135	2024	6	9.9	150	10	2.03	1.38	1.47	0.65	0.09	
362	135	2200	6	10	150	10	2.24	1.56	1.44	0.68	0.09	
363	136	0	6	10.2	150	10	2.05	1.36	1.51	0.69	0.09	
364	136	200	6	10.2	150	10	2.39	1.56	1.53	0.83	0.11	
365	136	400	6	10.2	150	10	2.49	1.59	1.57	0.9	0.12	
366	136	600	6	10.2	150	10	2.42	1.59	1.52	0.83	0.11	
367	136	819	6	10	150	10	2.34	1.49	1.57	0.85	0.12	
368	136	819	6	10	150	10	2.4	1.52	1.58	0.88	0.12	Poretics filter
369	136	1100	150		150	10	1.61	1.2	1.34	0.41	0.06	Station 136
370	136	1100	150		150	10	1.67	1.29	1.29	0.38	0.05	Poretics filter
371	136	1100	90		150	10	5.67	3.71	1.53	1.96	0.27	
372	136	1100	90		150	10	5.61	3.83	1.46	1.78	0.24	Poretics filter
373	136	1100	70		150	10	4.05	2.59	1.56	1.46	0.20	
374	136	1100	70		150	10	3.91	2.57	1.52	1.34	0.18	Poretics filter

