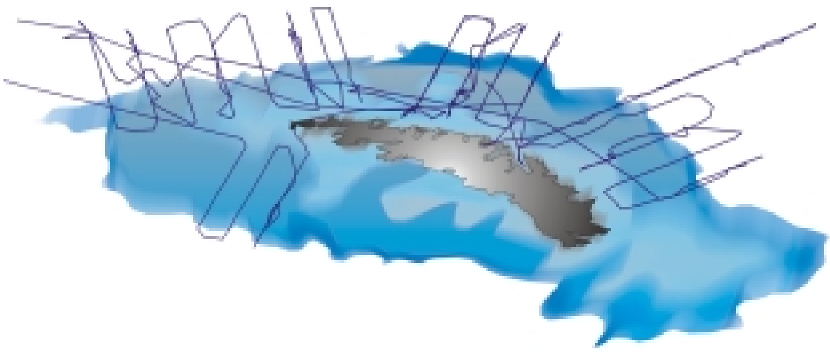
Biosciences Division Cruise Report

JR57-CORE PROGRAMME VI

18th December 2000 - 12th January 2001



British Antarctic Survey

NATURAL ENVIRONMENT RESEARCH COUNCIL

Introduction

Welcome to the cruise report for Biosciences Cruise JR57 carried out around South Georgia during December 2000-January 2001.

Cruises acquire and generate huge amounts of data which are generally worked up by individuals and groups, and which becomes available post cruise over varying time-scales, generally in the form of papers and data reports. However there are also large amounts of metadata surrounding such acquisitions and these have their own utility, particularly with regard to describing how, where and when the primary data were collected, manipulated and stored Our decision to locate this report on the local web has been prompted by the importance we attach to the nature of such metadata and the need to ensure that they can be easily accessed. We are undertaking a long-term study of the variability in the marine ecosystem surrounding South Georgia and the various ways in which we go about this should be reflected in the way we report on our activities.

The structure of this report is consistent with that of the normal 'hard copy' report and following a statement about cruise objectives and a narrative summary, reflects the activities undertaken by the different groups. Where preliminary findings are apparent these are summarised, although in many cases data need to be evaluated in the context of previous cruises before conclusions can be drawn. Numerous summary tables are provided both in the text of individual reports and as separate appendices. The event-log (a primary source of information linking all cruise elements together in space and time) is also appended although it is anticipated that this will also be mounted on the O drive MLSD directory.

During the course of a cruise most people make recommendations of various sorts for improving some aspect of their science or working conditions. These are pitched at various levels, the simplest almost acting as an *aide memoire* for the individual concerned, whereas others may have significance for the ship-using community at large.
In the past bringing these recommendations to the attention of the relevant people has generally been problematic. They have often been tucked away in reports without being clearly directed at any one individual. No one in particular has felt it their responsibility to take them forward and many have simply not been acted upon or pursued.
To try and improve on this we have drawn them together along with information on the intended recipient and whether they have still to be actioned. If they do then the onus is on the individual/chief scientist for landing them in the appropriate court. Clearly should some issues need a wider forum they will be taken forward to the BAS wide ship-users committee

Peter Ward
Nathan Cunningham

Recommendations

Nutrient Chemistry

The Millipore Super-Q water purifier along with its integral UV lamp functioned very well throughout the cruise, but will probably require servicing when next in the UK. Towards the end of the cruise water resistivity was falling below 18 MΩ cm, and the 0.22 μm final filters on the hand dispensers were discoloured (presumably from traces of mixed-bed deionisers ?).
Action: MJW Inform Chief Engineer

Each year the nutrient chemists autoanalyser produces significant quantities of chemical waste. This is routinely fed into hazardous waste drums and returned to UK for disposal. Various size drums are supplied the most convenient being the small squat (25l?) with side handles. These are far easier to manipulate, manoeuvre and store in the chemical lockers than the alternative larger blue drums.
Action: MJW inform John Shears.

The deck covering in the chemistry laboratory is beginning to lift.
Action: Chief Officer informed at end of cruise.

Acoustics

Removal of the EK500 transducers to fit the multibeam sonar and sub-bottom profiler took place during summer 2000. Other alterations also took place including cable re-routing and replacing the fluid in the transducer space. We were unable to calibrate the system before the beginning of the field season and so, despite reassurances that the system "appeared to be working", we had to sail in the unenviable situation of not being entirely sure that the system would be fully operational (possible loss of quadrants etc). Thankfully the system did function well but If future ship alterations impinge upon the EK500 system then it is imperative that sufficient time be allocated to fully calibrate the system before science cruises that will depend for their success on a fully functional system.
Action: Technical services

Oceanographic Equipment

1) The Niskins should be carefully examined and the causes of the leaks traced. Any worn O-rings should be replaced. Any cracked or poorly manufactured bottles should be replaced. The closing and sealing mechanisms should be given special attention.

2) The 8400B salinometer should be exchanged for the new one being purchased by BAS as soon as practicable, and returned to Ocean Scientific for servicing. Particular attention should be given to tracing the cause of the unstable conductivity readings.

3) The peristaltic pump on the 8400B should be overhauled, and if necessary replaced. Since the pump forms a conduit for samples into the salinometer, it should always be kept as clean and well maintained as possible, otherwise the integrity of the final measurements will inevitably

suffer.

4) Two new crates of salinity bottles should be purchased.

Navigation

The possibility of re-siting the Seatex Ashtech antennae should be investigated, including consultation with Simrad and Dr. Brian King (SOC). Should this not be feasible, the possibility of feeding the Ashtech ADU-2 data into the Seatex processing system rather than its own Ashtech data should be investigated, since it appears that the ADU-2 performs substantially better.

Oceanlogger replacement

There is one very serious problem with the BAS oceanlogger, namely a lag (of unknown source) between the response of the temperature and conductivity cells in the thermosalinograph. Since calculating salinity requires *both* these measurements (not just conductivity), during periods of changing water properties, derived salinity shows very large and completely spurious spikes. On consulting previous cruise reports, it became apparent that this problem was first reported as long ago as 1995 (the WOCE section A23). Presumably it has been present for as long as the oceanlogger has been in existence. On WOCE A23, a lagged filter was used to attempt to compensate for this problem. More recently (BAS MLS cruises), various filters were tried, but these were all long, and led to averaging over as much as 4 minutes. We observe that the length of filter being used recently is much longer than that used during WOCE A23, suggesting that the problem is getting worse with time. Rather than “treating the symptoms not the disease”, by producing progressively longer filters (each of which would smooth out more and more of the genuine oceanographic variations of surface properties), it must surely be time to tackle the problem at source.

A second problem encountered on JR57 was the malfunction of the PAR and TIR sensors towards the end of the cruise. Data are not available for this period.

Solving the problem with the oceanlogger is long overdue. It is over 5 years since the problem was first identified, and progress has apparently not been made. The thermosalinograph system should be intensively studied until the cause is found. If the cause cannot be traced, the system should be replaced with a more reliable one.
Action: Mike Meredith to discuss with Technical Services

Cruise personnel

On this cruise we were fast approaching the minimum number of people required to undertake the planned programme satisfactorily. The number of scientific and technical personnel participating in the cruise was 20 of which 3 were working on BAS casual labour contracts and 2 were from SOC and largely concerned with the technical aspects of TUBA. Whilst the cruise went well and all work was accomplished, the lack of 24hr cover in key areas meant a number of people were routinely putting in considerably more than the 12 hour shifts on which they were

rostered, particularly during intensive phases such as the 3 day occupation of the long transect in the ECB. On future cruises the lack of cover for the phytoplankton biologist and the nutrient chemist will mean that we may/ will not be able to work round the clock in these areas.
Action: This issue has been brought to the attention of programme and project leaders**.**

Gear Shipment

Being in the field most years entails ordering and packing gear well in advance of the sailing date. The return of the ship in UK spring leaves little time for gear servicing and refurbishment before the process starts again. This year the return of JCR in June, a month later than normal, exacerbated this problem to the extent that our 2 containers are to be shipped home onboard Shackleton.
Action: Future Cruise Leaders

At the cruise planning stage we should identify the time-scales that gear will be away from UK, what needs to be returned and when. There may well be costs involved in trying to get gear back in good time (commercial freighting cost currently around £1.5K per container.) that needs to be explored with ALD.

TUBA

External factors and conflicting commitments delayed the building of the new TUBA, (joint AFI project with SOC) and in order to get the instrument ready for this cruise, it was necessary to work on it in the laboratory until the last moment. The Gear was shipped from SOC on the 4th of December using a commercial freighting company and was to arrive in Stanley via Florida and Santiago within 7 days. Our worst fears were realised, however, when news arrived that our consignment had not made the flight from Santiago to Stanley in time for the ship sailing, and so discussions about the best course of action were taken up with the PSO, Captain, and colleagues at both SOC and BAS.
Action: The lessons learned from the TUBA saga are quite clear insofar as last minute commercial airfreight is not a foolproof way of getting gear to and from the Falklands.

Data Management

To integrate the SCS system into an underway data management system and subsequently store the ASCII files the PESTO data structure. With this implementation, it will allow easier access by the ships' scientific personal to the underway data.
Action: Discuss with Technical Services

Cruise Objectives (Peter Ward)

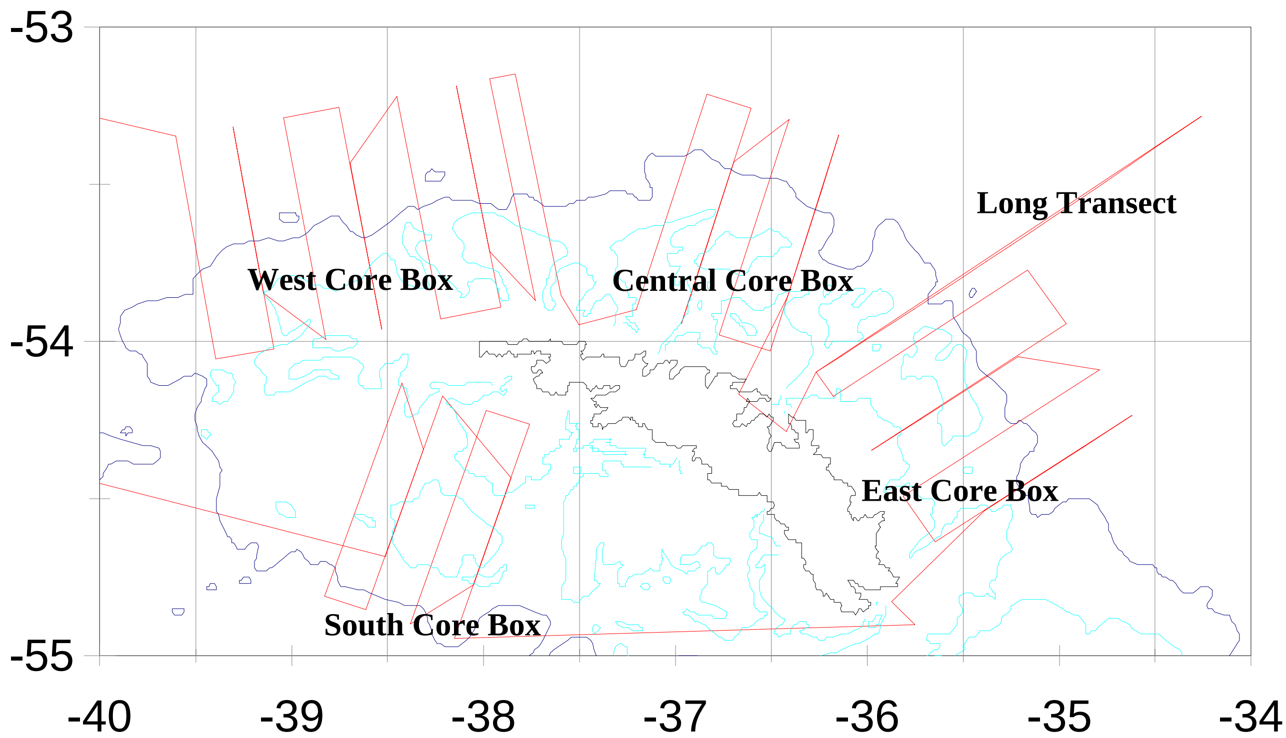
Cruise JR57 was the first in a series of cruises scheduled to be carried out annually for the Variability in the Southern Ocean Project (VSOE) which forms part of the OED (Ocean Ecosystem Dynamics) Programme. In many respects it represents a continuation of the philosophy of the old “Core Programme” under Q2 and is concerned with monitoring interannual oceanographic and biological variation in the region of South Georgia and ultimately to understand its causes.

Translated into a scientific programme the project is concerned with acoustically surveying a number of transect pairs (each transect 80 km long and orientated at right angles to the shelf) grouped into 3 ‘core boxes’ along the north coast of South Georgia and a further one to the south (Fig 1). The transect pairs are run during the hours of daylight at 10kts and data obtained by the Simrad EK500 scientific echo-sounder (3 transducers operating at 38, 120 and 200 KhZ respectively) are used to calculate mean volume backscattering strength (MVBS) and hence to estimate zooplankton (mainly krill) biomass. Running the transects during the hours of daylight means that the vast majority of planktonic scatterers are below the level of the ship’s hull mounted transducers compared with at night when an unknown proportion rise up into the near surface waters above the level of the downwards looking transducer. The Undulating Oceanographic Recorder (UOR) is towed behind the ship whilst the ship is transecting, programmed to undulate between near surface and ~ 150 m (shallower when over the shelf) with a periodicity of 60 sec. Sensors mounted on the undulator include a CTD, transmissometer, fluorometer, PAR and seaWIFS (6 downwelling, 4upwelling) and an OPC (optical plankton counter). These provides real time data which are, with the exception of the OPC (which logs to its own PC), logged to the SCS.

At night stations are worked 20 km in from each end of the second of each transect pair when a CTD deployment provides information on water temperature conductivity and fluorescence. A rosette sampler equipped with 10-l capacity water bottles provides water from standard depths for chlorophyll determination and nutrient chemistry. Mesozooplankton are sampled with a paired bongo net equipped with nets of 100 μm and 200 μm mesh which is deployed in the top 200 m. Macroplankton and nekton are sampled with a Rectangular Midwater Trawl (RMT) deployed to fish from near surface to 200 m and a surface neuston sledge.

Additionally for this series of cruises, a 160 km long transect, running out from near the mouth of Cumberland Bay to the NE, has been instated to locate the position of the Southern Antarctic Circumpolar Current Front (SACCF) in relation to South Georgia. The SACCF is presently thought to be very influential in transporting krill from the region of the Antarctic Peninsula across the Scotia Sea towards South Georgia. Its proximity or otherwise to the island may have profound effects on the amount of krill locally available for dependant predators. This transect thus provides us with the opportunity to study variation in its physical and biological characteristics and assess its influence on local ecosystem dynamics.

Figure 1: Cruise Track



An investigation of the diet of the mackerel ice-fish (*Champsocephalus gumnnari*) in relation to the distribution of its principal copepod prey (*Drepanopus forcipatus*) was also undertaken at a series of near-shore stations. At periods throughout the cruise the multi-net and the down-wire net monitor (DWNM) were deck tested and worked on until finally the unit was operational and was satisfactorily water tested in the afternoon of the 7th Jan on completion of the central transect pairs. This was a necessary expenditure of time, as the gear was needed to be fully operational for the AFI TUBA project, which in part had been allocated some time on the succeeding cruise (JR58).

Under ideal circumstances the transect pairs are run in order from West to East against the prevailing water currents with an echosounder calibration taking place on the Stromness buoy after completion of the central box. This year this was not possible because of bad weather which we encountered at the start of the western box and again during an attempt to run the central transect pairs. To minimise time losses to the programme we opted to undertake some of the nearshore sampling and the echosounder calibration at the start whilst awaiting improvements in the weather. When this duly occurred we first worked the eastern box before relocating to the western start point and running the western and central transect pairs in their planned order. After night-time station work at C2.2N and C2.2S the vessel moved to the southern box passing through Stewart Strait just after breakfast on the 8th Jan. Because of our late arrival at the transect start point we were only able to run one of the transect pair (S1.2) during daylight. This was followed by the two night-time stations and then a relocation to waypoint S2.1. We commenced transect pair S2.1 and S2.2 in the early hours of the 9th Jan and upon completion the vessel departed for Stanley.

Arrival time at the survey area at South Georgia was at 1430hrs 20th Dec 2000 and departure at 1200hrs 9th Jan 2001, a total of 20 days.

Cruise JR57 Narrative. (Peter Ward)

11th Dec

The advance scientific party departed BAS HQ at 1700 hrs for Brize Norton and the flight to Mount Pleasant. An uneventful journey saw us arriving at FIPASS at 1630 hrs on the 12th.

13th Dec

Mobilisation started at 0830 hrs when the SOC container was swung off the afterdeck and the BAS containers were brought onboard. The SOC group were to remain onboard until their departure later in the week. BAS gear was taken down into the scientific hold and located in the laboratories. Second of the two containers swung onboard and unloaded after lunch.

A letter drafted to John Hall about the TUBA freight and the possibilities of finding extra time on the Autosub cruise if it doesn't arrive on Saturday's Lan Chile flight in time to meet our departure date.

14th Dec

Mobilisation continued throughout the day. News filtered through that the second scientific party was going to be delayed. Their expected arrival time is unknown at present. Cruise tracks copied to Captain and second officer.

15th Dec

Setting up gear continued and most major items are now in place. Meetings with various groups and individuals to sort out scientific requirements, logging arrangements and watches etc.

16th Dec

Second group arrived at ship at 0500 hrs after a 14 hr stopover in Ascension. Sufficient time for most to do some sightseeing including trips up Green Mountain.

Our worst fears realized when TUBA gear failed to arrive on the incoming flight. Meeting with principals in evening to discuss situation. Decided that Nick Crisp and Andy Harris should remain onboard for JR57 to undertake some of the necessary software writing and that I would contact John Hall with a view to trying to get some extra time on JR58 to undertake the work. It is just not sensible with the present hiatus regarding flights to and from the Falklands for them to return to the UK. Net result is that Jon Watkins, Nick Crisp, Andy Harris and Rachel Woodd-Walker will have to spend another month at sea.

17th Dec

Shore leave ends today at 1600 hrs and we sail at 1700 hrs. awaiting further freight from RAF flight. This too failed to materialize. It has been said many times before over the years, but why do we put up with such a shoddy service from the RAF? In terms of cruise planning, equipment and personnel changes it makes a mockery of the planning process.

Depart FIPASS 1700 hrs and get away only to return to Port William a couple of hours later to medivac seaman Dale, who having broken his nose whilst in Stanley, has given cause for medical concern. Back out to sea at 2000hrs heading for 53o S and then travel due east to W1.1N. XBT transecting starts. Weather rather windy. A quiet evening for most.