375	136	1100	30		150	10	2.14	1.34	1.60	0.8	0.11	
376	136	1100	30		150	10	2.14	1.42	1.51	0.72	0.10	Poretics filter
377	136	1100	7		150	10	1.96	1.34	1.46	0.62	0.09	
378	136	1100	7		150	10	1.98	1.33	1.49	0.65	0.09	Poretics filter
379	136	1302	6	9.1	150	10	1.63	1.07	1.52	0.56	0.08	
380	136	1500	6	9.2	150	10	1.64	1.04	1.58	0.6	0.08	
381	136	1700	6	9.3	150	10	1.74	1.08	1.61	0.66	0.09	
382	136	1919	6	9.8	150	10	1.68	1.1	1.53	0.58	0.08	
383	136	2102	6	9.8	150	10	1.77	1.15	1.54	0.62	0.09	
384	136	2302	6	9.6	150	10	1.99	1.24	1.60	0.75	0.10	
385	137	100	6	9.6	150	10	1.59	1.06	1.50	0.53	0.07	oretics filters onwards
386	137	300	6	9.6	150	10	2.15	1.38	1.56	0.77	0.11	
387	137	500	6	9.8	150	10	1.92	1.22	1.57	0.7	0.10	
388	137	700	6	10.2	150	10	2.45	1.61	1.52	0.84	0.12	
389	137	900	6	10.1	150	10	2.3	1.5	1.53	0.8	0.11	
390	137	1100	80		50	10	3.74	2.5	1.50	1.24	0.51	1st CTD cast
391	137	1100	150		150	10	1.37	0.98	1.40	0.39	0.05	Station 137
392	137	1100	80		50	10	3.74	2.44	1.53	1.3	0.54	
393	137	1100	50		150	10	2.6	1.69	1.54	0.91	0.12	
394	137	1100	30		150	10	2.52	1.62	1.56	0.9	0.12	
395	137	1100	7	9.8	150	10	2.58	1.69	1.53	0.89	0.12	
396	137	1313	6	10.1	150	10	2.74	1.79	1.53	0.95	0.13	
397	137	1500	6	9.8	150	10	2.82	1.75	1.61	1.07	0.15	
398	137	1700	6	10.4	150	10	2.43	1.64	1.48	0.79	0.11	
399	137	1904	6	10.7	150	10	2.61	1.66	1.57	0.95	0.13	
400	137	2101	6	11.1	150	10	2.66	1.74	1.53	0.92	0.13	
401	137	2300	6	13.1	150	10	3.5	2.22	1.58	1.28	0.18	
402	138	100	6	12	150	10	3.11	1.96	1.59	1.15	0.16	
403	138	300	6	13.4	150	10	3.77	2.44	1.55	1.33	0.18	
404	138	500	6	13.5	150	10	4.33	2.72	1.59	1.61	0.22	
405	138	702	6	18.7	150	10	4.33	2.66	1.63	1.67	0.23	
406	138	911	6	12.2	150	10	2.98	1.85	1.61	1.13	0.16	
407	138	1100	60		100	20	3.31	2.08	1.59	1.23	0.51	1st CTD cast
408	138	1100	150		150	10	1.2	0.89	1.35	0.31	0.04	Station 138
409	138	1100	120		150	10	4.7	3.11	1.51	1.59	0.22	
410	138	1100	60		100	20	3.08	1.95	1.58	1.13	0.47	
411	138	1100	30		150	10	3.72	2.28	1.63	1.44	0.20	
412	138	1100	7	13.1	150	10	3.23	2.3	1.40	0.93	0.13	
413	138	1300	6	11.6	150	10	3.11	2.08	1.50	1.03	0.14	
414	138	1506	6	11.6	150	10	2.58	1.8	1.43	0.78	0.11	
415	138	1704	6	10.9	150	10	1.92	1.36	1.41	0.56	0.08	
416	138	1911	6	17.4	150	10	2.58	1.99	1.30	0.59	0.08	
417	138	2100	6	21	100	10	3.12	2.33	1.34	0.79	0.16	
418	138	2304	6	26.4	100	10	3.88	2.74	1.42	1.14	0.23	
419	139	102	6	37	100	10	4.35	3.09	1.41	1.26	0.26	
420	139	302	6	43.8	100	20	3.75	2.68	1.40	1.07	0.44	
421	139	500	6	59.8	100	20	5.07	3.64	1.39	1.43	0.59	
422	139	720	6	49.5	50	10	5.28	3.82	1.38	1.46	0.60	
423	139	904	6	24.6	100	20	3.53	2.74	1.29	0.79	0.33	
424	139	1100	40		100	10	5.43	4.23	1.28	1.2	0.25	1st CTD cast
425	139	1100	120		150	10	0.91	0.76	1.20	0.15	0.02	Station 139
426	139	1100	40		100	10	3.7	2.9	1.28	0.8	0.16	
427	139	1100	30		100	20	3.19	2.46	1.30	0.73	0.30	
428	139	1100	20		100	10	5.42	3.96	1.37	1.46	0.30	
429	139	1100	7	22.5	100	10	4.84	3.7	1.31	1.14	0.23	
430	139	1311	6	34.7	50	20	3.59	2.72	1.32	0.87	0.72	
431	139	1503	6	28.8	100	20	4.67	3.42	1.37	1.25	0.51	
432	139	1701	6	34	100	40	2.78	2.12	1.31	0.66	0.54	
433	139	1910	6	56	100	40	2.24	1.8	1.24	0.44	0.36	
434	139	2102	6	60.3	100	20	5.19	4.34	1.20	0.85	0.35	
433A	139	2300	6	66.8	25	10	2.35	2.07	1.14	0.28	0.23	
434A	140	100	6	78.3	25	10	2.61	2.35	1.11	0.26	0.21	
435	140	300	6	70.9	25	10	3.34	2.86	1.17	0.48	0.40	
436	140	500	6	44.3	50	10	3.9	3.39	1.15	0.51	0.21	
437	140	700	6	56.8	50	10	4.81	4.17	1.15	0.64	0.26	
438	140	900	6	29	100	20	3.49	3.07	1.14	0.42	0.17	
439	140	1100	50		100	20	3.22	2.77	1.16	0.45	0.19	1st CTD cast
440	140	1100	120		150	10	1	0.9	1.11	0.1	0.01	Station 140
441	140	1100	50		100	20	2.96	2.55	1.16	0.41	0.17	
442	140	1100	30		100	20	3.26	2.76	1.18	0.5	0.21	
443	140	1100	20		100	20	3.27	2.79	1.17	0.48	0.20	
444	140	1100	7	~30	100	20	3.21	2.75	1.17	0.46	0.19	
445	140	1354	6	35	100	20	5.34	4.65	1.15	0.69	0.28	
446	140	1500	6	38	100	20	5.57	4.97	1.12	0.6	0.25	
447	140	1717	6	46.2	50	20	3.34	2.86	1.17	0.48	0.40	
448	140	1908	6	87.5	50	20	3.76	3.26	1.15	0.5	0.41	
	Fluorometer scale changed, x10 to x3.16											
449	140	2030	6	35	25	10	3.9	3.38	1.15	0.52	0.43	
450	140	2100	6	29.2	50	20	3.5	3.04	1.15	0.46	0.38	
451	140	2300	6	31.6	50	20	3.55	3.12	1.14	0.43	0.35	
452	141	100	6	28.3	50	20	2.7	2.47	1.09	0.23	0.19	
453	141	300	6	19	100	20	5.5	4.84	1.14	0.66	0.27	

454	141	500	6	33.3	50	20	4.05	3.56	1.14	0.49	0.40		
455	141	630	6	23.6	50	20	3.71	3.2	1.16	0.51	0.42		
456	141	800	6	13.7	100	20	5.57	4.96	1.12	0.61	0.25		
457	141	1000	20		50	20	4.03	3.49	1.15	0.54	0.44		1st CTD cast
458	141		120		150	10	1.35	1.22	1.11	0.13	0.02		Station 141
459	141		50		100	40	3.53	3.18	1.11	0.35	0.29		
460	141		30		50	20	4.01	3.55	1.13	0.46	0.38		
461	141		20		50	20	3.96	3.53	1.12	0.43	0.35		
462	141		7	~17	50	20	3.91	3.48	1.12	0.43	0.35		
463	141	1222	6	14	50	20	3.9	3.52	1.11	0.38	0.31		
464	141	1406	6	14.1	50	20	3.31	2.99	1.11	0.32	0.26		
465	141	1605	6	20	50	20	4.36	3.97	1.10	0.39	0.32		
466	141	1758	6	30.5	25	20	2.63	2.28	1.15	0.35	0.58		
467	141	2000	6	39.2	25	20	2.45	1.52	1.61	0.93	1.53		
468	141	2102	6	34.7	25	10	5.55	3.45	1.61	2.1	1.73		
469	141	2200	6	31.2	25	10	4.69	3.02	1.55	1.67	1.38		
470	141	2300	6	30.7	25	10	6.29	3.95	1.59	2.34	1.93		
471	142	0	6	38.1	25	20	3.13	2.08	1.50	1.05	1.73		
472	142	100	6	31.8	25	10	6.36	4.07	1.56	2.29	1.89		
473	142	200	6	22.7	50	20	6.01	3.79	1.59	2.22	1.83		
474	142	300	6	24.4	50	20	6.17	3.9	1.58	2.27	1.87		
475	142	400	6	14.6	100	40	4.98	3.3	1.51	1.68	1.38		
476	142	500	6	12.1	100	40	5.34	3.48	1.53	1.86	1.53		
477	142	600	6	12	100	40	6.53	4.21	1.55	2.32	1.91		
478	142	802	6	9.5	150	40	6.75	4.16	1.62	2.59	1.42		
479	142	1000	30		100	40	5.4	3.4	1.59	2	1.65		1st CTD cast
480	142	1000	100		150	40	5.19	3.64	1.43	1.55	0.85		Station 142
481	142	1000	50		150	40	4.91	3.39	1.45	1.52	0.83		
482	142	1000	30		50	40	3.11	1.99	1.56	1.12	1.85		
483	142	1000	20		50	20	6.32	3.96	1.60	2.36	1.94		
484	142	1000	7	11.7	50	40	3.36	2.14	1.57	1.22	2.01		
485	142	1200	6	8	100	40	4.72	2.92	1.62	1.8	1.48		
486	142	1348	6	11	100	80	4.03	2.55	1.58	1.48	2.44		Station 142A
487	142	1511	6	14	50	40	3.11	1.91	1.63	1.2	1.98		Station 142B
488	142	1625	6	19.4	50	40	5.56	3.4	1.64	2.16	3.56		Station 142C
489	142	1729	6	28	25	40	4.01	2.51	1.60	1.5	4.94		Station 142D
490	142												

22 May, 1996. Calibration of fluorometer not completed. All chlorophyll values are correct in relative terms only. Also calibration will differ before and after Montevideo.

(ix) Summary Nutrient & Bacterial Log

Underway samples for nutrients and bacterial numbers. (All times in GMT)																									
Date	Day	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
23.04.96	114	X			X				X				X							X					X
24.04.96	115		X		X				X					X							X				
25.04.96	116	X					X		X		X										X				
29.04.96	120												X				X						X		
30.04.96	121		X				X				X								X				X		
01.5.96	122		X				X				X								X				X		
02.05.96	123		X				X				X								X				X		
03.05.96	124		X				X					X						X				X			
04.05.96	125	X				X				X								X				X			
05.06.96	126	X				X				X								X				X			
06.05.96	127		X				X					X						X				X			
07.05.96	128	X				X				X								X				X			
08.05.96	129	X				X					X						X		X		X				X
09.05.96	130				X				X								X				X				X
10.05.96	131				X				X								X				X				X
11.05.96	132				X				X								X				X				X
12.05.93	133				X				X								X				X				X
13.05.96	134				X				X				X				X				X				X
14.05.96	135				X				X								X				X				X
15.05.96	136				X				X							X				X				X	
16.05.96	137			X				X								X				X				X	
17.05.96	138			X				X								X				X				X	
18.05.96	139			X				X								X				X				X	
19.05.96	140			X				X								X				X				X	
20.05.96	141			X				X							X					X			X		
21.05.96	142		X				X							X		X	X	X							