18th Dec
Overnight weather deteriorates and a strong S Westerly blowing. Gear testing scheduled for 0900hrs deferred. By midday SW 8 with a rough sea. Large depression seen some days earlier in the Bellingshausen Sea now moving east. Course changes made during the day to make the track more comfortable. XBT transect suffers periodic interruptions due to water on afterdeck. General tiredness and queasiness amongst scientific personnel. Weather shows signs of moderating by evening.

19th Dec
Weather moderated overnight and XBTs recommenced at 0400hrs. Shakedown station at 0900hrs when CTD, Bongo nets, Neuston sledge and UOR tested. One or two modifications required to some items of gear but generally successful. Continue on passage ETA W1.1N now 0900hrs tomorrow.

20th Dec
Weather took a turn for the worse overnight. XBT'ing stopped once again and ships speed reduced to 7-8 kts. Arrive at waypoint at 1430 hrs local. Hove-to with a view to starting transecting tomorrow morning if weather good enough.

21st Dec
0500 hrs ship onto heading but conditions still too rough. Still blowing a force 7 and acoustics pointless. Head towards South Georgia across the swell to seek shelter and to test the RMT and then a night of fishing inshore. Decide to leave western box until later in the cruise and make a start on central box tomorrow, weather permitting. Successful net testing and fishing overnight. Early acoustic indications are that there is quite a lot of krill around.

22nd Dec
Much better weather and transect pair C1.1 and C1.2 started on time from inshore end. Target fishing in the afternoon on diffuse layers which turned out to be small euphausiids and copepods. Stations worked satisfactorily at night.

23rd Dec
Weather has taken a turn for the worse again. UOR deployed at 0520 hrs as we commence transect pair C2.1 and C2.2. from the offshore end. Communication lost with UOR halfway down the transect. Slow ship to recover in deteriorating conditions and in turning rolls badly (36^{o}). Chaos!. Enough of this. Turn and head for East Cumberland Bay arriving just after 0900 hrs. Spend night fishing for larval fish and zooplankton and then head off to Stromness for echo-sounder calibration.

24th Dec
Still too lumpy outside so decision to undertake calibration earlier than planned is vindicated. Tie up at buoy 0700 hrs and calibration commences after breakfast with a CTD deployment. Calibration spheres in place quickly and operation starts in earnest.

Boats ashore running ashore from 0900 hrs. Most people took opportunity to stretch their legs. Lots of snow on the island and the sea temperatures have commonly been around 0-1oC which is quite chilly for this time of year. Fault found in the termination of the UOR which would explain the loss in communication a couple of days ago. Calibration concluded successfully around 2200 hrs.

25th Dec
A beautiful South Georgia morning. Boat ashore for yesterdays calibrators around 0900 hrs. People recovering from the celebrations of Xmas eve. Splendid lunch served and a good turnout. Crew entertained pre-lunch in officers and scientists lounge. Many people relaxing for rest of day although watch patterns still adhered to by the majority. The cruise ship *Hanseatic* anchors for an hour or so in the afternoon disgorging tourists ashore by the boatload.

26th Dec
Depart buoy 0700 hrs enroute for E1.1S. Grey lowering morning on the buoy and raining but out past Cape Saunders the sun starts to shine. UOR in water at 0930 hrs but recovered at 1000 hrs because it can't seem to dive below 30 m. Loose bolt on wing fixed and redeployed. Progress down the transect arriving at E1.1N at around 1830 hrs. Over 50 km of scattering layers seen in the middle part of the transect which offers the prospect of target fishing tomorrow. Station work commences on way back at 10 km intervals with bongo nets and near bottom CTDs.

27th Dec
For once the weather is about right with the overnight force 6 having moderated to a 4. Trundled through the day in variable conditions; sometimes bright sunshine, sometimes fog. Zooplankton catches rather poor in upper third of transect and much effort required in sorting. SST generally $<1^{o}C$.

Target fishing in late afternoon at scattering layers resulted in generally small krill (year class1) which is a good result.

28th Dec
Cracking on with the transect and had started station E1.1.40 by 2230 hrs. Back towards the shelf and rich catches of phytoplankton start to appear in the nets. Extends for several stations from around E1.1.80-E1.1.50.

29th Dec
Transect completed successfully at around 1200 hrs. Hydraulics problem on midships gantry

held us up for around an hour and thick fog overnight meant we slowed down, nonetheless the whole exercise completed in a shade over 3 days. Weather once again deteriorating as we move into East Cumberland Bay for more deck testing of the multi-net and a final night of larval fish netting. Multi-net somewhat temperamental at the moment so deck cleared at 1900 hrs to allow RMT to be swung into place in preparation for tonight's fishing. Strange and beautiful evening light; sun rays, thick fog, occasional views of high peaks and thick mank at sea level.

30th Dec
Move from the bay to the start of E2.1 at 0400 hrs. Wind force 7-8 inshore and several large bergs occupying the start position. On track and undulator deployed. Complete transect pair around 1430 hrs. Wind still force 7 and a rough sea. Moderated sufficiently later in afternoon to allow target fishing on some strong marks which resulted a successful catch of krill. Both stations completed overnight.

31st Dec
Late start to E3.1 because of overnight fog. Undulator deployed but comms lost again further down the transect. Redeployed at transect head but lost comms again almost immediately. Recovered and proceeded without it. Move onto station work in the evening. Thick phytoplankton 'gloop' found at E3.2N. Ocean logger fell over today which is most unusual. Turned out to be a date time problem!

Data and plots for E1.1 are beginning to appear. Physics indicates the SACCF located at station E1.1 60 and again at around E1.1.140. Meander a veritable desert as far as meso-zooplankton is concerned although acoustics indicates most of scatterers (mainly krill) are located within the meander. Fast jets associated with station E1.1.60 are locus for high phytoplankton bloom (6-7 $\mu g\ l^{-1}$) and egg production activity by major biomass copepod species. Production of all sorts much less over inner shelf. Zooplankton samples also taken for C;N analysis.

1st Jan 2001
Ships bell on the focsle head rung in the new year at midnight. Witnessed by a hardy group of revellers. Sky just beginning to lighten at midnight. Finish station work and Eastern Core Box is completed. We then head across the 170 miles separating us from the Western Core Box start point at W1.1N. Breezy day up on the monkey island as South Georgia slips by, the lower and middle slopes clear of cloud. UOR successfully back in the water at around 1300 hrs and recovered at 1400 hrs. Target fishing in the afternoon produced some great hauls on virtually monospecific layers of *Thysanöessa* sp., a small species of euphausiid. Time allows further fishing through the evening and night. Dense targets seen in early evening subject of much speculation as to their identity. Turned out to be large krill (plenty of gravid females and adult males) and not myctophid fish which seemed to be a popular each-way bet.

2nd Jan
Onto transect W1.1 at 0500 hrs. Breezy day with visibility coming and going in the sudden snow squalls. Blowing a good force 6 for most of the day but calmed down somewhat by evening.

Particularly fine evening light. Transects completed and stations worked without problems. Target fishing in the afternoon produced more small euphausiids. Discussion amongst principals about what we do with any remaining time at the end of this box. Consensus is that we re-run the central box rather than move south. More SeaWIFS images in from EJM. Unfortunately December weekly composites not very clear doubtless reflecting poor weather and increased cloud cover relative to October and November.

3rd Jan
Sunny morning with a rolling swell. Transects W2.1 and W2.2 proceed in a very tranquil manner. Afternoon spent trialing multinet. Towed at around 15-20 m depth with Osprey camera pointing back towards the cod-end. Nets opened and closed as they should until the fifth and final one which opened as it should and then closed too quickly. High current persisted in Deck Unit indicating motor still running. Mechanical glitch responsible which burnt out a relay in the net monitor. Monitor patched up for RMT hauls in evening.

Message to all soliciting cruise report contributions. Stations work completed as normal.

4th Jan
Despite a benign weather forecast we are heading down W3.1 in a pretty stiff westerly this morning. Beam sea which is making us lurch around a bit. Acoustics not brilliant. Lower parts of Willis and Bird islands visible in the mank. Weather moderated by afternoon and target fished another dense swarm of *Thysanöessa* sp. Discuss options for activities at the end of this box and for remainder of programme.

5th Jan
Start W4.1 and W4.2 in thick fog with lots of loose ice about but sea reasonably calm. Finished on time and successfully fished the LHPR in the afternoon targetting a diffuse layer that turned out to be *Themisto*. In the evening South Georgia sliding by in broken sunshine and a force5/6. Found sheltered water along from the Bay of Isles and used the evening bongo netting and RMT fishing for zooplankton/fish larvae

Forecast indicates that we should be set fair for the next few days.
Lots of plots now appearing from the long transect E1.1 stimulating much discussion about sources of krill at different ends of the island.

6th Jan
Sparkling morning as we start transect C1.1 around 0500 hrs in the morning. South Georgia still clearly visible out on the transect head some 100 km distant. First clear views of Mt Paget this season. Acoustics indicates that first time we ran this transect early in the trip, krill biomass was around 16 g m^{-2} wet mass and is now over 70! Target fishing at inshore end of C1.2S. Three hauls in quick succession targeted on strong scatterers which proved to be krill as predicted. Stations worked as normal overnight.

7th Jan

Grey morning with South Georgia just visible from the outer end of C2.1. Transects run as normal. Multi-net water tested in afternoon. Operated successfully and then target fished on small euphausiids and krill. Stations worked as normal overnight.

8th Jan

Enroute to the southern box and S1.2 in the early hours. A very rare sort of morning; glassy calm and bright sunshine as vessel steams along the north coast. Most people out with cameras on monkey island and focusle head. Through Stewart Strait just after breakfast and onto the transect by 1000 hrs. Completed this second of the original transect pair and target fished in the afternoon. Repositioned stations worked overnight.

9th Jan

Earlier than usual start to transect pair S2.1 and S2.2 at 0315 hrs. Completed by 12 15 hrs and then break off and head for Stanley. XBT s to be deployed on passage.

10th Jan

Variable speed made throughout the day as persistent fog and head seas affect progress. Packing gear continues. Cruise dinner in the evening.

11th Jan

Windy day. Ship making 14 knots in early part of the day to make ETA at Cape Pembroke 0800 hrs tomorrow. Returning gear manifested.

12th Jan

Very short steep swell as we approach the Falklands. Winds gusting to 50 kts. Inside and tied up at western end of FIPASS at 0900 hrs. Demobilisation commenced 1030 hrs and complete by early afternoon.

13th Jan

Returning scientific party departed ship at 1830 hrs for Mount Pleasant.

Phytoplankton biomass (Rebecca Korb & Olga Crighton)

Objectives

To provide routine measurements of phytoplankton biomass based on chlorophyll*a* concentration, in samples from the scientific pumped seawater supply and from CTD casts. These discrete samples will be used to develop calibration procedures for *in situ* measurements of chlorophyll fluorescence.

Introduction

The measurement of chlorophyll *a* as a proxy for phytoplankton biomass has been one of a suite of parameters measured as part of the core programmes examining interannual variability around the waters of South Georgia. As on previous cruises, chlorophyll was measured *in vivo* on the scientific pumped seawater supply using a Turner through-flow fluorometer and Nν-shuttle undulator equipped with a Chelsea Instruments fluorometer. Underway sensors were calibrated using extracted chlorophyll from near surface, hourly water samples. This year, the CTD was fitted with a new instrument (Chelsea Instruments Aquatracker) and fluorescence of this sensor was calibrated against discrete samples from water bottle profiles.

Methods

Measurement of in vivo fluorescence on the ship's pumped seawater supply

A Turner Designs Model 10 through-flow fluorometer is connected to the ship's scientific pumped seawater supply in series with, and downstream from, a Sea Bird Electronics thermosalinograph and a Litre/Meter flowmeter. The fluorometer, thermosalinograph and flowmeter data are logged at 5-second intervals to a dedicated microcomputer using Lab Windows software, and thence to the ship's data acquisition system.

The intake for the seawater supply is in the bottom of the ship's hull; at a nominal depth of 6 m. Discrete samples for calibration were taken from the outflow from the fluorometer. When the ship was on passage between and during transect legs in the core boxes, samples were taken at approximately hourly intervals. On stations, sampling was taken to coincide with the recovery of the CTD-rosette to provide an additional depth in the water column, chlorophyll profile.

Practical problems: At times, there appeared to be a Y2K problem with the Ocean logger recording underway *in vivo* fluorescence, resulting in a few periods where the fluorescence trace was flat.

In situ measurements of in vivo chlorophyll fluorescence

In vivo chlorophyll fluorescence was measured using Chelsea Instruments flash lamp fluorometers deployed in the Nν-shuttle undulator and with a Chelsea Instruments Aquatracker on the CTD.

Measurements of extractable particulate chlorophyll

Samples for whole-community chlorophyll were filtered under moderate vacuum onto Whatman GF/F glass-fibre filters. Samples were then extracted in 10 ml of 90% acetone in the dark at approx. 4°C for 24 hours. Fluorescence was measured using a bench top fluorometer, before and after acidification of the extract with dilute hydrochloric acid.

The bench top fluorometer was calibrated against a standard prepared from chlorophyll *a* extracted from the cyanobacterium *Anacystis nidulans* (Sigma Chemicals). The standard solution will be calibrated using a spectrophotometer. Data were entered to a specially designed QuattroPro spreadsheet during the cruise.

Preliminary results

Eastern Core Box, Long Transect

At the northern end of this transect, phytoplankton biomass was low, with values generally below 1.0mg m^{-3} (Figure 2). A moderate bloom, of up to 6.7 mg m^{-3} appeared to be associated with the Southern Antarctic Circumpolar Current Front (SACCF). The position of this bloom coincided with steeply sloping temperature contours near 53.7°S as well as high current velocities in this area. Vertical mixing of the water column in this area resulted in high phytoplankton biomass extending down to almost 100 m, a depth likely to be well below the euphotic zone. On-shelf stations (i.e. less than 250 m depths) showed a reduction in biomass - around 3 - 4mg m^{-3} - the majority of which was found in the upper 40m of the water column.

Core Boxes, CTD stations

Distinct spatial variability of biomass was found between the core boxes (Figure 3). Phytoplankton blooms were observed at a number of stations: all of the southern box, off-shelf in the eastern box and at the western-most, on-shelf station of the western box (W1.2 S). The highest recorded levels of biomass reached values of 12-15 mg Chl *a* m^{-3}. At all other stations, phytoplankton biomass was low, falling to 0.5- 4 mg m^{-3}.

Underway measurements

Chlorophyll *a* estimates from the pumped seawater supply supported the CTD data, Phytoplankton biomass was greatest in the southern box, off-shelf in the eastern box and at the western-most, on-shelf station. Plots of chlorophyll against latitude and longitude (Figure 4) further demonstrated the presence of elevated biomass associated with the Southern Antarctic Circumpolar Current Front. Furthermore, this data demonstrated the occurrence of a bloom over a wide area of the southern to western side of South Georgia. However, continuous fluorescent measurements, from the Turner through flow fluorometer, suggested that this elevated biomass was extremely variable over short distances and appeared to be correlated with temperature. These relationships will be further examined at Cambridge, where the underway data sets will be fully calibrated against the discrete samples.