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(x) Synechococcus Log

AMT-2 Experimental Log Nick Fuller

Day	*Depths taken (m)*	*Samples*	*Analyses*
114	7, 20, 30, 40, 50, 70	1l conc'd to 10ml, -60°C: each depth 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth 50ml, 4°C: each depth 50ml filt'd thro' 0.45µm, 4°C: each depth 50ml preserved, -60°C: 7 & 70m 50ml preserved, 4°C: each depth	*Synechococcus* counts
115	7, 20, 30, 40, 60, 80	1l conc'd to 10ml, -60°C: 7m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth	*Synechococcus* counts
116	7, 20, 40, 60, 80, 100	1l conc'd to 10ml, -60°C: each depth 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth 50ml preserved, -60°C: 7 & 100m	*Synechococcus* counts
120	7, 30, 50, 80, 110	1l conc'd to 10ml, -60°C: 7m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth	*Synechococcus* counts
121	7, 20, 40, 60, 90, 120	1l conc'd to 10ml, -60°C: each depth 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth 50ml, 4°C: each depth 50ml filt'd thro' 0.45µm, 4°C: each depth 50ml preserved, -60°C: 7 & 120m	*Synechococcus* counts
122	7, 20, 40, 60, 80, 100	1l conc'd to 10ml, -60°C: 7m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth	*Synechococcus* counts
123	7, 30, 50, 70, 90, 110	1l conc'd to 10ml, -60°C: each but 110m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth 50ml preserved, -60°C: 7 & 110m	*Synechococcus* counts
124	7, 30, 50, 70, 90, 110	1l conc'd to 10ml, -60°C: 7m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth	*Synechococcus* counts
125	7, 30, 50, 80, 100, 150	1l conc'd to 10ml, -60°C: 7, 50, 80, 100m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth 50ml, 4°C: each depth 50ml filt'd thro' 0.45µm, 4°C: each depth 50ml preserved, -60°C: 7 & 100m	*Synechococcus* counts
126	7, 30, 60, 100, 150, 170	1l conc'd to 10ml, -60°C: 7m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth	*Synechococcus* counts
127	7, 30, 70, 130, 170	1l conc'd to 10ml, -60°C: 7, 30, 70, 130m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth 50ml preserved, -60°C: 7 & 130m	*Synechococcus* counts
128	7, 30, 60, 90, 100, 120	1l conc'd to 10ml, -60°C: 7m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth	*Synechococcus* counts
129	7, 20, 30, 60, 80, 100	1l conc'd to 10ml, -60°C: 7, 30, 60m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth	*Synechococcus* counts

130	7, 20, 40, 70, 80, 120	1l conc'd to 10ml, -60°C: each but 120m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth 50ml, 4°C: each depth 50ml filt'd thro' 0.45μm, 4°C: each depth 50ml preserved, -60°C: each depth 50ml preserved, 4°C: each depth	*Synechococcus* counts
131	7, 20, 40, 60, 80, 100	1l conc'd to 10ml, -60°C: 7m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth	*Synechococcus* counts
132	7, 30, 40, 50, 70, 100	1l conc'd to 10ml, -60°C: each but 100m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth 50ml preserved, -60°C: 7 & 70m	*Synechococcus* counts
133	7, 20, 30, 40, 60, 80	1l conc'd to 10ml, -60°C: 7m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth	*Synechococcus* counts
135	7, 30, 50, 70, 100	1l conc'd to 10ml, -60°C: each depth 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth 50ml, 4°C: each depth 50ml filt'd thro' 0.45μm, 4°C: each depth 50ml preserved, -60°C: 7 & 70m 50ml preserved, 4°C: each depth	*Synechococcus* counts
136	7, 30, 50, 70, 90, 120	1l conc'd to 10ml, -60°C: 7m 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth	*Synechococcus* counts
137	7, 50, 60, 80, 100, 120	1l conc'd to 10ml, -60°C: each depth 1ml preserved, 4°C: each depth 50ml filt'd; membranes at 4°C: each depth 50ml preserved, -60°C: 7 & 120m	*Synechococcus* counts
138			

Purpose of samples:

1l conc'd to 10ml:	molecular analysis of *Synechococcus* viruses
1ml preserved:	total virus counts
50ml filt'd onto membrane:	*Synechococcus* counts
50ml @ 4°C:	isolation of *Synechococcus* strains
50ml filt'd through 0.45μm:	isolation of *Synechococcus* viruses
50ml preserved, @ -60°C:	*Prochlorococcus* counts
50ml preserved, @ 4°C:	visual analysis of viruses

(xi) Phytoplankton & Production Log

APPENDIX: PHYTOPLANKTON AND PRIMARY PRODUCTION LOGSHEET

	Depth	Size Chloro	Size Phot	Calcific	P-I exp	Phyto Taxon La Coruña	Phyto Taxon Plymouth
Stn 1	7	x	x		x	x	x
JD 114	20	x	x			x	
	40	x	x		x	x	
	60	x	x		x	x	x
	90	x	x			x	
Stn 2	7	x	x		x	x	x
JD 115	20	x	x			x	
	30	x	x		x	x	x
	40	x	x			x	
	50	x	x		x	x	
Stn 3	7	x	x		x	x	x
JD 116	30	x	x			x	
	50	x	x		x	x	x
	70	x	x			x	
	100	x	x		x	x	
Stn 4	7	x			x	x	x
JD 120	30	x				x	
	50	x			x	x	
	80	x			x	x	x
	110	x				x	
Stn 5	7	x	x	x	x	x	x
JD 121	30	x	x		x	x	
	50	x	x			x	
	70	x	x	x	x	x	x
	90	x	x			x	
Stn 6	7	x	x	x	x	x	x
JD 122	40	x	x			x	
	60	x	x		x	x	
	90	x	x			x	
	110	x	x	x	x	x	x
	120	x	x			x	
Stn 7	7	x	x	x	x	x	x
JD 123	30	x	x			x	
	50	x	x		x	x	
	80	x	x	x	x	x	x
	100	x	x			x	
Stn 8	7	x	x	x	x	x	x
JD 124	30	x	x			x	
	70	x	x		x	x	
	100	x	x	x	x	x	x
	120	x	x			x	
Stn 9	7	x	x	x	x	x	x
JD 125	50	x	x		x	x	
	80	x	x	x	x	x	x
	100	x	x			x	
	150	x	x			x	
Stn 10	7	x	x	x	x	x	x
JD 126	60	x	x			x	
	100	x	x			x	
	150	x	x	x	x	x	x
	170	x	x			x	
Stn 11	7	x	x	x	x	x	x
JD 127	70	x	x			x	x
	90	x	x			x	
	130	x	x	x	x	x	x

	170	x	x			x	
Stn 12	7	x	x	x	x	x	x
JD 128	70	x	x		x	x	
	100	x	x	x	x	x	x
	100	x	x			x	
	120	x	x			x	
Stn 13	7	x	x	x	x	x	x
JD 129	30	x	x		x	x	
	60	x	x	x	x	x	x
	80	x	x			x	
	100	x	x			x	
Stn 14	7	x	x	x	x	x	x
JD 130	40	x	x		x	x	x
	70	x	x	x	x	x	x
	80	x	x			x	
	120	x	x			x	
Stn 15	7	x	x	x	x	x	x
JD 131	40	x	x		x	x	
	60	x	x	x	x	x	x
	80	x	x			x	
	100	x	x			x	
Stn 16	7	x	x	x	x	x	x
JD 132	30	x	x		x	x	
	50	x	x	x	x	x	x
	70	x	x			x	
	100	x	x			x	
Stn 17	7	x	x	x	x	x	x
JD 133	20	x	x		x	x	
	40	x	x	x	x	x	x
	60	x	x			x	
	80	x	x			x	
Stn 18	7	x	x	x	x	x	x
JD 135	30	x	x		x	x	
	50	x	x			x	
	70	x	x	x	x	x	x
	100	x	x			x	
Stn 19	7	x	x	x	x	x	x
JD 136	50	x	x		x	x	
	70	x	x			x	
	90	x	x	x	x	x	x
	120	x	x			x	
Stn 20	7	x	x	x	x	x	x
JD 137	60	x	x		x	x	
	80	x	x	x	x	x	x
	100	x	x			x	
	120	x	x			x	
Stn 21	7	x	x	x	x	x	x
JD 138	40	x	x		x	x	
	60	x	x	x	x	x	x
	80	x	x			x	
	100	x	x			x	
Stn 22	7	x	x	x	x	x	x
JD139	20	x	x			x	
	40	x	x	x	x	x	x
	50	x	x		x	x	
	80	x	x			x	
Stn 23	7	x	x	x	x	x	x
JD 140	30	x	x		x	x	
	50	x	x	x	x	x	x
	60	x	x			x	

	80	x	x			x	
Stn 24	7	x	x	x	x	x	x
JD 141	20	x	x	x	x	x	x
	30	x	x			x	
	50	x	x		x	x	
	80	x	x			x	
Stn 25	7	x	x	x	x	x	x
JD 142	30	x	x	x	x	x	x
	50	x	x		x	x	
	80	x	x			x	
	100	x	x			x	