Figure 2: JR57, Chl. a, Long transect

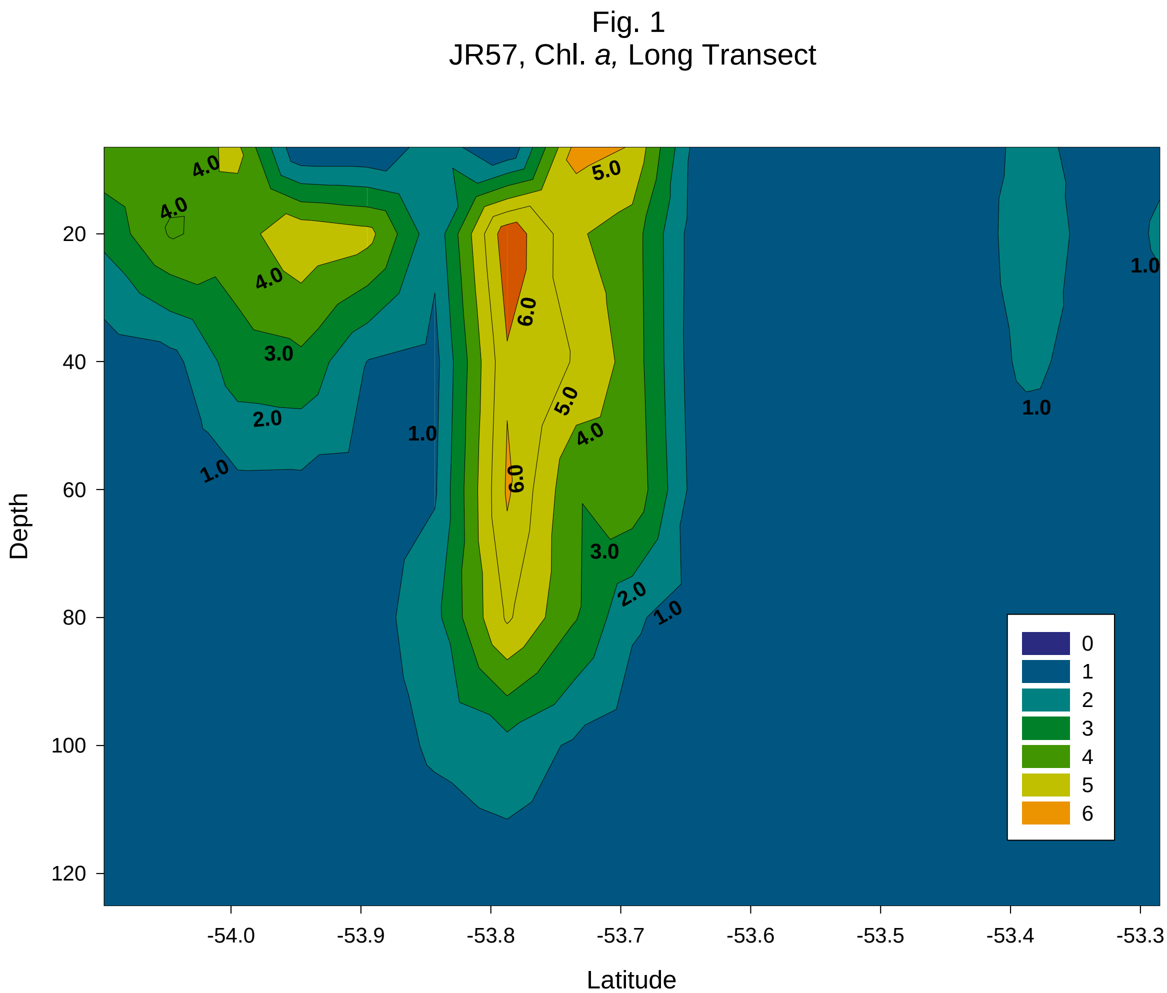
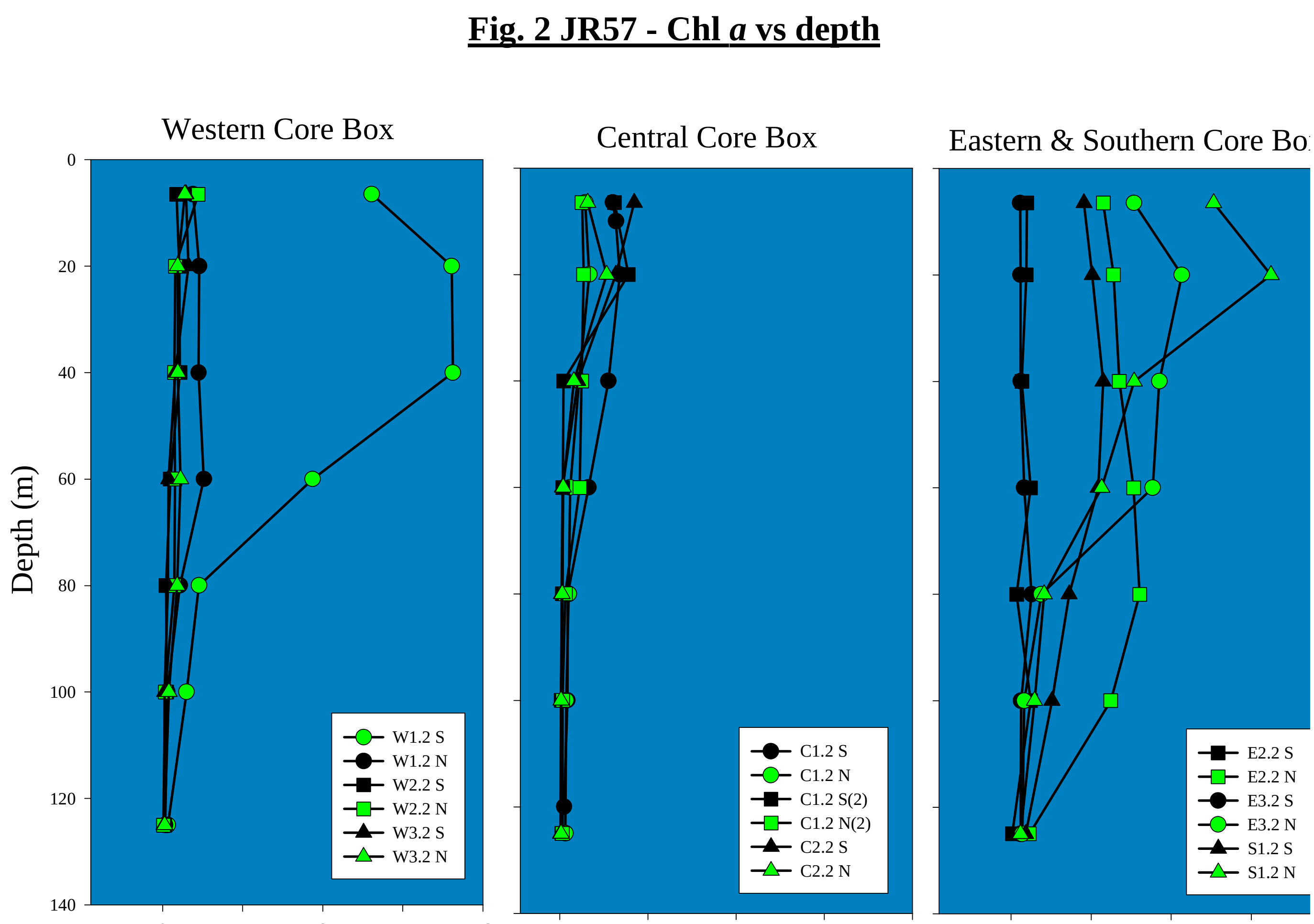


Figure 3: JR57, Chl. a vs. Depth



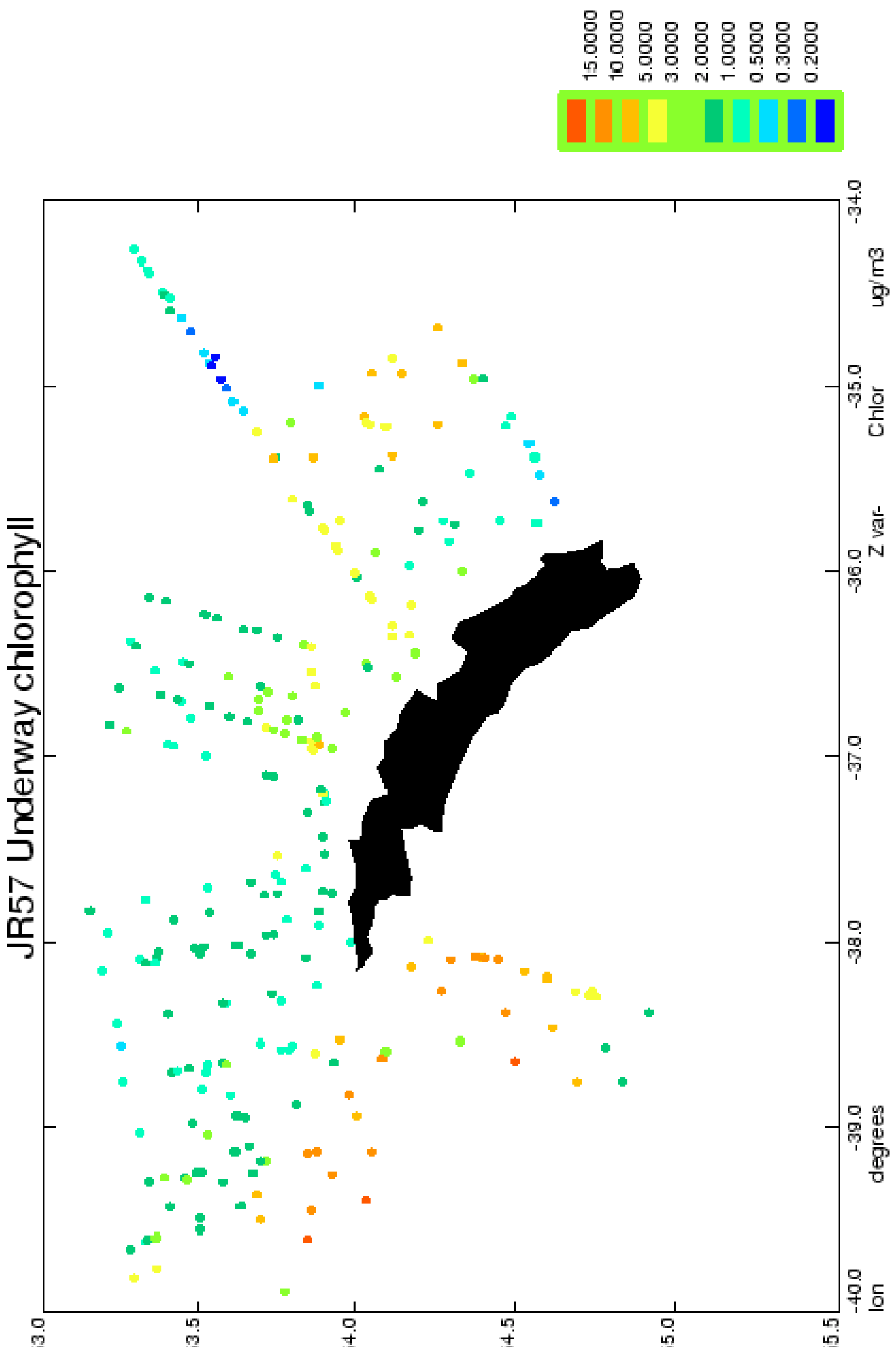


Figure 4: JR57, Chl. a vs. Depth

Nutrient Chemistry (Mick Whitehouse)

Introduction

During the Core Programmes nutrient concentrations are monitored in conjunction with chlorophyll *a* and physical oceanography measurements to address a variety of questions concerning the South Georgia system. By measuring the extent of intra- and inter-cruise variability in the Core Survey Boxes and along the “Northeast section” we aim to -

1. Relate nutrient loss from, and remineralization within the surface mixed layer, to primary and secondary production.
2. Document and investigate the marked contrast in primary production frequently found between specific areas within the South Georgia system.
3. Resolve what mechanisms promote the high phytoplankton abundance frequently found in deep oceanic waters “downstream” to the north of the island.
4. Investigate the potential impact of the Southern Antarctic Circumpolar Current Front on phytoplankton productivity at South Georgia.
1. Set the Core Programme measurements in the context of long-term records of environmental variability at South Georgia.

Methods

Discrete sample collection

Water bottle samples for nutrient analysis were collected from all CTD casts along the “Northeast section” (events 069, 072, 075, 078, 081, 085, 088, 091, 094, 097, 101, 104, 107, 111, 113, 116, 119), in the Eastern Core Box (events 135, 143, 152, 161), the Central Core Box (first visit events 043, 051; second visit events 228, 237, 243, 252), the Western Core Box (events 171, 177, 185, 194, 199, 208), and in the Southern Core Box (events 257, 266). Full details of CTD events are detailed elsewhere in this report (Meredith & ....), but water bottle samples were nominally collected at 20, 40, 60, 80, 100, 125, 150 and 200 m, plus a further four depths between 200 m and the bottom of the cast. In addition, a near-surface sample was taken for nutrient analysis from the ship’s non-toxic seawater supply (inlet at ~6-7 m).

Continuous monitoring

During underway survey transects within the Core Boxes, and during passage through Stewart Strait, the ships non-toxic seawater supply was continuously monitored for nutrient levels, and the results were recorded once every ten seconds using a *National Instruments* data acquisition package.

Sample preparation, analysis, and other pertinent details

Discrete and continuously collected water samples were filtered through a mixed ester membrane (Whatman WME, pore size 0.45 μm). The filtrate was analysed colorimetrically for dissolved nitrate+nitrite (NO_3+NO_2-N), nitrite (NO_2-N), ammonium (NH_4-N), silicate ($Si(OH)_4$-Si) and phosphate (PO_4-P) using a Technicon segmented flow analyser (see Whitehouse 1997 for full analytical details). Calibrations were made against spiked “low nutrient seawater”, kindly collected in the tropics by Malcolm Woodward during an AMT cruise. Hull-to-laboratory time lags in the pumped non-toxic seawater supply (essential information for integrating chemistry with other hydrographic data and geographical position), were estimated on a previous cruise by Simon Wright.

Initial observations

Full data analysis will be undertaken on our return to the UK and deposited in the Biosciences database. However, some initial observations of the measurements are given below, although concentrations given below should be regarded as approximate.

Although lower than winter levels measured previously, nutrient concentrations were relatively high throughout. When considered in conjunction with low chlorophyll concentrations and cool surface temperatures, it would appear that nutrients had been under-utilised at this stage in the season compared with previous surveys made at a similar time of the year.

Northeast Section

Physical oceanography measurements indicated that this section crossed the westerly inflexion of the Southern Antarctic Circumpolar Current Front (SACCF), and further north, its return to an easterly flow. Within the frontal jets nutrient concentrations were high (surface silicate, nitrate, and phosphate >35, 25, 2.0 mmol m^{-3} respectively). Deep water silicate concentrations were particularly high (>125 mmol m^{-3}). Concentrations at the northern-most end of the section were a little lower. However, at the southern expression of the SACCF surface nutrient depletion was evident coincident with elevated chlorophyll *a* concentrations. At stations 6, 7, 8 silicate, nitrate, and phosphate concentrations were approximately 12, 20, 1.5 mmol m^{-3} respectively, in contrast to higher levels to the south on the island shelf.

Eastern Core Box

Nutrient concentrations here were high. Certainly much higher than in the relatively warm conditions found in this area during cruise JR38. However, two patterns of interest are obvious; onshelf concentrations are higher than those offshelf, and there appeared to be surface accumulations of ammonium at some stations on the island shelf.

Western Core Box

Although nutrient concentrations were generally high within this Core Box, more variability was evident, between on- and offshelf stations and from east to west. Nitrate levels were not greatly reduced from winter conditions at >20 mmol m^{-3}, while phosphate concentrations were ~1.5-1.8 mmol m^{-3} as compared with 1.0-1.2 mmol m^{-3} measured during more typical summer surveys such as JR17. Silicate concentrations were >20 mmol m^{-3} at some stations. In previous seasons silicate depletion to <1.0 mmol m^{-3} has been measured within this box. Surface ammonium levels were also variable. However, as with the Eastern Core Box, there appeared to be surface accumulations of ammonium at some stations.

Central Core Box

As with the other survey areas nutrient concentrations here were high during both the initial visit (when the survey was aborted), and again two weeks later when the full survey was run. Near-surface silicate levels remained within the 20-25 mmol m^{-3}, whereas nitrate and phosphate concentrations were consistently >22 and 1.8- 2.0 mmol m^{-3} respectively.

Stewart Strait and the Southern Core Box

As was found during a previous cruise (JR28), ammonium concentrations were higher within Stewart Strait than in the surrounding waters (~1-1.5 mmol m^{-3} on this occasion, a little lower than previously reported). Other nutrients remained high during the passage through the Strait. At the offshore station of the Southern Core Box, the first evidence of major nutrient drawdown was found. Coincident with phytoplankton concentrations of ~10 mg m^{-3}, near-surface silicate levels were about 2 mmol m^{-3}, while nitrate and phosphate levels were <20 and <1.5 mmol m^{-3} respectively. Furthermore, pycnocline ammonium concentrations were high (> 1.5 mmol m^{-3}), and surface mixed-layer nitrite levels were elevated (>0.3 mmol m^{-3}). A similar pattern was evident at the inshore station

Instruments and logistics

The Millipore Super-Q water purifier along with its integral UV lamp functioned very well throughout the cruise, but will probably require servicing when next in the UK. Towards the end of the cruise water resistivity was falling below 18 MΩ cm, and the 0.22 μm final filters on the hand dispensers were discoloured (presumably from traces of mixed-bed deionisers ?).

The autoanalyser produced enough effluent to fill 9 waste drums. If there was a choice, I find the squat drums far more convenient to handle. Following some concerns as to the unknown hazards associated with handling this mixed autoanalyser effluent, tests were made this season to assess whether phenol fumes may present a problem. Extensive tests with a portable dräger gas detection pump were made when and wherever phenol fumes might present a hazard e.g. during reagent preparation, in the vicinity of stored reagents, during the decanting of chemical effluents. No trace of phenol was detected at all (full results to be documented elsewhere). The deck covering in the chemistry laboratory is beginning to lift.

Finally, having the cool stow and hazardous chemicals readily available to us in the scientific area, and having sufficient stowage space in the scientific hold, speeded up our mobilisation considerably and is much appreciated.

References

Whitehouse, M. J. (1997) *Automated seawater nutrient chemistry*. British Antarctic Survey, Cambridge, 14 pp.

Zooplankton Research (Peter Ward, Rachael Shreeve & Juliette Butcher)

Water temperatures were generally cold this year and the nature of the copepod populations; low abundance and in the main dominated by over-wintered stages, concurs with findings from previous core programs where we have experienced similar low water temperatures.

Plankton samples have been taken in accordance with other core programme cruises.
Two vertical bongo hauls have been taken from 200 - 0 m at all CTD stations, bathymetry permitting. The first haul is sorted for individuals for dry mass, carbon mass, C:N determinations and females for egg production experiments. The second haul is preserved intact in 4% formaldehyde in sea water; these will be used to study the zooplankton abundance and population stage frequency back in the UK.

Moulting rate experiments were not carried out routinely this year as we have found from previous core program data that stage duration's do not differ significantly with other environmental parameters, and it is the mass of the individuals that differ most, we have therefore concentrated on these latter measurement.

Dry and carbon mass and C:N determinations

The dominant species and stages of copepod in the plankton this year was *Calanoides acutus* stage CIV, CV. Where their abundance allowed, 60 CIV (6 groups of 10) and 30 CV (6 groups of 5 individuals) were placed in pre-weighed tin foil capsules. These were dried on ship at 60^{o}C for later analysis in the UK.

Egg production experiments

Female *Rhincalanus gigas* and *Calanoides acutus* were sorted from the hauls and incubated in 3 groups of 10, (where numbers allowed) at ambient sea-surface water temperature (2^{0}C) for 24 hours. At the end of the experiment the number of eggs that the females had spawned were counted and retained in incubations to determine egg viability in conjunction with a project co-ordinated by Xabier Irigoien (SOC). The eggs were again held at ambient sea surface water temperatures and monitored until all eggs had either hatched or looked unviable. Egg hatching success will be analysed in relation to the concentration of diatoms to see if high concentrations affect viability.

Zooplankton C:N Ratio Freezing Experiment

An experiment was also set up to see what effect the storage of zooplankton at -80 ^{o}C has on the C:N ratio. Two hundred and ten individuals of CV *Calanoides acutus* were taken from one station. These were preserved in 6 aliquots, each containing 30 individuals, preserved in 15 groups of 2. One of these samples was dried immediately after sorting, another was dried after one day of storage at -80^{o}C and the others will be dried at 2 weeks, 6 months, 1 year and 18 months intervals. These samples will then be analysed in the elemental analyser for their C:N content and compared to see if there is any change in the composition with the length of time that they are stored at -80^{o}C.

Bongo Nets

In addition to the core box station work we have also collected bongo net samples from closer inshore to look at the population of *Drepanopus focipatus*, a key prey item in the diet of the ice fish *Champsochephalus gunnari*. Two sites were each visited twice, they were in Cumberland Bay East and just off Cape Buller. At each site five stations at 1.25 mile intervals along a transect have been sampled with the bongo net. Individuals were sorted from the haul for carbon, dry and lipid mass determinations of the older stages, lipid class of the older stages, moulting rate and egg production studies. The residue of the hauls were preserved in 4% formaldyhye in sea water and will be used to look at various aspects of the population of *Drepanopus forcipatus* including it's patchiness and population stage frequency. For determining the moulting rates of the copepods, 16 aliquots were taken after thoroughly but gently mixing the haul. Four of these were preserved immediately, the remainder were each placed into 1.5 l jars of filtered sea water and incubated, six aliquots were incubated for 24 hours and the remaining six for 48 hours. After this time interval they were preserved in 4% formaldehyde in sea water to analyse back in the UK. Egg production of *D. forcipatus* was studied by holding individuals in 20 ml glass vials for 5 days. *D. forcipatus* brood their eggs, so the experiment was designed to look both at the number of eggs each female produces, and also the time it takes the eggs to hatch.

Preliminary Results

Females from the first of these experiments layed no viable eggs, so the experiment was repeated but adding males in half the vials with females in to see if mating was required before each spawning event to produce viable eggs. Other species of antarctic copepod that have been studies to date have stored sufficient sperm from one mating early in the season to produce a number of clutches of viable eggs. This work has been carried out in conjunction with sampling for the larvae of the ice fish *Champsochephalus gunnari*. This work was carried out in an attempt to link the condition of the ice fish larvae with it's main prey items and environmental parameters, and it's subsequent recruitment into the fishery.

The bongo net has seen the addition of two new pieces of equipment this year, they are a flow meter and a temperature and pressure probe.

The flow meter has not functioned as it should, it frequently registered negative values, and it's use was discontinued after a few deployments. We assume that this failure is due to the fact that is was designed to be continuously towed, and not to be lowered vertically to a certain depth and then hauled as in the case of the bongo net. The temperature probe has however functioned very well, giving very accurate detailed temperature profiles from the exact water mass that the zooplankton are taken form. This has been particularly useful at the close inshore stations we have sampled for the copepod *Drepanopus forcipatus*, where there would otherwise have been no such environmental data.

As in previous core program cruises we have continued to take a sample of water from the 20 meter water bottle from the CTD at each station. One sub-sample was preserved in lugols iodine, for the identification and enumeration of phytoplankton species, these samples are stored in darkened bottles in the constant temperature room. Another sub-sample was filtered onto 0.7 μm pre-ashed filter to look at the C:N ratio and estimate the mass of particulate organic carbon (POC). These filters are stored in the -80^{o}C freezer.

Acoustic report (Andrew Brierley, Jon Watkins, Rachel Woodd-Walker)

Pre-season changes

The installation of the multibeam sonar and sub-bottom profiler during summer 2000 had several potential ramifications for underway bioacoustic observations from RRS *James Clark Ross*. First, the hull mounted EK500 transducers were removed during installation of the transducers for the new systems and the fluid within the EK500 transducer spaces was changed: this could have had an effect on system calibration. Second, a new cable linking the 200 kHz transducer to the UIC room had been installed and this could also potentially have altered system performance (albeit for the better). Third, the EK500 itself had to be moved when the UIC/darkroom dividing wall was removed. Because of resulting necessary cable re-routing, this too may have had an effect on system performance. The EK500 system box is now rack-mounted and the monitor is fixed to the bench top above. We were unable to calibrate the system before the beginning of the field season and so, despite reassurances that the system "appeared to be working", we had to sail in the unenviable situation of not being entirely sure that the system would be fully operational (possible loss of quadrants etc). If future ship alterations impinge upon the EK500 system then it is imperative that sufficient time be allocated to fully calibrate the system before science cruises that will depend for their success on a fully functional system.

System configuration

The new rack mounting of the EK500, and the alteration of bench layout in the "acoustic corner" of the UIC room has presented the opportunity for a more permanent logging set up: two new Pentium PCs (WS_1 and WS_2) have been installed on/under the benching adjacent to the EK500 monitor and are connected to the EK500 by a dedicated LAN. This has overcome the need to broadcast EK500 telegrams around the main LAN. Finally a custom-designed rack holding the new printers has been installed. The EK500 operating area is now greatly improved and mobilization/ demobilization times will in future be much reduced. We note our thanks to ETS/ITS for facilitating these changes.

Noise

System noise, especially at 200 kHz, continues to present problems. Observations by Vsevelod Afanasyev during the early season survey suggested that the rising bands of noise at 200 Hz were not internally generated, as had been a possibility, but are picked up by the transducer cables somewhere along their routing. It is difficult to see how this can be overcome other than by locating the echosounder systems box physically closer to the transducers. Perhaps the replacement of the EK500 (with the EK60) may present an opportunity for this to be achieved. Alternatively, bringing the towfish into commission may offer an alternative approach.

Data logging

EK500 and WS_1 and WS_2 clocks were set manually with reference to the ship's master clock each morning.

Acoustic data were logged exclusively to PC using Echolog_EK (version 2.00.21). Data were logged to EK500 Workstation 1 (EK500_WS_1, IP address 129.177.031.009, Internal IP port 2863, Ethernet address 00-01-02-a3-3d-27). The /Ethernet Com Menu settings needed to achieve this are given in Appendix 1. Data acquisition rate was between 1.8 and 1.9 KB/s. Since the data were not being logged simultaneously to bsumlsb (unix) there was no need to configure the IP or ethernet addresses for global broadcast as has previously been the case. EK500 settings were downloaded daily using Echoconfig_EK (version 2.01.07, listening for EK500_WS_1 IP port 2863, writing to EK500 IP port 2000) to, for example, D:\sonardata\settings dumps\January7_2001.txt and compared to a master setting using the *diff* command under Cygwin (could also use *fc* under dos) in order to check for setting changes (as always this procedure would fail to detect a change in sound speed).

While Workstation 1 was dedicated to logging/EK500 control, data were viewed live and post processed on Workstation 2 using Echoview (version 2.00.106). The D: directory on WS_1 was shared as G: on WS_2 to facilitate live viewing. Echolog_EK and Echoconfig_EK were installed on EK500_WS_2 so that in the event of a crash on EK500_WS_1 logging could be swapped to WS_2 quickly and data loss would be minimal. In this event the remote IP and ethernet addresses in the EK500 would have to be changed to those of WS_2 (IP address 129.177.031.010, Ethernet address 00-01-02-14-53-d6).

External trigger

The EK500 is now triggered over one of its serial ports by the Simrad Synchronization Unit (SSU). This unit (located in the multibeam processing area) is designed to ensure that the various acoustic instruments on the ship (EA500, EK500, Multibeam, Topas) can operate together without interference. The configuration of the SSU is however far from straightforward and we were unable to make the multibeam operate without interfering with the EK500. As a matter of urgency a set of clear notes outlining SSU configuration should be provided. Simrad have been contacted in this respect but, so far, no response has been received.

GPS

GPS data are now rebroadcast to the EK500 (over the serial port) from the SCS.

Data handling

Each morning .ek5 files from the previous day were copied to a day specific directory on D:/Log Data on EK500_WS_1 and also to D:\jr57\ek5 on EK500_WS_2. Once sufficient data had been accumulated (approx. 3 or 4 days) two duplicate CDs of these data were burnt. We encountered some difficulties writing CDs at the beginning of the cruise, which seemed to be due to the fact that the C: drive on the writing machine (EK500_WS_1) was almost full - there has to be some free space on C: in order for the CD writing software to be able to buffer the data it is writing.

Calibration Narrative - December 24 2000

The ship was anchored and moored to the buoy off Stromness by 08:00, December 24 2000. A CTD cast was made to determine temperature, salinity and sound speed profiles. The 60 mm copper sphere was deployed first and, once a snag on the port forward line had been cleared (by lowering a shackle down the line) the sphere became visible in the EK500 TS window at a depth of approx. 30 m. The sound speed was consequently set to 1456 m s^{-1} (the mean of values between 6 and 30 m - see Table 1).

Table 1: Data from CTD cast

Pressure	Depth	Temperature	Salinity	Sound Velocity
db	**m**	**°C**	**psu**	**m s^{-1}**
7.000	6.934	2.023	33.686	1456.585
9.000	8.915	2.019	33.688	1456.603
11.000	10.896	1.989	33.697	1456.517
13.000	12.877	1.935	33.718	1456.338
15.000	14.859	1.844	33.744	1456.008
17.000	16.840	1.818	33.753	1455.934
19.000	18.821	1.816	33.754	1455.963
21.000	20.802	1.809	33.757	1455.966
23.000	22.783	1.775	33.768	1455.865
25.000	24.764	1.740	33.778	1455.755
27.000	26.745	1.723	33.783	1455.717
29.000	28.726	1.710	33.787	1455.698
		Mean 1.850	**33.743**	**1456.079**

The 38 kHz TS gain was adjusted with reference to the mean TS value from on axis (sorted in QuattroPro) single target detection's exported from Echoview 2 (live view T1 single target detections, draw a box around the sphere trace, right click to “export selection” and choose “detection's”). The Sv gain was adjusted with reference to s_A values obtained by Echoview integration's of sphere echoes (NASC in Echoview parlance). This process was repeated with the 120 and 200 kHz Cu spheres (on-axis 200 kHz pings were obtained by aligning on time with 120 kHz pings that were 0° alongships and -1.4° athwartships (starboard)). Lobe was run with Cu spheres for 38 and 120 kHz. Repeat calibrations of all frequencies were carried out with the WC sphere.

In addition to determining correct gains in a cyclical, iterative manner, all gain / TS (or s_A) values were plotted after the fact and the best fit gain value for the theoretical TS or s_A was determined by regression. Gain values from these two approaches, and from Lobe for the 38 and 120 kHz transducers, are given in Table 2. We opted to use the mean of the iterative and regressed gain values obtained for the WC sphere for 2 reasons 1) the WC spheres were used for the calibration last season, and the values we obtained here were close to those values, 2) at 38 kHz the Cu sphere suggested a large difference between calibrated Sv and TS gains. Such a difference is not consistent with previous findings and, despite much checking, we were left uncertain as to the validity of this result. The 38 kHz Sv and TS gains were much closer with the WC sphere.

Table 2: Summary of gain values obtained using the various spheres and calculation methods. (Values opted for are in bold).

	Cu iterative	Cu regression	Cu Lobe	WC iterative	WC regression	Mean Cu	Mean WC	Mean All
38 TS	25.93	25.92	25.97	25.33	25.33	25.94	**25.33**	25.70
38 Sv	24.74	24.75		25.60	25.57	24.75	**25.59**	25.17
120 TS	20.70	20.73	20.89	20.33	20.31	20.77	**20.32**	20.59
120 Sv	20.91	20.90		20.43	20.20	20.91	**20.32**	20.61
200 TS	23.78	23.83		22.73	22.75	23.81	**22.74**	23.27
200 Sv	23.88	23.87		22.71	22.71	23.88	**22.71**	23.29

After calibration, all EK500 settings were returned to the pre-calibration values. Thus, when processing, all data from the 2000/01 season, the following corrections should be made (Table 3).

Table 3: EK500 Settings

Frequency, kHz	**Gain**	**Logging, dB**	**Calibration, dB**
38	Sv	25.49	25.59
	TS	25.60	25.33
120	Sv	20.26	20.32
	TS	20.26	20.32
200	Sv	22.78	22.71
	TS	23.07	22.74

Preliminary estimates of krill density

Mean krill lengths, and associated target strengths at 120 kHz are given in Table 4.

Table 4: Krill lengths and target strengths

Survey box	**mean length, mm**	**TS, dB kg^{-1}**
west early	46.6	-38.55
west main	45.7	-38.59
central	35.8	-38.89
east	32.3	-39.02
south	41.3	-38.71

Mean along-transect krill densities, determined using the above TS values and 120 kHz data remaining after a ΔMVBS 120 kHz - 38 kHz filter of 2 to 12 dB (implemented in Echoview) are shown in Table 5.

Table 5: Transect lengths and krill densities

Box	Transect	Date	Length	Density
West	W11	02 Jan	80.798	43.81
West	W12	02 Jan	80.411	31.85
West	W21	03 Jan	80.695	100.69
West	W22	03 Jan	81.257	27.81
West	W31	04 Jan	74.041	37.61
West	W32	04 Jan	79.429	7.33
West	W41	05 Jan	80.604	23.13
West	W42	05 Jan	81.386	5.66
Central	C11	06 Jan	80.405	72.83
Central	C12	06 Jan	80.364	54.52
Central	C21	07 Jan	80.108	48.36
Central	C22	07 Jan	80.460	13.10
East	E1 (long)	26 Dec	163.081	80.025
East	E1 (inner 80 km)	26 Dec	79.994	82.63
East	E21	30 Dec	83.277	206.98
East	E22	30 Dec	74.605	7.32
East	E31	31 Dec	80.490	32.22
East	E32	31 Dec	82.464	63.59
South	S12	08 Jan	80.778	72.44
South	S21	09 Jan	80.346	19.80
South	S22	09 Jan	80.658	4.73

Weighted mean krill densities and variances (after Jolly and Hampton) are given for each box in Table 6 along with biomass values (density scaled by area).

Table 6: Mean krill densities, variances and area biomasses

Box	Dimensions, km	Mean Density, g m^{-2}	Variance	Biomass, tonnes
West	133.33 x 80	3.46	5.17	36,936
West	133.33 x 80	34.72	113.47	370,427
Central	66.66 x 80	47.20	156.61	251,684
East	88.33 x 80	80.41	1227.96	568,197
South	66.66 x 80	32.10	422.64	171,184

Core Box Net Sampling (Tony North & Jon Watkins)

Two distinct types of net sampling were carried out during JR57; station sampling and target fishing.

Station sampling

A total of 16 Core Box stations were sampled using an RMT8 net haul in conjunction with two neuston net samples.

The RMT8 was fished as a double oblique, near surface (<10 m) to 250 m (or within 10 m of bottom if depth <250 m) and 250 m to near surface. Each net was fished for a nominal 30 minutes. Net was 4.5 mm mesh and 8 m^2 area. All deployments successful with generally no problems.

The Neuston sledge net fishes on the surface (<1 m) and has a mouth1 m wide and 0.4 m deep, it normally fishes at a maximum depth of about 0.3 m and so the effective mouth area is ~ 0.3 m^2. The mesh is usually 2.5 mm but when this net was damaged, until it was repaired, a 4.5 mm mesh was used for Events 139 to Event 155. This net was normally fished as two sequential neuston net deployments immediately after the launch of the RMT8. Each Neuston net fished for at least 10 minutes. Soft mesh cod-ends were always used, although a closed cod-end bucket is available - this was not trialed. All deployments were generally successful, although in marginal conditions when a twist got into the towing warp the sledge was towed briefly on one runner and the net was torn. Sometimes fish larvae hang up in the net and stick to it, and then turn up (stiff) in the cod-end several hauls later.

The Neuston sledge net is a definite improvement on the Foredeck net (2.5 mm mesh, 1 m^2) used during recent previous cruises. The Neuston net stays at the surface whereas the Foredeck net may fish anywhere in the upper 3 m. Furthermore the Neuston seems to catch at least as many fish, squid and krill, as the Foredeck Net, indicating it is probably relatively efficient - the Neuston sledge has only one third the mouth area of the Foredeck net.

Target fishing

Each day after the acoustic transects were finished there was a period of several hours which was utilized for fishing targets that had been detected with the EK500 scientific echo-sounder. The RMT8 net was usually used for this task although tows were also completed with the MNET and LHPR. Depths and fishing times for all target fishing deployments were determined solely by the depth of the targets.

The positions of all net hauls taken during the cruise can be seen in Figure 5.

Copepod/Larval Fish transects.

At 3 locations over 4 night, (off Cape Buller, off Cape Wilson and twice in Cumberland East Bay). A 5 n.mile transect was sampled for copepods and fish larvae. This comprised 5 Bongo net stations at 1.25 n.mile intervals and then two sequential RMT8 (each with 2 Neuston nets) deployments, each of 2 RMT nets, each net fished for 30 mins at 0-100 or 100-0 m depth.

Sample Sorting Analysis Protocol

Core Box Stations

The total catch volume of all net catches was recorded. From each RMT8 deployment of two nets the first net was analyzed and the second net (or sub-sample) was preserved in 10% formalin solution (see Appendix 1 below). Similarly, the catch of the first Neuston net (of each pair) was analyzed and the zooplankton from the second neuston was preserved. Generally, fish were removed from all samples, where possible, and analyzed. Generally, the krill, or a sub-sample of krill was removed from all samples, the volume determined, and length (anterior of eye to tip of telson), sex and maturity stage recorded (JL Watkins). A few samples of krill were preserved in 95% pure ethanol, 5% pure water for genetic studies.

General analysis of RMT8 and Neuston net samples. After total volume, the major components were removed and their volume determined. The major taxa from the total sample, or from a known volume of sub-sample, were then counted. Notes were made of other minor taxa. Fish were identified, measured (standard length) and the volume of individuals ≥1 ml was evaluated. Most fish larvae were preserved in ethanol for genetic studies.

Samples of the dominant fish species by mass (lanternfishes) and a sample of krill were preserved frozen at −20°C for Richard Phillips for studies of stable isotopes to determine predator diets. Apparently, the freezer temperature rose to −2°C on one occasion.

Recommend some mechanism is installed to give warning of rise in freezer temperatures to make it unlikely that the −20°C freezer can get warmer than −12°C before an engineer is called to fix it. Otherwise there seems to be the likelihood of valuable samples being ruined.

Target net hauls

A similar protocol for target nets was carried out, however, in this case samples (or subsamples) from all net hauls were preserved in formalin for future reference in Cambridge.

Fish

Samples taken at Core Box transects were from RMT8 and Neuston net hauls along the north and south end of the grids. Similar samples were also taken at three locations nearshore. The latter were during one night off Cape Buller, two separate nights in Cumberland East Bay, and one night off Cape Wilson. Nearshore sampling was to investigate the diet of larval Mackerel Icefish, *Champsocephalus gunnari*, in relation to the abundance of their main prey, the copepod *Drepanopus forcipatus*. Fish were removed from all nets. The fish were identified, counted and measured (standard length). Larval fish shrink soon after capture, and all larvae or a random sample of between 25 and 30 larvae of each species were measured as soon as possible; the remaining larvae were counted. The volume of each fish species or volume of individual fish (if > 5 ml) were estimated from most samples, except for a few RMT8 Net 2 samples from the Core Box that were preserved entire.

Fish from Neuston net samples included, in order of abundance, larval *Gobionotothen gibberifrons*, fingerling *Notothenia rossii*, *Notothenia coriiceps* and larval *Champsocephalus gunnari*. Many of these were preserved in ethanol (95 to 90 % Analar with pure water) for potential genetic work on fish stocks. The RMT8 nets contained a few of these fish larvae, and lanternfishes (Myctophidae) and deep water smelt (Bathylagidae). The lanternfish and smelt comprised a significant portion of the total macroplankton/nekton biomass. These species, in order of abundance were, *Gymnoscopelus opisthopterus*, *Electrona antarctica*, *Bathylagus gracilis, Protomyctophum bolini, Gymnoscopelus fraseri, Krefftichthys anderssoni* and a few other species. Some myctophids were frozen for Richard Phillips for work on stable isotopes to explore the diet of bird and seals.