(xii) Zooplankton and Particulate Log

Particulate log - size fractionated carbon & nitrogen									
Sample #	Date	Time	Stn. no	Depth	Size fract.	Vol filt	reps	Comments	
7224	23/04/96	1330	114	7	total	500	3		
7225				7	<10	500	3		
7226				7	<5	500	3		
7227				7	<2	500	4	rep has 2 filters	
7228				60	total	250	3		
7229				60	<10	250	3		
7230				60	<5	250	3		
7231				60	<2	250	3		
7240	24/04/96		115	7	total (<200	500	3		
7241				7	<10	500	3		
7242				7	<5	500	3		
7243				7	<2	500	3		
7244				30	total (<200	500	3		
7245				30	<10	500	3		
7246				30	<5	500	3		
7247				30	<2	500	3		
7252	25/04/96		116	7	total (<200	500	3		
7253				7	<10	500	3		
7254				7	<5	500	3		
7255				7	<2	500	3		
7256				50	total (<200	500	3		
7257				50	<10	500	3		
7258				50	<5	500	3		
7259				50	<2	500	3		
7264	29/04/96		120	7	total (<200	500	3		
7265				7	<10	500	3		
7266				7	<5	500	3		
7267				7	<2	500	3		
7268				80	total (<200	500	3		
7269				80	<10	500	3		
7270				80	<5	500	3		
7271				80	<2	500	3		
7276	30/04/96		121	7	total (<200	500	3		
7277				7	<10	500	3		
7278				7	<5	500	3		
7279				7	<2	500	3		
7280				70	total (<200	500	3		
7281				70	<10	500	3		
7282				70	<5	500	3		
7283				70	<2	500	3		
7288	01/05/96		122	7	total (<200	500	3		
7289				7	<10	500	3		
7290				7	<5	500	3		
7291				7	<2	500	3		
7292				110	total (<200	500	3		
7293				110	<10	500	3		
7294				110	<5	500	3		
7295				110	<2	500	3		
7300	02/05/96		123	7	total (<200	500	3		

7301				7	<10	500	3		
7302				7	<5	500	3		
7303				7	<2	500	3		
7304				90	total (<200	500	3		
7305				90	<10	500	3		
7306				90	<5	500	3		
7307				90	<2	500	3		
7308									
7312	03/05/96		124	7	total (<200	500	3		
7313				7	<10	500	3		
7314				7	<5	500	3		
7315				7	<2	500	3		
7316				100	total (<200	500	3		
7317				100	<10	500	3		
7318				100	<5	500	3		
7319				100	<2	500	3		
7320									
7325	04/05/96		125	7	total (<200	500	3		
7326				7	<10	500	3		
7327				7	<5	500	3		
7328				7	<2	500	3		
7329				80	total (<200	500	3		
7330				80	<10	500	3		
7331				80	<5	500	3		
7332				80	<2	500	3		
7337	05/05/96		126	7	total (<200	500	3		
7338				7	<10	500	3		
7339				7	<5	500	3		
7340				7	<2	500	3		
7341				150	total (<200	500	3		
7342				150	<10	500	3		
7343				150	<5	500	3		
7344				150	<2	500	3		
7353	06/05/96		127	7	total (<200	500	3		
7354				7	<10	500	3		
7355				7	<5	500	3		
7356				7	<2	500	3		
7357				130	total (<200	500	3		
7358				130	<10	500	3		
7359				130	<5	500	3		
7360				130	<2	500	3		
7369	07/05/96		128	7	total (<200	500	3		
7370				7	<10	500	3		
7371				7	<5	500	3		
7372				7	<2	500	3		
7373				100	total (<200	500	3		
7374				100	<10	500	3		
7375				100	<5	500	3		
7376				100	<2	500	3		
7385	08/05/96		129	7	total (<200	500	3		
7386				7	<10	500	3		

7387				7	<5	500	3		
7388				7	<2	500	3		
7389				60	total (<200	500	3		
7390				60	<10	500	3		
7391				60	<5	500	3		
7392				60	<2	500	3		
7401	09/05/96		130	7	total (<200	500	3		
7402				7	<10	500	3		
7403				7	<5	500	3		
7404				7	<2	500	3		
7405				70	total (<200	500	3		
7406				70	<10	500	3		
7407				70	<5	500	3		
7408				70	<2	500	3		
7417	10/05/96		131	7	total (<200	500	3		
7418				7	<10	500	3		
7419				7	<5	500	3		
7420				7	<2	500	3		
7421				60	total (<200	500	3		
7422				60	<10	500	3		
7423				60	<5	500	3		
7424				60	<2	500	3		
7433	11/05/96		132	7	total (<200	500	3		
7434				7	<10	500	3		
7435				7	<5	500	3		
7436				7	<2	500	3		
7437				50	total (<200	500	3		
7438				50	<10	500	3		
7439				50	<5	500	3		
7440				50	<2	500	3		
7451	12/05/96		133	7	total (<200	500	3		
7452				7	<10	500	3		
7453				7	<5	500	3		
7454				7	<2	500	3		
7455				40	total (<200	500	3		
7456				40	<10	500	3		
7457				40	<5	500	3		
7458				40	<2	500	3		
7467	14/05/96		135	7	total (<200	500	3		
7468				7	<10	500	3		
7469				7	<5	500	3		
7470				7	<2	500	3		
7471				70	total (<200	500	3		
7472				70	<10	500	3		
7473				70	<5	500	3		
7474				70	<2	500	3		
7475					blank		3		
7480	15/05/96		136	7	total (<200	500	3		
7481				7	<10	500	3		
7482				7	<5	500	3		
7483				7	<2	500	3		