Krill

The length, sex and maturity stage of more than 3600 krill (total length 135927 mm) was determined during the cruise. A wide range of different sizes of krill were found this season. There were significant numbers of juvenile year 1+ krill found at the eastern end of the island. In the west and south west core boxes large krill (50-60 mm) were found but there was little sign of the juvenile krill in the size range 25-30 mm. The general distribution of the size classes can be seen in Figure 6.

Squid

Squid were also caught in the RMT8 net and neuston net, they were preserved in ethanol (as above).

Figure 5: Net sampling sites on JR57; △- target net hauls, ▽- station net hauls, event numbers are shown to right of net hauls

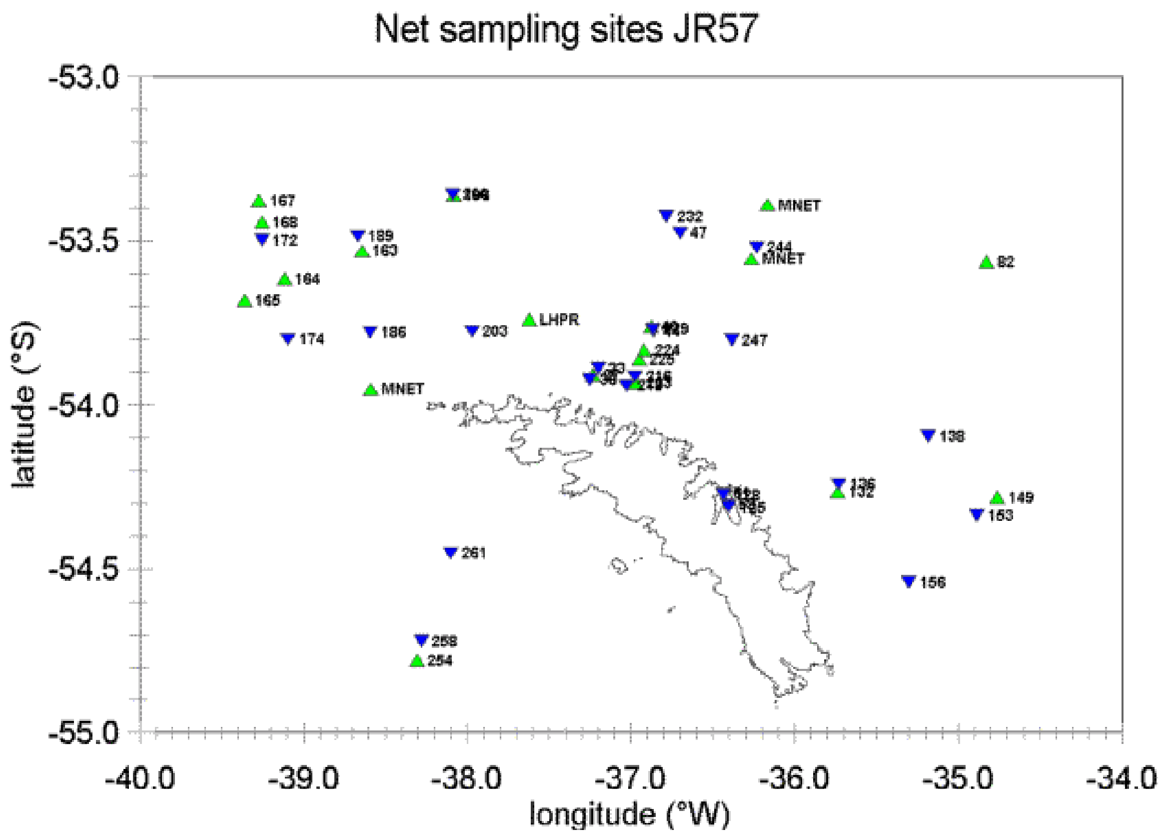


Figure 1: Net sampling sites on JR57; △- target net hauls, ▽- station net hauls, event numbers are shown to right of net hauls

Figure 6: Krill length frequency within the 4 main core boxes

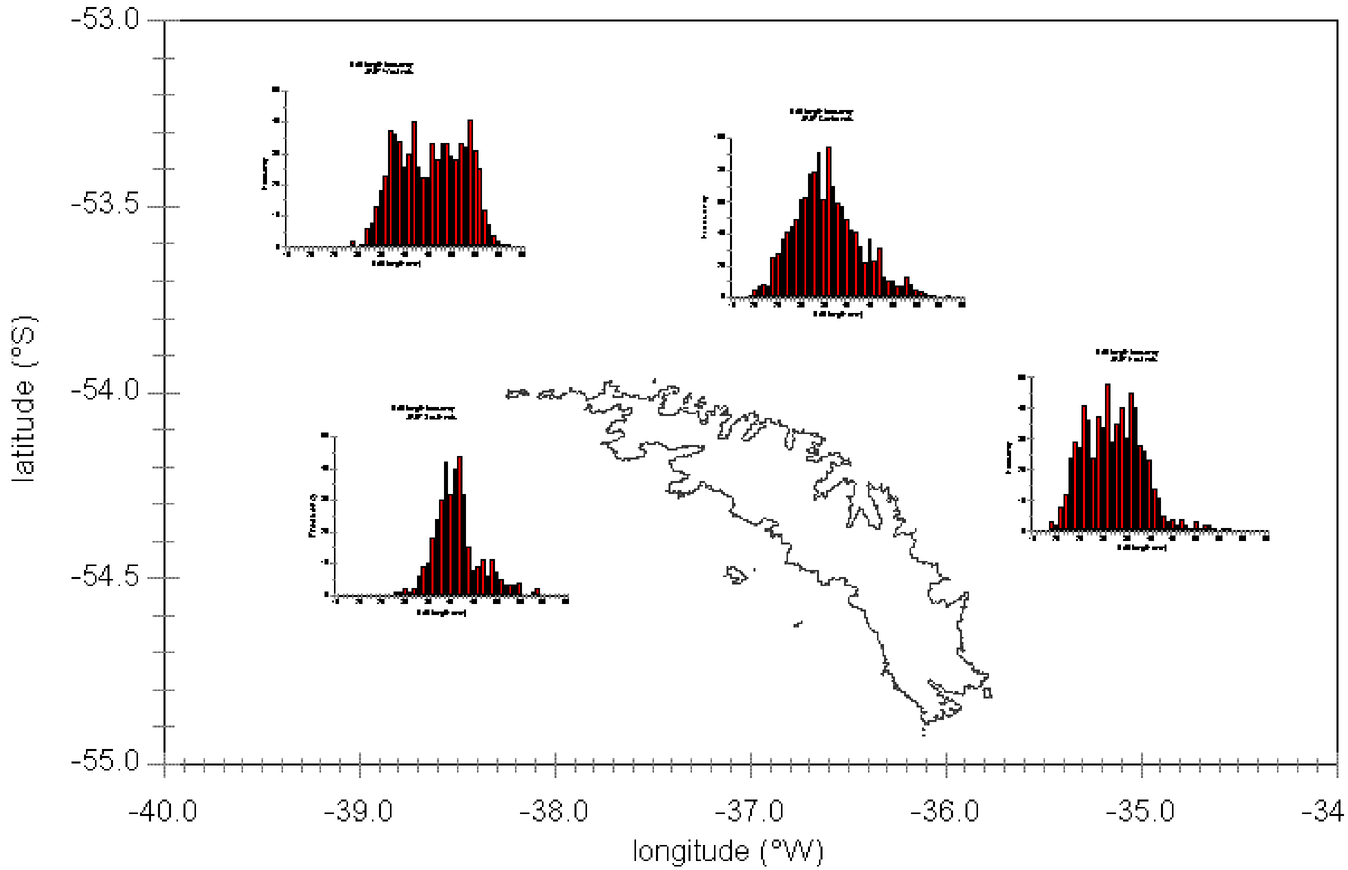


Figure 2: Length frequency plots for Antarctic krill, *Euphausia superba*, in the east, central, west south core boxes

Appendix 1

Formalin was 10% by volume of concentrated formaldehyde (40% solution) made up with 90% seawater; hence it is called 10% formalin or 4% formaldehyde. No chalk or other chemicals were added.

Appendix 2

Times of sunset and Sunrise (from http://aa.usno.navy.mil/AA/data/docs/RS_OneYear.html#formb)

2000/2001 54° 17´ S, 36° 25´ W; GMT −**3** h

Day	**Set**	**Rise**
15/12	19:56	02:46
30/12	20:02	02:56
1/1	20:01	02:57
15/1	19:51	03:18

Oceanographic Sampling (Mike Meredith)

Vessel-Mounted Acoustic Doppler Current Profiler (VM-ADCP)

Instrument Set-up

The VM-ADCP on the RRS *James Clark Ross* is an RD Instruments 153.6 kHz unit sited in a sea chest. This is recessed in the hull to offer protection from ice, and is closed to the sea by a 33 mm thick window of Low Density PolyEthylene (LDPE). Prior to the 2000/2001 Antarctic field season, the *James Clark Ross* underwent refitting so as to accommodate the new swath bathymetry system; during this, the VM-ADCP transducers were temporarily removed, and the fluid in the sea chest was changed from silicone oil to a mixture of 90% deionised water / 10% ethylene glycol.

For JR57, the ADCP was configured to record data in 64 x 8 m bins. Data were recorded in ensembles of 2 minute duration. The `blank beyond transmit' was set to 4 m, this coupled to the depth of the transducer being approximately 6 m gave the centre of the first bin depth at 14 m. The ADCP system used version 17.07 firmware and version 2.48 RDI Data Acquisition Software (DAS) software run on a Viglen IBM-type 286 PC. The 2 minute ensembles of data were fed through a printer buffer directly to the Level C.

During JR57, data were collected in one of two modes. Water track mode was used where the water depth was sufficiently great to preclude useful bottom tracking. Bottom track mode was used otherwise (generally the Falkland Plateau and South Georgia shelf), and was configured through the Direct Command menu of the DAS software. The command FH0004 was directly entered, which sets the instrument to make one bottom track ping for every four water tracked pings. On some previous cruises (e.g. JR27), the command FF00020 was also used; this alters the sea floor detection capability of the instrument, thereby changing the amount of bottom track data available for calibration purposes. However, on JR57 the default setting of FF00040 was found to be sufficient. Due to the nature of the cruise programme, a substantial quantity of bottom-tracked data was available (more than twice the amount logged on JR55).

Data processing

a) Read data into Pstar

A unix script (*57adpexec0*) was used to read the data from the RVS Level C into the Pstar processing software. Data were handled in 12 hourly chunks. Two files are written as the output of this script, one containing the water track data and the other the bottom track data.

b) Temperature correction

The ADCP DAS software assumes that the fluid surrounding the transducers is ambient seawater, and derives a speed of sound through measured temperature at the transducer head and an assumed salinity of 35. However, a correction is clearly needed to account for the fluid being the 90% deionised water / 10% ethylene glycol mixture instead of seawater.

From point measurements obtained from RDI, we previously derived the following equation for the speed of sound through the mixture as a function of temperature:-

$$c = 1484 + 3.6095t - 0.0352\,t^2$$

The individual velocity measurements from which this equation was derived were quoted to an accuracy of 0.01%, with the environmental conditions being known to within ± 35 kPa pressure and ± 0.5°C temperature.
This equation was used to derive a correction term to adjust the speed of sound assumed by the DAS to one appropriate for the mixture in the sea chest. The correction term was:-

$$(1484 + 3.6095t - 0.0352\,t^2) / (1449.2 + 4.6t - 0.055t^2 + 0.00029t^3)$$

This correction is applied to both the raw water and bottom tracked velocities using the unix script *57adpexec0.1*. A further correction for temperature is applied in this script, due to the temperature-dependency of the velocity scaling correction A (see later). This correction was the value derived on JR55, i.e. (1-0.00152*temp).

c) Clock correction

Since the ADCP data stream is time stamped by the PC running the DAS software (rather than the ship's master clock, as most data streams are), there is a timing error associated with the raw data. The drift of the PC clock from the master clock is of the order of one second per hour. Accordingly, the time difference was measured several times a day and a correction applied to the data using the Unix script *57adpexec1*.

d) Gyrocompass error correction

To calculate true velocities from the ADCP, information on the ship's heading is required. The ship's gyrocompass provides near-continuous measurements of heading, however it has an inherent error, and can oscillate for several minutes after a turn. Accordingly, we correct the gyro heading using data from the Ashtech ADU-2 (see navigation report). The Ashtech system does not provide continuous data, and hence cannot provide a direct correction, but it does allow a correction to be applied on an ensemble by ensemble basis. The 2-minute averaged Ashtech-minus-gyro heading correction ("a-ghdg") is manually despiked and interpolated before use. The script *57adpexec2* applies the correction to the data.

e) Calibration

Two corrections to the ADCP data are now required. The first is to compensate for the misalignment of the Ashtech antenna array relative to the ADCP transducers (ϕ), and the second is an inherent scaling factor associated with the ADCP velocities (A).

Initially, bottom tracked velocities were calibrated with a nominal scaling of A = 1 and $\phi = 0$ using the unix script *57adpexec3*. For calibration, the time stamps of the ADCP data were then shifted by 60 seconds, so as to represent the end of each 2-minute ensemble rather than the midpoint. The ADCP data were then merged with a smoothed version of the GPS navigation, and 20-minute average absolute speeds and headings from the satellite fixes were derived. Similarly, speeds and headings were derived from the bottom-tracked ADCP data, and data outside the range 400-740 cm/s were excluded from the calibration procedure. A and ϕ were then calculated as:-

$A = U_{gps} / U_{adcp}$, $\phi = \phi_{gps} - \phi_{adcp}$

where U_{gps} and U_{adcp} are the 20 minute averaged speeds from the GPS and bottom-tracked ADCP respectively, and ϕ_{gps} and ϕ_{adcp} are the 20 minute averaged headings from the GPS and bottom-tracked ADCP respectively.

The direction of ϕ was reversed to bring it into the correct orientation, and it was put in the range $-180 < \phi < 180°$. A value for A of 1.0253 was derived. ϕ was found to be -1.4781. (These values compare to 1.0269 and -1.55 derived for JR55). When this same procedure was followed for JR55, it was apparent that there was a residual dependence of A on temperature, of the form A = 1.0269(1-0.00152*temp). This temperature dependency is likely to be an artefact of imperfectly known speed of sound through the fluid in the sea chest. There was insufficient high-quality bottom-tracked data collected in different temperature conditions on JR57 to further examine this temperature dependency (this was mainly a consequence of rough weather upon leaving Port Stanley adversely affecting the data quality for the period on the Falkland Plateau). Accordingly, the value derived for JR55 (1-0.00152*temp) was included in the script *57adpexec0.1*.

f) Absolute velocities

The data were reprocessed with the new values for A and ϕ. Accordingly, calibrated water velocity relative to the ship was obtained. Ship's velocities between ensembles were then derived by merging in and processing the RVS bestnav navigation data. Absolute water velocities were then derived by removing the ship's velocities from the ADCP data. This was performed using the Unix script *57adpexec4*. Final velocities were stored in files 57adp[jday][a/p].abs.

Summary

Following its successful operation on JR55, the VM-ADCP continued to perform well on JR57. It appears that the instrument is now working substantially better than it had been observed to prior to the refitting of the *James Clark Ross* in the summer of 2000. The only occasions of noticeably poor data quality on JR57 were during the extended periods of bad weather at the start of the cruise, during which all the ship's acoustic instruments seemed to suffer (e.g. EK500, EA500). In water track mode, the instrument continued collecting data to a depth in excess of 300 m. In bottom track mode, good bottom tracked data was obtained in depths regularly exceeding 500 m.

Conductivity-Temperature-Depth (CTD) system

For JR57, a Conductivity-Temperature-Depth (CTD) probe was used to vertically profile the temperature and salinity of the water column. Associated instrumentation profiled the light transmission and fluorescence of the water column, and captured up to twelve discrete samples. A full list of CTD deployments is given in Table 7.

Table 7: CTD Deployments made during JR57

Event	**Station ID**	**Date ddmmyy (jday)**	**Lat [°]**	**Lat [° S]**	**Lon [°]**	**Lon [° W]**	**Depth of water [m]**	**Depth of cast [dbar]**
013	Test	191200 (354)	-52.6832	52 40.99	-46.1088	46 06.53	3418	1016
043	C1.2S	221200 (357)	-53.7720	53 46.32	-36.8738	36 52.43	217	208
051	C1.2N	231200 (358)	-53.4294	53 25.76	-36.6918	36 41.51	1263	1017
064	EK500 Calibration	241200 (364)	-54.1587	54 09.52	-36.7001	36 42.01	58	47
069	E1.1.160	261200 (361)	-53.2854	53 17.12	-34.2630	34 15.78	3349	3342
072	E1.1.150	271200 (362)	-53.3362	53 20.17	-34.3864	34 23.19	3448	3456
075	E1.1.140	271200 (362)	-53.3880	53 23.28	-34.5039	34 30.23	3548	3562
078	E1.1.130	271200 (362)	-53.4385	53 26.31	-34.6360	34 38.16	3608	3619
081	E1.1.120	271200 (362)	-53.4719	53 28.31	-34.7748	34 46.49	3596	3605
085	E1.1.110	271200 (362)	-53.5385	53 32.31	-34.8889	34 53.33	3599	3606
088	E1.1.100	281200 (363)	-53.5897	53 35.38	-35.0115	35 00.69	3622	3632
091	E.1.1.090	281200 (363)	-53.6395	53 38.37	-35.1375	35 08.25	3621	3633
094	E1.1.080	281200 (363)	-53.6912	53 41.47	-35.2588	35 15.53	3597	3611
097	E1.1.070	281200 (363)	-53.7344	53 44.06	-35.3908	35 23.45	3051	3120

Event	Station ID	Date ddmmyy (jday)	Lat [°]	Lat [° S]	Lon [°]	Lon [° W]	Depth of water [m]	Depth of cast [dbar]
101	E1.1.060	281200 (363)	-53.7874	53 47.25	-35.5195	35 31.17	2457	2494
104	E1.1.050	281200 (363)	-53.8432	53 50.59	-35.6385	35 38.31	1000	991
107	E1.1.040	291200 (364)	-53.8952	53 53.71	-35.7627	35 45.76	659	652
110	E1.1.030	291200 (364)	-53.9458	53 56.75	-35.8885	35 53.31	284	273
113	E1.1.020	291200 (364)	-53.9950	53 59.70	-36.0132	36 00.79	289	275
116	E1.1.010	291200 (364)	-54.0469	54 02.82	-36.1397	36 08.38	271	256
119	E1.1.000	291200 (364)	-54.0976	54 05.86	-36.2661	36 15.97	276	268
135	E2.2S	301200 (365)	-54.2458	54 14.75	-35.7234	35 43.41	224	216
143	E2.2N	311200 (366)	-54.0380	54 02.28	-35.2178	35 13.07	2187	1011
152	E3.2N	311200 (366)	-54.3321	54 19.93	-34.8776	34 52.65	1792	1017
161	E3.2S	010101 (001)	-54.5598	54 33.59	-35.3832	35 22.99	178	171
171	W1.2N	020101 (002)	-53.4929	53 29.58	-39.2511	39 15.07	3151	1017
179	W1.2S	030101 (003)	-53.8457	53 50.74	-39.1432	39 08.59	289	277
185	W2.2S	030101 (003)	-53.7850	53 47.10	-38.5846	38 35.08	207	199
194	W2.2N	040101 (004)	-53.4319	53 25.92	-38.6950	38 41.70	3499	1018
199	W3.2N	040101 (004)	-53.3617	53 21.70	-38.0840	38 05.04	2661	1013
208	W3.2S	050101 (005)	-53.7136	53 42.81	-37.9663	37 57.98	132	127
228	C1.2S	060101 (006)	-53.7712	53 46.27	-36.8740	36 52.44	214	203

Event	Station ID	Date ddmmyy (jday)	Lat [°]	Lat [° S]	Lon [°]	Lon [° W]	Depth of water [m]	Depth of cast [dbar]
237	C1.2N	070101 (007)	-53.4291	53 25.75	-36.6926	36 41.56	1267	1016
243	C2.2N	070101 (007)	-53.5141	53 30.85	-36.2340	36 14.04	1527	1017
252	C2.2S	080101 (008)	-53.8572	53 51.43	-36.4146	36 24.88	233	223
257	S1.2S	080101 (008)	-54.7288	54 43.73	-38.2811	38 16.87	264	255
266	S2.2N	090101 (009)	-54.3886	54 23.32	-38.0835	38 05.01	201	193

Equipment

The CTD system used on JR57 was the BAS Sea-Bird 911 plus (serial number 09P15759-0480). The CTD was fitted with seven scientific sensors: -

1) Primary temperature (SBE 3 plus, serial number T32191, calibrated 22-6-2000)
2) Primary conductivity (SBE 4C, serial number C41913, calibrated 22-6-2000)
3) Pressure (series 410K-105 Digiquartz pressure transducer, serial no. 067241, calibrated 28-6-1999)
4) Secondary temperature (SBE 3 plus, serial number T32307, calibrated 22-6-2000)
5) Secondary conductivity (SBE 4C, serial number C41912, calibrated 22-6-2000)
6) Transmissometer (serial number cdt-396dr, calibrated 17-10-2000)
7) Fluorometer (Chelsea Instruments Aquatracka Mk.III, serial number 088216, calibrated 7-1-2000)

The temperature and conductivity sensors were connected to two SBE 5 T submersible pumps (serial numbers 051813 and 051807). The CTD was connected to a SBE 32, 12 position carousel water sampler carrying twelve 10 litre Niskins. In addition to these, an altimeter was fitted to permit accurate near-seabed approach, but the altimeter data were not processed alongside the data from the other sensors. Also fitted to the water sampler frame was an SBE 35 high precision thermometer (serial number 3515759-005).

Data Acquisition and Initial Processing

a) SBE 911 plus

During JR57, the CTD package was deployed from the midship's gantry and A-frame of the *James Clark Ross.* The general procedure was to start data logging (see below), deploy, and then stop with the CTD at 10 dbar pressure. After a 5 minute soak at this level, the package was raised nearly to the surface, then lowered to the target depth without stopping. For the long transect (northeast of South Georgia), the target depth was the bottom depth minus 10 m. For standard core program (core box) stations, the on-shelf station target depth was bottom depth minus 10m, and the off-shelf station target depth was 1000 m. The Niskin bottles were closed during the upcast; bottle closure depths are listed in Table 8. The downcast data were calibrated and averaged to 2 dbar intervals to form the final CTD product (see below).

Table 8: Niskin bottle closure depths for CTD deployment during JR57

Station ID	Water depth [m]	Cast depth [dbar]	Bottle levels [m wire out]
C1.2S	217	208	200, 180, 160, 140, 120, 100, 80, 60, 40, 40, 20, 10
C1.2N	1263	1017	1000, 800, 600, 400, 200, 150, 125, 100, 80, 60, 40, 20
E1.1.160	3349	3342	Bottom (3270), 2000, 1000, 600, 200, 150, 125, 100, 80, 60, 40, 20
E1.1.150	3448	3456	Bottom (3378), 2000, 1000, 600, 200, 150, 125, 100, 80, 60, 40, 20
E1.1.140	3548	3562	Bottom (3490), 2000, 1000, 600, 200, 150, 125, 100, 80, 60, 40, 20
E1.1.130	3608	3619	Bottom (3538), 2000, 1000, 600, 200, 150, 125, 100, 80, 60, 40, 20
E1.1.120	3596	3605	Bottom (3525), 2000, 1000, 600, 200, 150, 125, 100, 80, 60, 40, 20
E1.1.110	3599	3606	Bottom (3530), 2000, 1000, 600, 200, 150, 125, 100, 80, 60, 40, 20
E1.1.100	3622	3632	Bottom (3555), 2000, 1000, 600, 200, 150, 125, 100, 80, 60, 40, 20
E.1.1.090	3621	3633	Bottom (3555), 2000, 1000, 600, 200, 150, 125, 100, 80, 60, 40, 20
E1.1.080	3597	3611	Bottom (3535), 2000, 1000, 600, 200, 150, 125, 100, 80, 60, 40, 20
E1.1.070	3051	3120	Bottom (3057), 2000, 1000, 600, 200, 150, 125, 100, 80, 60, 40, 20
E1.1.060	2457	2494	Bottom (2445), 2000, 1000, 600, 200, 150, 125, 100, 80, 60, 40, 20
E1.1.050	1000	991	Bottom (988), 800, 600, 400, 200, 150, 125, 100, 80, 60, 40, 20
E1.1.040	659	652	Bottom (641), 600, 400, 300, 200, 150, 125, 100, 80, 60, 40, 20
E1.1.030	284	273	Bottom (269), 200, 180, 150, 125, 100, 80, 60, 50, 40, 30, 20
E1.1.020	289	275	Bottom (270), 200, 180, 150, 125, 100, 80, 60, 50, 40, 30, 20
E1.1.010	271	256	Bottom (251), 200, 180, 150, 125, 100, 80, 60, 40, 40, 30, 20
E1.1.000	276	268	Bottom (263), 250, 200, 150, 125, 100, 80, 60, 40, 40, 30, 20
E2.2S	224	216	Bottom (212), 200, 180, 150, 125, 100, 80, 60, 50, 40, 30, 20
E2.2N	2187	1011	1000, 800, 600, 400, 200, 150, 125, 100, 80, 60, 40, 20

Station ID	Water depth [m]	Cast depth [dbar]	Bottle levels [m wire out]
E3.2N	1792	1017	1000, 800, 600, 400, 200, 150, 125, 100, 80, 60, 40, 20
E3.2S	178	171	Bottom (166), 150, 140, 125, 100, 80, 80, 70, 60, 60, 40, 20
W1.2N	3151	1017	1000, 800, 600, 400, 200, 150, 125, 100, 80, 60, 40, 20
W1.2S	289	277	Bottom (272), 200, 180, 150, 125, 100, 80, 60, 50, 40, 30, 20
W2.2S	207	199	Bottom (195), 175, 150, 125, 100, 80, 80, 60, 60, 40, 40, 20
W2.2N	3499	1018	1000, 800, 600, 400, 200, 150, 125, 100, 80, 60, 40, 20
W3.2N	2661	1013	1000, 800, 600, 400, 200, 150, 125, 100, 80, 60, 40, 20
W3.2S	132	127	Bottom (125), 125, 125, 100, 100, 80, 80, 60, 60, 40, 20, 20
C1.2S	214	203	Bottom (200), 200, 175, 150, 125, 100, 80, 80, 60, 60, 40, 20
C1.2N	1267	1016	1000, 800, 600, 400, 200, 150, 125, 100, 80, 60, 40, 20
C2.2N	1527	1017	1000, 800, 600, 400, 200, 150, 125, 100, 80, 60, 40, 20
C2.2S	233	223	Bottom (217), 200, 180, 150, 125, 100, 80, 60, 50, 40, 30, 20
S1.2S	264	255	Bottom (250), 225, 200, 175, 150, 125, 100, 80, 60, 40, 40, 20
S1.2N	201	193	Bottom (188), 175, 150, 125, 100, 80, 70, 60, 50, 40, 30, 20

Data from the CTD system were logged via an SBE 11 plus deck unit to a 486 Viglen PC running version 4.226 of Seasoft Data Acquisition Software (Sea-Bird Electronics Inc.). The initial module used for data acquisition was the *Seasave* program. For JR57, the data average rate was set to 1, producing 24 Hz raw data (the maximum permitted with the system). Seasave per CTD cast generates four files. These are as follows, where NNN is the event number of the cast: -

- 57ctdNNN.dat (raw data file)
- 57ctdNNN.con (configuration data, generally a copy of the input configuration file jr57.con)
- 57ctdNNN.hdr (header file containing sensor information)
- 57ctdNNN.bl (file with data cycle numbers for bottle closures)

Following *Seasave*, the SBE program *Datcnv* was run to calibrate the data, and convert to ASCII output. This file was named as 57ctdNNN.cnv. Subsequently, the SBE program *Celltm* was run, so as to correct for thermal mass effects in the measured conductivity. The resultant file was named as 57cnvNNN.cnv.

Two DOS executable (.bat) files were then run. The first (doprint.bat) connected to the ship's PC network, and allowed the data to be copied onto the Q: drive. The second (doftp.bat) enabled FTP connection to the JRUF Sun Workstation, thus allowing the data to be read into Pstar for more sophisticated processing than was available in the *Seasoft* modules.

b) SBE35 high precision thermometer

The SBE 35 high precision thermometer is a self-recording instrument: upon closure of each Niskin, it stores a temperature in its erasable/programmable read-only memory (EPROM). For JR57, the SBE 35 was set to record temperatures as the mean of 8.8 seconds of data. Up to 160 measurements can be stored in EPROM concurrently, thus data were downloaded approximately every 2-3 days to avoid loss of data. Connecting the SBE 35 to the CTD logging PC via an interface box, and running the SBE program Term35 enabled downloading. Once connected and a suitable filename entered (generally DDD.out, where DDD is the Julian day of the download), the following direct commands were issued: -

- DS (to check data status, number of data cycles stored etc.)
- DD (data dump, to write the data into the specified file)
- IL (initialise logging, to clear EPROM ready for further data acquisition)

The SBE program *Cnv35* was then run to convert the data to temperature; the resultant file was named DDD.txt. These data were then transferred to JRUF via FTP for further processing within the Pstar environment.

c) Discrete Salinity Samples

At each CTD station on JR57, all twelve Niskin bottles were closed and sampled for salinity analysis. The primary purpose of this is to calibrate the salinity measurements made by the CTD sensors. Samples were drawn into 200-ml medicine flats, each having been rinsed three times prior to filling. The bottles were filled to about three-quarters of maximum, to allow expansion of the (cold) samples, and to allow effective mixing upon shaking of the samples prior to analysis. The rim of each bottle was wiped with a tissue to prevent salt crystals forming upon evaporation, and a plastic seal inserted into the bottleneck to prevent loss of sample. A Bakelite cap was screwed down to keep the insert in place. The bottles and crates were numbered and colour coded for reference.

Once a crate of samples was full (every two CTD casts), the crate was moved into the *James Clark Ross*'s Micro Bio / Radiation Lab, where the BAS Guildline Autosal model 8400B (serial number 63360) was sited for JR57. The samples were left for a minimum of 24 hours to enable their temperatures to equalise with the laboratory temperature (around 19°C). The samples were then analysed on the 8400B, with measurements being made using Ocean Scientific standards P137 (K15 = 0.99995, S = 34.998, date of preparation = 9-12-1999) and P133 (K15 = 0.99986, S = 34.995, date of preparation = 11-11-1997). One ampoule of standard was used per twelve samples. The 8400B-cell temperature was set to 21°C for the duration of JR57. Once conductivity measurements had been made for each sample, they were entered into a Quattro Pro spreadsheet for conversion to salinity, with the resultant data being written out as ASCII and transferred to JRUF for subsequent processing in Pstar.

Data processing within Unix

The Unix scripts used for JR57 were developed from the existing set of scripts used on previous BAS cruises, and were largely originated by Dr. Mark Brandon (now Open University). The main changes made were conversion of the programs to allow for the processing of fluorescence and light transmittance data, and the omission of the *ctdoff* program in favour of *phisto.* The Unix processing procedure on JR57 was: -

- **seactdfltr0** - runs RVS *datapup* program to convert data from ascii file 57cnvNNN.cnv into Pstar format. Output files are named 57ctdNNN.raw (the raw data in Pstar format), and 57ctdNNN (which also includes a rough salinity variable).
- **seactdfltr2** - creates sample files in Pstar format for the CTD data, the discrete salinity samples and the SBE 35 temperature data. Output files are named 57ctdNNN.bottle (the CTD data averaged for the 10 seconds around the bottle confirmation data cycle number in the SBE .bl file), 57ctdNNN.samp (as previous, but also including the salinity sample data and SBE35 temperatures), and 57samNNN.dif (the file 57ctdNNN.samp with the pre conductivity salinity residual).
- **seactdfltr4** - derives a conductivity for the salinity sample values in 57ctdNNN.samp, then calculates the conductivity residual. Produces two diagnostic plots, one of the conductivity residual as a function of the conductivity, and the other of the conductivity as a function of depth (CTD conductivity with bottle conductivity overlaid). Output is 57ctdNNN.cond
- **phisto -** produces a histogram of the conductivity residual, and enables the mean and standard deviation of the residual to be derived for various combinations of bottle included/excluded from the calibration procedure. Based on the results of these, a best value for the conductivity offset is derived.
- The bottles rejected from the calibration procedure and the final values for the conductivity offsets derived are listed in Table 9.
- **seactdfltr5 -** applies conductivity residual to the data, and recalculates the salinity. Output is 57ctdNNN.cal.
- **seactdfltr6** - reiterates seactdfltr2, but now operating on the salinity values corrected for the conductivity offset of the SBE 911 plus. Output files are 57ctdNNN.cbottle (CTD data averaged for the 10 seconds around the bottle confirmation data cycle number in the SBE .bl file), 57ctdNNN.csamp (as previous, but also including the salinity sample data and SBE35 temperatures), and 57samNNN.cdif (the file 57ctdNNN.samp with the pre conductivity salinity residual).
- **phisto** - run on 57samNNN.cdif, excluding the same bottles as were excluded from the original calibration. Operates as a check that calibration is satisfactory.
- **seactdfltr7 -** launches the Pstar program *mlist*, which scrolls through the pressure variable and enables the start and stop of the downcast to be identified. Runs some basic checks using median filters via the Pstar program *pmdian*, rederives potential temperature and density, and interpolates data from 24 hz to 2 dbar intervals. Output is 57ctdNNN.2db and 57ctdNNN.24hz.
- **seactdfltr8.** Optional. If the CTD is not brought close to the surface after the 5 minute soak immediately following deployment, the 1 dbar level may be absent in the final file. This routine can be used to copy the 3 dbar level into the 1 dbar level for completeness.

Output is 57ctdNNN.2db.

- **seactdfltr9.** Optional. Linearly interpolates across gaps. Should not really be necessary. Output is 57ctdNNN.2db.

Table 9: Conductivity Offsets between Discrete Samples and CTD Measurements

Event	**Station ID**	**Offset**	**Bottles rejected in calibration**
013	Test	-0.0018	6, 8
043	C1.2S	0.0006	11
051	C1.2N	-0.0008	2, 4, 5, 7
069	E1.1.160	-0.0015	5, 7
072	E1.1.150	-0.0021	3 (no sample), 5, 6, 7
075	E1.1.140	-0.0018	3, 8
078	E1.1.130	-0.0019	5, 8, 12
081	E1.1.120	-0.0015	6, 9
085	E1.1.110	-0.0005	9, 12
088	E1.1.100	0.0001	5, 8, 9, 10, 12
091	E.1.1.090	-0.0011	3, 4, 5, 6, 7, 8, 9, 10, 11
094	E1.1.080	-0.0011	6, 8, 9
097	E1.1.070	-0.0017	5, 6, 7, 8, 9, 10, 11
101	E1.1.060	-0.0014	5, 7, 10, 12
104	E1.1.050	-0.0020	5, 6, 7, 8, 9, 10, 11, 12
107	E1.1.040	-0.0012	7, 9, 10, 11, 12
110	E1.1.030	-0.0021	3, 5, 10
113	E1.1.020	-0.0011	2, 3, 4, 8
116	E1.1.010	0.0002	1
119	E1.1.000	0.0002	1, 2, 3, 11, 12
135	E2.2S	-0.0008	1, 2, 3, 11
143	E2.2N	-0.0006	6, 7, 9, 11, 12
152	E3.2N	-0.0002	6, 7, 9, 10, 11, 12
161	E3.2S	-0.0015	9, 12
171	W1.2N	-0.0019	5, 6, 7, 8, 9, 10, 11, 12

Event	Station ID	Offset	Bottles rejected in calibration
179	W1.2S	-0.0005	1, 3, 6
185	W2.2S	-0.0003	8, 10
194	W2.2N	-0.0024	7, 8, 10, 11, 12
199	W3.2N	-0.0015	5, 6, 7, 8, 9, 10
208	W3.2S	-0.0034	6, 7, 10, 11
228	C1.2S	0.0005	1, 2, 7, 8, 11, 12
237	C1.2N	-0.0006	5, 6, 8, 10
243	C2.2N	-0.0014	5, 6, 7, 8, 9, 10, 11, 12
252	C2.2S	-0.0003	10, 11
257	S1.2S	-0.0006	1, 4, 6, 7, 8
266	S1.2N	-0.0007	2, 3, 4

As of the time of writing, the fluorometer data have not been calibrated other than applying the manufacturer's calibrations at the time of data acquisition. When compared to directly measured discrete samples of chlorophyll, the values from the CTD fluorometer appear to be consistently about half the true values. They do, however, show good spatial coherence with the true values. A further calibration to bring the CTD values into line with the bottle values is needed, and will be applied once derived.