7484				90	total (<200	500	3		
7485				90	<10	500	3		
7486				90	<5	500	3		
7487				90	<2	500	3		
7493	16/05/96		137	7	total (<200	500	3		
7494				7	<10	500	3		
7495				7	<5	500	3		
7496				7	<2	500	3		
7497				80	total (<200	500	3		
7498				80	<10	500	3		
7499				80	<5	500	3		
7500				80	<2	500	3		
7505	17/05/96		138	7	total (<200	500	3		
7506				7	<10	500	3		
7507				7	<5	500	3		
7508				7	<2	500	3		
7509				60	total (<200	500	3		
7510				60	<10	500	3		
7511				60	<5	500	3		
7512				60	<2	500	3		
7517	18/05/96		139	7	total (<200	500	3		
7518				7	<10	500	3		
7519				7	<5	500	3		
7520				7	<2	500	3		
7521				40	total (<200	500	3		
7522				40	<10	500	3		
7523				40	<5	500	3		
7524				40	<2	500	3		
7530	19/05/96		140	7	total (<200	500	3		
7531				7	<10	500	3		
7532				7	<5	500	3		
7533				7	<2	500	3		
7534				50	total (<200	500	3		
7535				50	<10	500	3		
7536				50	<5?	500	3		
7537				50	<2?	500	3		
7538				50	<2	500	3		
7544	20/05/96		141	7	total (<200	500	3		
7545				7	<10	500	3		
7546				7	<5	500	3		
7547				7	<2	500	3		
7549				20	total (<200	500	3		
7550				20	<10	500	3		
7551				20	<5	500	3		
7552				20	<2	500	3		
7548					blk		3		
7557	21/05/96		142	7	total (<200	500	3		
7558				7	<10	500	3		
7559				7	<5	500	3		
7560				7	<2	500	3		
7561				30	total (<200	500	3		
7562				30	<10	500	3		

7563				30	<5	500	3		
7564				30	<2	500	3		
7565					blk		3		
						610 samples			

Zooplankton									
nated carbon & nitrogen									
Sample #	Date	Time	Stn.no	Net	ize Fractio	Split	reps	Comments	
7232	23/04/96	1330	114	WP2-200	200-500	50/500	3		
7233					500-1000	50/500	3		
7234					1000-2000	50/500	3		
7235					>2000	50/500	3		
7236	24/04/96	1330	115	WP2-200	200-500	50/500	3		
7237					500-1000	50/500	3		
7238					1000-2000	50/500	3		
7239					>2000	50/500	3		
7248	25/04/96	?	116	WP2-200	200-500	50/500	3		
7249					500-1000	50/500	3		
7250					1000-2000	50/500	3		
7251					>2000	50/500	3		
7260	29/04/96	?	120	WP2-200	200-500	100/500	3	0µm fraction lost!	
7261					500-1000	100/500	3		
7262					1000-2000	100/500	3		
7272	30/04/96	?	121	WP2-200	200-500	50/500	3		
7273					500-1000	50/500	3		
7274					1000-2000	50/500	3		
7275					>2000	50/500	3		
7284	01/05/96	?	122	WP2-200	200-500	50/500	3		
7285					500-1000	50/500	3		
7286					1000-2000	50/500	3		
7287					>2000	50/500	3		
7296	02/05/96	?	123	WP2-200	200-500	50/500	3		
7297					500-1000	50/500	3		
7298					1000-2000	50/500	3		
7299					>2000	100/500	3		
7308	03/05/96	?	124	WP2-200	200-500	50/500	3		
7309					500-1000	50/500	3		
7310					1000-2000	50/500	3		
7311					>2000	100/500	3		
7320	04/05/96	?	125	WP2-200	200-500	50/500	3		
7321					500-1000	50/500	3		
7322					1000-2000	50/500	3		
7323					>2000	100/500	3		
7333	05/05/96	?	126	WP2-200	200-500	100/500	3	126 day station	
7334					500-1000	100/500	3		
7335					1000-2000	100/500	3		
7336					>2000	100/500	3		
7345	05/05/96	?	126	WP2-200	200-500	50/500	3	126 night station	
7346					500-1000	50/500	3		
7347					1000-2000	50/500	3		
7348					>2000	50/500	3		