The nature of the sampling on JR57, with many bottles being closed very near to the surface (for measurements of chlorophyll and nutrients), meant that a large number of salinity samples were not best suited for the purpose of calibrating the CTD. Large salinity gradients in the near-surface waters produce inevitable offsets between the data sets; such samples are easily identified as "fliers", and are best excluded from the calibration procedure, which logically should lend more weight to the less variable bottom waters. With the exclusion of such fliers, the standard deviation of the difference between bottle and calibrated CTD salinity is slightly better than 0.001 for JR57, when averaged over all the deployments. For the overall accuracy of the data set to be ascertained, analysis of duplicate discrete salinity samples is now required.

Problems

In general, the CTD and associated instrumentation performed well on JR57. There were some problems with the capture and processing of the discrete salinity samples however. It was noticed on several occasions that some of the Niskins leaked on deck after recovery of the CTD package. This invariably occurred from the bottom endcap of the bottles. Some O-ring seals were replaced, and on two occasions complete Niskins were replaced. (Whilst salinities were measured from all samples, any outlying values were discarded from the calibration procedure, thus these leaks will not adversely affect the CTD data quality). The number of leaks was far higher than has been encountered on previous cruises, and it is feared that the bottle closure mechanisms are not performing well. This would be extremely problematic for any colleagues who might be measuring e.g. dissolved gases.

A second problem was instability of the conductivity readings given by the Autosal 8400B. In general, the reading jumped from value to value much more than could be expected of a typical 8400B. A stable reading could not be obtained with flow through the cell, i.e. with the peristaltic pump turned on. This is normally possible with an 8400B. The cause of this behaviour is not known. The problem was handled by using the same manual averaging procedure on the samples and standards, and whilst it is unlikely to have had an impact on the data quality, it nonetheless necessitated considerably more user effort than would otherwise have been required.

At the start of the cruise, the peristaltic pump on the 8400B was found to be in a very bad condition. Some of the electrical contacts showed signs of corrosion; these were cleaned to the best of our ability, but are still not entirely satisfactory. Some of the tubing was split; other tubing had worn and was not watertight. This led to leaking of samples into the pump housing, and leaking of air into the tubing and salinometer cell. Much of the tubing showed black stains inside of an unknown origin. We were fortunate that there was a supply of new tubing and connectors on board, provided by Mick Whitehouse, and the pump was made operational for the duration of the cruise.

A number of salinity bottles were found to have badly chipped necks. These were discarded, since the plastic inserts would not have formed an airtight seal, and sample loss through evaporation would have resulted. The total number of salinity bottles on the *James Clark Ross* is currently at about the minimum workable level: during the period of intensive CTD work (the long transect to the Northeast of South Georgia), there were periods when we had just one crate of empty bottles.

Recommendations

- The Niskins should be carefully examined and the causes of the leaks traced. Any worn O-rings should be replaced. Any cracked or poorly manufactured bottles should be replaced. The closing and sealing mechanisms should be given special attention.
- The 8400B salinometer should be exchanged for the new one being purchased by BAS as soon as practicable and returned to Ocean Scientific for servicing. Particular attention should be given to tracing the cause of the unstable conductivity readings.
- The peristaltic pump on the 8400B should be overhauled, and if necessary replaced. Since the pump forms a conduit for samples into the salinometer, it should always be kept as clean and well-maintained as possible, otherwise the integrity of the final measurements will inevitably suffer.
- Two new crates of salinity bottles should be purchased.

Oceanlogger

Instrumentation

The oceanlogger system onboard the *James Clark Ross* was operated for virtually the entire duration of cruise JR57. It is a PC-based logging system, built in-house at BAS, with the primary purpose of logging measurements from several of the ship's continuously run data sources. Accordingly, it draws data from the ships pumped non-toxic supply, plus assorted meteorological parameters. The range of instruments supplying data is listed in Table 10. The instruments with an analogue output are connected to self-contained digitising Rhopoint modules located close to the relevant instrument. The controlling PC using the RS485 protocol then interrogates the modules.

Table 10: Instruments supplying data to the Oceanlogger

Instrument	**Type**	**Siting**	**Data stream idents.**
Sea temp. Sensor	4 wire PRT	Transducer space	Sstemp
Flow meter	Liter metre	Prep Lab	flow
TSG	SBE21 (serial no. 214800-	Prep Lab	tstemp, cond
Fluorometer	Turner Systems	Prep Lab	fluor
Air temp. sensor	Vector T351	Foremast	atemp
PAR sensor	Kipp & Zonen CM5	Foremast	par
TIR sensor	Didcot DRP1	Foremast	tir
Barometer	Vaisala PA11	UIC	press
Anemometer	Guildline Sonic	Foremast	wind_spd, wind_dir

Processing in Unix

Data from the oceanlogger were read from the SCS into Pstar on the JRUF Unix system in 12 hour sections. A standard script was used for this, called jr57*_ocean.* This called three separate Unix scripts in sequence, *oclexec0*, *oclexec1* and *twvelexec.*

oclexec0 executes the RVS *datapup* command to draw data from the SCS "oceanlog" and "anemom" data streams into Pstar format. These are merged to form a single file, called 57oclNNN[a/p].raw, where NNN is the Julian day, and [a/p] identifies whether the data is am or pm.

oclexec1 performs some basic quality control (despiking conductivities), then derives a raw (uncalibrated) salinity. Two-minute averages are formed, and navigation from the GPS is merged. Meteorological data is written out to a separate file. Files produced are 57oclNNN[a/p], 57oclNNN[a/p].2min, and 57metNNN[a/p].raw.

twvelexec uses GPS and gyrocompass data to calculate true wind velocity and direction, rather than relative to the ship. Output is 57metNNN[a/p].true.

Salinity calibration

Discrete samples for salinity analysis were drawn approximately once every four hours from the outflow of the thermosalinograph in the Prep. Laboratory. These were taken in 200 ml medicine flats, sealed with plastic inserts, and stored for 24 hours to allow their temperatures to equalise with laboratory temperature. Subsequently, they were analysed following an identical procedure to samples drawn for CTD calibration (see CTD cruise report). For JR57, a total of 94 discrete samples were used in calibrating the oceanlogger salinity.

Calibration procedure was somewhat different to that employed on previous Core Programme cruises. Initially, conductivity was calculated using the measured bottle salinity and the temperature of the thermosalinograph housing. Conductivity residuals were then calculated by differencing these bottle conductivities with the measured thermosalinograph conductivities. Diagnostic plots were produced of these residuals versus (a) time and (b) bottle conductivity. Outliers were removed, and a running mean of total width 5 samples was applied to the data. Endpoints were extrapolated so that the conductivity residual series overlapped the thermosalinograph series at both the start and finish. The data were merged and interpolated, and the thermosalinograph data were then corrected according to the residual appropriate for the time of data collection. Following this procedure, we derive a standard deviation for the difference between bottle and thermosalinograph salinity of 0.078; this is the accuracy of the calibration.

Problems

There is one very serious problem with the BAS oceanlogger, namely a lag (of unknown source) between the response of the temperature and conductivity cells in the thermosalinograph. Since calculating salinity requires *both* these measurements (not just conductivity), during periods of changing water properties, derived salinity shows very large and completely spurious spikes. On consulting previous cruise reports, it became apparent that this problem was first reported as long ago as 1995 (the WOCE section A23). Presumably it has been present for as long as the oceanlogger has been in existence. On WOCE A23, a lagged filter was used to attempt to compensate for this problem. More recently (BAS MLS cruises), various filters were tried, but these were all long, and led to averaging over as much as 4 minutes. We observe that the length of filter being used recently is much longer than that used during WOCE A23, suggesting that the problem is getting worse with time. Rather than “treating the symptoms not the disease”, by producing progressively longer filters (each of which would smooth out more and more of the genuine oceanographic variations of surface properties), it must surely be time to tackle the problem at source.

A second problem encountered on JR57 was the malfunction of the PAR and TIR sensors towards the end of the cruise. Data are not available for this period.

Recommendations

Solving the problem with the oceanlogger is long overdue. It is over 5 years since the problem was first identified, and progress has apparently not been made. The thermosalinograph system should be intensively studied until the cause is found. If the cause cannot be traced, the system should be replaced with a more reliable one.

Depth Echosounding

The *James Clark Ross* has a hull-mounted Simrad EA500 Hydrographic Echosounder, with the transducers located approximately 5m below the water level. For JR57, data were logged into Pstar in 12 hourly segments using the standard Unix script *jr57_sim*. This ran *datapup* on the

SCS simulated level C data stream SIM500, taking the jday and am or pm as the requisite inputs. This data stream features uncorrected depth, i.e. it produces bottom depth calculated assuming a mean vertical sound velocity of 1500 ms^{-1}.

The Unix script *jr57_sim* ran *pedita* on the uncorrected depths, since the EA500 data often features spurious zeroes; these were replaced with absent data markers. Since the data are often very spiky, *pmdian* was run from within *jr57_sim*, whereby each successive value was replaced with the median of a moving window of five adjacent data cycles. Navigation data were merged in from the Bestnav stream. Corrected depths were calculated using *pcarter*, which feeds the ship's position into a set of reference tables to correct for the assumption that vertical sound velocity averages to 1500 ms^{-1}.

Following *jr57_sim*, *plxyed* was run on the data, so as to enable manual despiking to be performed to remove any remaining obvious spurious data. This routine marks any data cycles identified as missing; to create continuous data, *pintrp* was run to linearly interpolate across the gaps. Final cleaned data were stored in files named as 57sim[jday][a/p].corr.

Expendable Bathythermographs (XBTs)

A sequence of XBT drops was performed from RRS *James Clark Ross* during JR57. These were performed on transit from Port Stanley to South Georgia at the start of the cruise, and also for the return journey at the end.

Sippican T5 and T7 probes were used, having been provided by the U.K. Hydrographic Office, Taunton. A fixed launcher was used, sited on the rear port side of the aft deck. Data were logged by a Viglen IBM-type 486 PC running the Sippican WinMk12 software. Once a successful drop had been performed, data were transferred via ftp to the central Unix system (jruf) for processing. Two Unix scripts were used to process the data: -

- *xbtexec0* - This reads the data from ASCII into Pstar format, sets up header information, and extracts navigation and water depth from the RVS data streams appropriate for the time of the drop.
- *xbtexec.edit* - This runs a median despiking routine on the data, and launches the Pstar program "plxyed", which enables interactive editing of the XBT profile. This was used to remove any remaining spurious spikes, and also remove the noise recorded after the probe had reached its terminal depth.

The details of the XBT drops are listed in Table 11. There were a few bad drops where excessive spiking or clearly unrealistic values were logged. These were generally identified mid-drop, with the drop aborted and restarted with a new probe. However, there were far fewer failures than during the previous cruise (JR55). Since exactly the same equipment and procedure were used on JR55 as on JR57, this lends further weight to the idea that the large number of failures on JR55 was due to a rogue batch of poorly-constructed probes.

Table 11: XBT Drops during JR57 Cruise

Event	Date/time [ddmmyy hhmm]	Lat [°]	Lat [° S]	Lon [°]	Lon [° W]	Water depth [m]	Type	Fail?
001	181200 0100	-51.8252	51 49.51	-57.1802	57 10.81	314	T7	
002	181200 0309	-52.0425	52 02.55	-56.5121	56 30.73	971	T7	
003	181200 0507	-52.2346	52 14.08	-55.8974	55 53.84	1290	T7	
004	181200 0717	-52.4553	52 27.32	-55.2079	55 12.47	1614	T5	
005	181200 0800	-52.5310	52 31.86	-54.9755	54 58.53	1791	T5	
006	181200 1007	-52.7176	52 43.06	-54.3394	54 20.36	2360	T5	
007	181200 1159	-52.7238	52 43.43	-53.7549	53 45.29	2656	T5	
---	181200 1358	-52.7850	52 47.10	-53.1683	53 10.10	3060	T5	✓
008	181200 1404	-52.7937	52 47.62	-53.0984	53 05.90	3071	T5	
009	181200 1559	-52.8750	52 51.42	-52.5090	52 30.54	3463	T5	
010	191200 0736	-52.5322	52 31.93	-47.6157	47 36.94	3829	T5	
011	191200 0814	-52.5520	52 33.12	-47.3854	47 23.12	3767	T5	
012	191200 0956	-52.6057	52 36.34	-46.7901	46 47.41	3540	T5	
018	191200 1620	-52.7644	52 45.86	-45.5924	45 35.54	3567	T5	
019	191200 1811	-52.7350	52 44.10	-45.0161	45 00.97	3176	T5	
---	191200 2025	-52.7238	52 43.43	-44.2867	44 17.20	3284	T5	✓
020	191200 2031	-52.7246	52 43.48	-44.2457	44 14.74	3304	T5	
021	191200 2201	-52.7360	52 44.16	-43.7667	43 46.00	3245	T5	
---	201200 0001	-52.7783	52 46.70	-43.2017	43 12.10	2721	T5	✓
022	201200 0005	-52.7814	52 46.88	-43.1692	43 10.15	2721	T5	
---	201200 0404	-52.8762	52 52.57	-42.2557	42 15.34	2507	T5	✓
---	201200 0408	-52.8787	52 52.72	-42.2327	42 13.96	2733	T5	✓
023	201200 0409	-52.8801	52 52.81	-42.2187	42 13.12	2299	T5	
---	201200 0603	-52.9430	52 56.58	-41.8500	41 51.00	2180	T5	✓
024	201200 0610	-52.9492	52 56.95	-41.8160	41 48.96	2311	T5	
025	211200 1401	-53.7629	53 45.77	-38.3194	38 19.16	190	T7	
026	211200 1604	-53.8849	53 53.09	-37.7993	37 47.96	135	T7	

Event	Date/time [ddmmyy hhmm]	Lat [°]	Lat [° S]	Lon [°]	Lon [° W]	Water depth [m]	Type	Fail?
268	090101 2000	-53.7722	53 46.33	-39.8868	39 53.21	1420	T5	
269	090101 2200	-53.6091	53 36.55	-40.5557	40 33.34	2210	T5	
270	090101 2357	-53.4621	53 27.73	-41.1421	41 08.53	1709	T5	
271	100101 0112	-53.3956	53 23.74	-41.4094	41 24.56	1385	T5	
272	100101 0356	-53.2509	53 15.05	-41.9966	41 59.80	1403	T5	
273	100101 0601	-53.2043	53 12.26	-42.4555	42 27.33	1366	T5	
274	100101 0757	-53.1465	53 08.79	-43.0442	43 02.65	1684	T5	
275	100101 0952	-53.0522	53 03.13	-43.6596	43 39.58	1790	T5	
276	100101 1203	-53.0205	53 01.23	-44.1626	44 09.76	2157	T5	
---	100101 1403	-53.9732	52 58.39	-44.6750	44 40.50	2346	T5	✓
---	100101 1403	-53.9732	52 58.39	-44.6750	44 40.50	2346	T5	✓
277	100101 1410	-52.9718	52 58.31	-44.7344	44 44.06	2369	T5	
278	100101 1602	-52.9182	52 55.09	-45.3522	45 12.13	2626	T5	
279	100101 1800	-52.8693	52 52.16	-45.8081	45 48.49	2660	T5	
280	100101 1959	-52.8306	52 49.84	-46.2194	46 13.16	3108	T5	
281	100101 2159	-52.7881	52 47.29	-46.6254	46 37.52	2942	T5	
282	100101 2358	-52.7400	52 44.40	-47.1141	47 06.85	3429	T5	
283	110101 0155	-52.6957	52 41.74	-47.5477	47 32.86	3828	T5	
284	110101 0357	-52.6394	52 38.36	-47.9859	47 59.15	3755	T5	
285	110101 0603	-52.6013	52 36.08	-48.4486	48 26.92	3718	T5	
286	110101 0759	-52.5486	52 32.92	-49.0283	49 01.70	3602	T5	
287	110101 0954	-52.4755	52 28.53	-49.7591	49 45.55	3490	T5	
288	110101 1154	-52.4028	52 24.17	-50.5149	50 30.89	3183	T5	
289	110101 1357	-52.3318	52 19.91	-51.2381	51 14.29	2877	T5	
290	110101 1600	-52.2498	52 14.99	-51.9541	51 57.25	2585	T5	
291	110101 1800	-52.1826	52 10.96	-52.6267	52 37.60	2393	T5	
292	110101 1954	-52.1011	52 06.07	-53.2418	53 14.51	2161	T5	
293	110101 2157	-52.0535	52 03.21	-53.9021	53 54.13	1964	T5	

Event	Date/time [ddmmyy hhmm]	Lat [°]	Lat [° S]	Lon [°]	Lon [° W]	Water depth [m]	Type	Fail?
294	120101 0001	-51.9821	51 58.93	-54.5923	54 35.54	1670	T5	

Navigation on JR57 (Mike Meredith)

Data from five of the six scientific navigational instruments on RRS *James Clark Ross* were logged routinely into Pstar during JR57. Three of these data streams were used regularly in processing other oceanographic data sets. The instruments used were the Trimble 4000 GPS receiver, the Sperry Mk 37 Model D Gyrocompass, the Ashtec ADU-2 GPS receiver, the GLONASS GPS (Ashtech GG24) receiver, and the Chernikeeff Aquaprobe Mk V Electromagnetic log. The Sperry SRD 421 Doppler log was not operational for the duration of the cruise. In addition to these instruments, a Racal Satcom received GPS SV range correction data via INMARSAT B: this was passed to the Trimble and other GPS receivers to allow them to operate in differential mode. The navigation data were processed twice daily using a standard unix script (*jr57_nav_go*), which called separate Unix scripts for each instrument (detailed below). The main script takes as input the Julian day, and whether the *a.m.* or *p.m.* data is to be processed.

Trimble 4000

The Trimble 4000 in differential mode was the primary source of positional information on JR57. The data were processed using the Unix script *gpsexec0*, called from *jr57_nav_go*. This first calls *datapup* to transfer the data from the RVS SCS data stream to Pstar binary files. It then executes *pcopya*, which resets the raw data flag, and *pheadr*, which sets up the Pstar dataname and header. Finally a *datpik* command is performed to remove data with a dilution of precision (hdop) greater than 5. The two twice daily output files are called 57gps[jday][a/p].raw and 57gps[jday][a/p], these being written before and after the *datpik* stage respectively. The processed data were then appended to a master file called 57gps01.

Gyrocompass

The data stream from the gyrocompass constitutes the most continuous information available on ship's heading. It is involved in processing data from meteorological instrumentation (so as to derive information on true wind velocity), and in processing the Acoustic Doppler Current Profiler (ADCP) data. It is also drawn into the bestnav stream (see below) to derive positional information by dead reckoning during periods of no GPS data coverage. Twice daily processing was performed using the Unix script *gyroexec0*, called from *jr57_nav_go*. This uses *datapup*, *pcopya* and *pheadr* in a similar manner to *gpsexec0* to retrieve the information from the RVS data stream and set the header information; followed by *datpik* to force all the heading data to lie between 0 and 360 degrees. The output file is called 57gyr[jday][a/p].raw. The data were also appended to a master file called 57gyr01. It had been noted previously (on JR55) that the RVS SCS was providing gyro data with numerous duplicate time stamps. To correct for this, a Pstar program (*pcopym)* was written and called from *gyroexec0* to exclude such data from the processed data stream; this was also incorporated into the processing for JR57.