7349	06/05/96	?	127	WP2-200	200-500	50/500	3	127 day station
7350					500-1000	50/500	3	
7351					1000-2000	50/500	3	
7352					>2000	100/500	3	
7361	06/05/96	2300	127	WP2-200	200-500	50/500	3	127 night station
7362					500-1000	50/500	3	
7363					1000-2000	50/500	3	
7364					>2000	50/500	3	
7365	07/05/96	?	128	WP2-200	200-500	50/500	3	128 day station
7366					500-1000	50/500	3	
7367					1000-2000	50/500	3	
7368					>2000	100/500	3	
7377	07/05/96	2300	128	WP2-200	200-500	50/500	3	128 night station
7378					500-1000	50/500	3	
7379					1000-2000	50/500	3	
7380					>2000	100/500	3	
7381	08/05/96	?	129	WP2-200	200-500	50/500	3	129 day station
7382					500-1000	50/500	3	
7383					1000-2000	50/500	3	
7384					>2000	100/500	3	
7393	08/05/96	2200	129	WP2-200	200-500	50/500	3	129 night station
7394					500-1000	50/500	3	
7395					1000-2000	50/500	3	fficult to filter: jellies
7396					>2000	50/500	3	
7397	09/05/96	?	130	WP2-200	200-500	50/500	3	130 day station
7398					500-1000	50/500	3	
7399					1000-2000	50/500	3	
7400					>2000	100/500	3	
7409	09/05/96	2200	130	WP2-200	200-500	50/500	3	130 night station
7410					500-1000	50/500	3	
7411					1000-2000	50/500	3	
7412					>2000	50/500	3	
7413	10/05/96	?	131	WP2-200	200-500	50/500	3	131 day station
7414					500-1000	50/500	3	
7415					1000-2000	50/500	3	
7416					>2000	50/500	3	
7425	10/05/96	2200	131	WP2-200	200-500	50/500	3	131 night station
7426					500-1000	50/500	3	
7427					1000-2000	50/500	3	
7428					>2000	50/500	3	
7429	11/05/96		132	WP2-200	500-1000	50/500	3	132 day station
7430					1000-2000	50/500	3	
7431					>2000	50/500	3	
7432					blk		1	blank filter
7442	11/05/96	2200	132	WP2-200	200-500	50/500	3	132 night station
7443					500-1000	50/500	3	
7444					1000-2000	50/500	3	

7445					>2000	50/500	3			
7446					blk		1	blank filter		
7447	12/05/96	?	133	WP2-200	200-500	50/500	3			
7448					500-1000	50/500	3			
7449					1000-2000	50/500	3			
7450					>2000	50/500	3			
7459	14/05/96	0130	135	WP2-200	200-500	50/500	3	135 night station		
7460					500-1000	50/500	3			
7461					1000-2000	50/500	3			
7462					>2000	50/500	3			
7463	14/05/96	1100	135	WP2-200	200-500	50/500	3	135 day station		
7464					500-1000	50/500	3			
7465					1000-2000	50/500	3			
7466					>2000	50/500	3			
7476	15/05/96		136	WP2-200	200-500	50/500	3			
7477					500-1000	50/500	3			
7478					1000-2000	50/500	3			
7479					>2000	50/500	3			
7488	16/05/96		137	WP2-200	200-500	50/500	3			
7489					500-1000	50/500	3			
7490					1000-2000	50/500	3			
7491					>2000	100/500	3			
7501	17/05/96		138	WP2-200	200-500	50/500	3			
7502					500-1000	50/500	3			
7503					1000-2000	50/500	3			
7504					>2000	50/500	3			
7513	18/05/96		139	WP2-200	200-500	50/500	3			
7514					500-1000	50/500	3			
7515					1000-2000	50/500	3			
7516					>2000	50/500	3			
7525	19/05/96		140	WP2-200	200-500	100/500	3			
7526					500-1000	100/500	3			
7527					1000-2000	100/500	3			
7528					>2000	100/500	3			
7529					blk		3			
7539	20/05/96		141	WP2-200	200-500	50/500	3			
7540					500-1000	50/500	3			
7541					1000-2000	50/500	3			
7542					>2000	50/500	3			
7543					blk		3			
7553	21/05/96		142	WP2-200	200-500	50/500	3			
7554					500-1000	50/500	3			
7555					1000-2000	50/500	3			
7556					>2000	50/500	3			