Ashtec ADU-2

The ship's gyrocompass is subject to an inherent error and can oscillate for several minutes after a turn. Consequently, the Ashtec ADU-2 is used to correct errors in the gyrocompass heading prior to input of the data to the ADCP processing. The data were processed using the four Unix scripts *ashexec0*, *ashexec1*, *ashexec2*, and *ashedit.exec*. The first three of these were called directly from *jr57_nav_go*, but it was found that *ashedit.exec* did not operate well when called from a separate script since the *plxyed* editor that it uses tended to crash. Consequently, *ashedit.exec* was run separately after completion of *jr57_nav_go.*

ashexec0 uses *datapup, pcopya* and *pheadr* to read in the data from the RVS data stream, reset the raw data flag, and set the header information. The output filename is 57ash[jday][a/p].raw. *ashexec1* uses *pmerge* to merge in data from the master gyro file (see below), followed by *parith* and *prange* to calculate the difference between the gyro and Ashtec heading, and force it to lie in the range +/- 180 degrees. The output file is 57ash[jday][a/p].mrg.

- *ashexec2* edits the merged data file, using the following Pstar programmes:
- *datpik* - reject all data outside the following limits
- heading outside 0° and 360°
- pitch outside -5° to 5°
- roll outside -7° to 7°
- attf outside -0.5 to 0.5
- mrms outside 0.00001 to 0.01
- brms outside 0.00001 to 0.1
- heading difference ("a-ghdg") outside -5° to 5°
- *pmdian* - remove outliers in a-ghdg of greater than 1° from a 5 point mean.
- *pavrge* - set the data file to a 2 minute time base.
- *phisto* - calculate the pitch limits.
- *datpik* - further selection of bad data outside the following limits
- pitch outside the limits created
- mrms outside the range 0 - 0.004
- *pavrge* - reset the data file to a 2 minute time base.
- *pmerge* - remerge in the heading data from the master gyro file.
- *pcopya* - change the order of the variables.

The output files are 57ash[jday][a/p].edit and 57ash[jday][a/p].ave. Finally, *ashedit.exec* was used to manually remove obvious outliers from a-ghdg and interpolate any gaps in the data, producing the output file 57ash[jday][a/p].ave.dspk.

On JR55, it had been noticed that the time stamping of the Ashtech data stream was delayed relative to that of the gyro data stream. Consequently, the difference in heading contained a component that was correlated with both the input streams, essentially adding a high-frequency component of variability to a-ghdg. Trials to minimise the standard deviation of a-ghdg by adjusting the time stamping of the Ashtech data identified a mean lag of around 0.9s. While the impact of this error is likely to be insignificant once averaging to 2 minutes is performed, it was nonetheless deemed to be unnecessary. The source of the error was not unambiguously identified, consequently it was removed by shifting the times of the Ashtech data forward by 0.9s. This procedure was followed for JR57.

GLONASS

The Ashtech GG24 receiver works by accepting data from both American GPS and the Russian GLONASS satellites. This increases accessibility to satellite fixes, and hence should provide more accurate navigation data than standard GPS coverage allows. However, previous experimentation revealed disappointing performance from the instrument (accuracy approximately 15 m on JR47). Data were logged routinely using *ggexec0,* called from *jr57_nav_go*, but were not used in the processing of other data streams. Filenames were of the form 57glo[jday][a/p].raw**.** Some basic quality control is performed on this file, with the resulting data stored in 57glo[jday][a/p].

Electromagnetic Log

The electromagnetic log gives the water velocity relative to the ship in a fore-aft direction. Data were logged routinely using *emexec0*, called from *jr57_nav_go*. Filenames were of the form 57eml[jday][a/p].raw.

Bestnav

Bestnav is a processed data stream, which contains 30 second interval position data. It uses the best available data source: GPS when available, dead reckoning from the ship's gyrocompass and speed otherwise. On JR57, the script *navexec0* was called from *jr57_nav_go* to read 12 hours of data at a time, and append them to a master file called abnv571. The script first runs *datapup*, *pcopya* and *pheadr* to retrieve the data and set its header information. *posspd* calculates east and north velocities, after which *papend* is used to append the data to the master file. *pdist* calculates the distance run, after which *pcopya* is used to remove the RVS calculated distance variable.

Addendum: Notes on Ashtech data and corrections to gyro data

During the summer of 2000, the *James Clark Ross* underwent refit so as to accommodate a Seatex swath bathymetry system. This system draws in heading data from the ship's gyrocompass, and also derives navigational information from its own two-antenna Ashtech system. Navigational processing is then performed in a more sophisticated manner than the derivation of a-ghdg outlined above. At the suggestion of Dr. Brian King (SOC) on JR55, the possibility of using navigational data from the Seatex system in the ADCP processing was investigated. It was hoped to circumvent the need for the labourious manual processing of Ashtech and gyro data, and to generate a heading or heading correction more reliable than that presently available. A section of navigation data from the Seatex system during JR55 was thus examined. The data featured a low noise level, but the difference between Ashtech and gyro heading was observed to be unstable. Essentially, the Seatex navigation heading tracked the Ashtech heading very well for periods, but then drifted towards the gyro heading (and back) for no apparent reason. It was clear that the data supplied to the Seatex from its own Ashtech antennae were not as reliable as the ADU-2 data in terms of temporal coverage. It is suspected that the siting of the two antennae may be responsible, with satellite fixes often being masked by the ship's mast. If these antennae can be better sited in terms of satellite accessibility, it would certainly benefit the Seapath swath bathymetry, and could potentially be of great benefit to the processing of the ship's ADCP data.

Recommendation

The possibility of re-siting the Seatex Ashtech antennae should be investigated, including consultation with Simrad and Dr. Brian King (SOC). Should this not be feasible, the possibility of feeding the Ashtech ADU-2 data into the Seatex processing system rather than its own Ashtech data should be investigated, since it appears that the ADU-2 performs substantially better.

Scientific gear (Doug Bone)

UOR

Following the complete failure of the UOR system last season the electronics for the powerline modem used to control vehicle 'flight' were replaced by Chelsea Instruments Limited. This season the system has worked well generally but problems have been experienced with the modem. The cause is obscure and not generally repeatable, taking the form of intermittent rather than regular transmissions between the surface and underwater units. This is being investigated in conjunction with Chelsea Instruments Limited.

The UOR was towed for approximately 1800 km, providing good data for virtually the whole of this time. Two major failures occurred, one when some of the copper conductors of the rubber sheathed connector terminating the towing cable fatigued due to flexing being concentrated in one spot. The second when a screw holding the 'wing' pivot in place dropped out. This caused the vehicle to dive to great depth. Fatiguing of connectors is inherent in the system and difficult to prevent completely. Loss of the screw could probably have been prevented by the use of a screw locking compound, the replacement screw has been locked.

RMT

On this cruise a pair of RMT8 nets have been fished for both 'standard' and targeted hauls. For most of the time they have been rigged to allow separate opening of the first and second nets so that entirely separate samples can be taken.

Few problems have been experienced, but there is reluctance for the spreader bar to drop down when the side wires are pulled up, this resulted in the release gear being damaged when the bar came down suddenly while the net was being recovered in darkness. A solution to this problem is being sought. Generally damage can be prevented by careful synchronisation of winch and gantry movements.

On the fifth haul of the cruise one of the nets came back with one entire side missing, this could have been due to a manufacturing fault and will be pursued on return to UK.

Neuston Net

For this cruise, night-time surface netting has been accomplished with a newly constructed 'Neuston Sledge' this has a total mouth area of 0.4 m^2 with a nominal 0.3m^2 submerged, two nets were provided, one with 2.5mm mesh and one with 5.5mm mesh. The fine mesh was used for the majority of the time and proved to very good at catching larval fish, one of the object of the move from the previous 1.0 m^2 frame net that did not fish efficiently.

Antarctic Multiple Plankton Sampler

This net was brought along as a, hopefully, good platform for mounting TUBA, the net is still under development and some time was taken to get it successfully integrated with the Down Wire Net Monitor. After a couple of mechanical problems were identified and remedied two successful hauls were carried out by way of trials. During the first haul the operation of the separate cod-end nets was monitored by an underwater TV camera. Krill were seen entering two nets and were extracted when the net was recovered. The second haul was carried out without the camera, went to 60m and successfully took a total of five samples from two layers identified on the echo sounder.

This operation illustrates the necessity to devote time to trials, problems that only occur in the 'real' situation need to be identified and remedied. It was also very useful to be able to work alongside Paul Woodroffe on the development of the Down Wire Net Monitor ensuring that mechanical changes are integrated with the electronic ones and that the software is written to comply with the requirements of the users.

Longhurst Hardy Plankton Recorder.

This is another potential platform for TUBA and was tried once to check that it worked correctly with the DWNM and to give new operators some experience.

ETS Engineer's Report (Paul Woodroffe)

This cruise has certainly been the most, technical, trouble free trip that I have experienced. The extensive investment in new CTD equipment and modernising other systems has really started to pay off in terms of reliability. Richard Bridgeman and Steve Bremner should be congratulated for persuading the powers that be to spend the money. Richard's spares catalogue and stock control system has also been a great help.

Unfortunately the Oceanlogger is now starting to show its age and this year's replacement system is much needed. The cable for the air temperature sensor was reterminated before the cruise as it had leaked. The PAR sensor was drooping at a 45 degree angle, so that was moved back to the horizontal and the clip tightened. A strange problem occurred on jday 366 which appeared to be some sort of Year 2000 issue with the bios of the Viglen 486 that the Oceanlogger runs on. The software was running but stopped displaying data. This was solved by resetting the date in the bios. Don't ask me why. The date was already correct, but re-inputting the date seemed to make everthing come to life again. On the last science day of the cruise, the foremast sensors went down. This can only be further investigated with a trip to the foremast, and that will have to wait until arrival in Port Stanley.

The latest version of the Net Monitor worked very well with the RMT and LHPR but there are some problems with running the higher current motor in the Multinet. This was solved with a temporary fix suggested by Andy Harris (SOC) but Doug and I will need to come up with a more permanent solution. We intend to make further tests in Stanley if possible. There were minor problems caused by a voltage leak, from a cable or instrument, that we will be investigating in Stanley. It was also found that one of the reed switch cable assemblies on the Valeport flow meters had leaked.

The software was running on an industrial PC purchased for the job this year which made a neat and robust installation. Unfortunately, we didn't have the right video driver for the Intel chipset, but this was quickly sourced by Cambridge helpdesk and FTP'd to the ship within 24 hours of our request, so thanks to them.

The Seabird CTD system has, yet again, proved to be very reliable and, miracle of miracles, has gone the whole way without requiring re-termination. It was, however, necessary to disconnect the cable on a couple of occasions to untwist it. One of the improvements made to the system for this cruise was the commandeering of a large flat screen monitor. This had the advantage of being visible in the bright daylight of the winch control room. Several extra instruments were hung on the frame for this cruise - transmissometer, fluorometer, altimeter and the SBE35 reference thermometer. After initial confusion over what data was coming up what channel, everything seemed to work OK, the altimeter being superb for navigating close to the bottom of the cast though it does tend to pick up a rather convincing false bottom at multiples of 100m from the bottom, thus making CTD operator a bit twitchy. Two of the bottles had to be replaced due to cracking causing leaks. We have plenty of spare bottles on board but will probably need to order some more this summer as the failures probably signal the beginning of the end for the current set of bottles which have been in use since the Ropex project on Endurance.

Other jobs tackled: a problem with the OPC was solved by re-soldering some of the connections on the 2 boards inside the pressure housing.

The GPS signal to the SCS was routed directly to the computer room via the ABC cabling in the JBL wiring system.

Some of the redundant cables were removed from the overhead cable trays and scientific wiring in the UIC room.

TUBA Cruise Report (Nick Crisp & Andy Harris, Southampton Oceanography Centre)

The Towed Undulating BioAcoustic Sensor, TUBA, (Crisp & Harris, 2000) is a high-frequency, multi-frequency sonar operating at seven frequencies from 175kHz to 2.2MHz, designed for the study of oceanic zooplankton abundance. A joint project between the Ocean Technology, and George Deacon Divisions at SOC, TUBA is designed to be used in combination with other bio-chemical/physical sensors on towed platforms such as undulating vehicles such as SeaSoar, or with net systems. A successful joint Antarctic Funding Initiative (AFI) bid with BAS had secured 3 days of ship time for experiments using TUBA mounted on the BAS Multinet system for the study of the fine-scale structure, and acoustic signatures of zooplankton aggregation in the Southern Ocean.

The current TUBA instrument is based on an earlier prototype that was successfully used on the SeaSoar undulating vehicle in the Mediterranean, and on a tow-yo frame, incorporating a CTD, in the straits of Gibraltar. The earlier prototype was, however, flawed in design in terms of the frequencies which were harmonically related, and therefore, interfered with one-another, and was insensitive at the higher frequencies due to the transducer design. Consequently, funding for a second, improved instrument, including 5 new transducers for the higher frequencies, was obtained and has resulted in a complete re-design of the instrument.

External factors and conflicting commitments have delayed the building of the new TUBA, and in order to get the instrument ready for this cruise, it was necessary to work on it in the laboratory until the last moment. The Gear was shipped from SOC on the 4th of December using a commercial freighting company and was to arrive in Stanley via Florida and Santiago within 7 days. Our worst fears were realised, however, when news arrived that our consignment had not made the flight from Santiago to Stanley in time for the ship sailing, and so discussions about the best course of action were taken up with the PSO, Captain, and colleagues at both SOC and BAS.

The outcome of our discussions was that we would stay onboard for the present cruise, continuing to work on aspects of the TUBA project that did not require having the instrument present (such as the acquisition software, circuit refinements, and general documentation), and help out with other cruise activities as required. As Brierley and Harris were already participants on the following AUTOSUB cruise (as PSO and AUTOSUB support respectively), an extra 3 berths and a day of ship-time were very kindly found for the remainder of the AFI team, so that our experiments could go ahead.

During the cruise, some difficulties with the Multinet electronics were encountered. Techniques employed in the TUBA electronics were successfully applied and helped to overcome the major problem.

The following enhancements were made to the TUBA acquisition software during the cruise:

- The capability for saving & reloading configuration files for TUBA was added. These are in an ASCII form so that they can be edited if required, by the user. Parameters include ping rate, pulse width, transmit power, receive gain, which transmitters & receivers are enabled, receive bandwidth, sampling bin size and distance from transducer head.
- The main user-interface was altered with the addition of a horizontally scrolling ‘echogram’

style graph to display last 1000 data points for each frequency, so that recent data can (up to 100 seconds worth, at a ping rate of 10 Hz) be observed. Previously, the real-time displays for TUBA were updated on a ping-by-ping basis and did not retain data.

- The binary format for TUBA data files was completely revised and tested, with the inclusion of all of the instrument's settings in the data header. A data replay capability is still under construction. Ultimately this will allow user to identify, and calculate MVBS for single targets. This will be achieved by selecting the target in the time-domain display window (effectively reducing the sampling volume to include only the item selected).

Both a Technical-Manual, including detailed test procedures, and a User-Manual are currently in progress.

References

Crisp, N.A. and Harris, A.J.K., 2000. "TUBA II – A compact multi-frequency sonar suited to use in autonomous or towed platforms for the study of upper-ocean zooplankton distribution and abundance", Proc. 2000 Int. Symp. on Underwater Technology. 23-26 May 2000, Tokyo, Japan. 6pp.

Data Logging System (Andy Barker)

SCS

The SCS data logging system has performed well throughout the entire cruise. During initial testing at FIPASS the machine locked up on several occasions, the problem was traced to a faulty digi I/O board. Following replacement of this with a spare, the system has been trouble free. Arrangements have been made with Cambridge to provide a replacement at the start of JR58 (Autosub cruise).

The SCS instrument configuration file has been modified to allow the net Monitor to be logged. Details are as follows:

Sensor type = NMEA Parent	Com port = COM 12
Baud rate = 9600	Record Size = 255
Termination = CR(13)	Sentence Label = $NETMON

Variables being logged are:

flow, flow2, depth, angle, cond, spare, par, fluor, alt, temp, net1, net2, cmd,type

The SCS system has been used to redistribute GPS signals to the EK500 and pc in the UIC room running RTMS (Real Time Mapping System).

This is the only change within the SCS system. For further information about the SCS system/ instrumentation set-up and configuration please refer to the document "SCS System Documentation", BAS reference No. TS0018 (August 2000).

Java Logging System

An additional level A type instrument has been logged throughout the cruise, this is the Chelsea Instruments Aquashuttle. The AtoSCS Java program has logged this. To log this instrument use the command Java AtoSCS aquashut.cfg

Details of the aquashut.cfg (aquashuttle configuration file are as follows:

```
INST=AQUASHUT
VARS=COND,TEMP,PRESS,CHLOR,TRAN,PAR,WIFD1,WIFD2,WIFD3,WIFD4,WI
FD5,WIFD6,WIFU1,WIFU2,WIFU3,WIFU4,DEPTH,CDPTH,WING,STRAN
BAUD=9600
COMM=COM20
RAWF=d:\datalog\jr57\aquashut.raw
NOAA=d:\datalog\compress\aquashut.ACO
STAT=d:\datalog\status\
```

Java Logging System has also functioned throughout the entire cruise without any problems.

Version numbers of Java applications are as follows:

AtoSCS.java	1.01
Datamon	1.00
Gyro	1.00

Unix Systems

JRUF the central UNIX box was unable to print, share or mount file systems after mains power failure on the 10th December. The problem was traced to an incorrect start-up script for the DNS (Domain Name Service) server. Modification to this and subsequent restart of the script soon resolved the problems.

NetWare server & PC's

The NetWare server and GroupWise email system has functioned well throughout the entire cruise. Sigmaplot 2000 has been installed on all PC's in the dataprep room. Several users have raised concerns about the reliability of Quattro pro, it seems to constantly crash. ITS will investigate to see if an update from Corel is available to hopefully resolve problems.

Sophos antivirus has been installed on the NetWare server to scan files on a daily basis. The Sophos client has been installed on all Windows NT machines throughout the vessel.

Data Management (Nathan Cunningham)

The underway data is still split into two components, the physical oceanography implementing PSTAR and analysed primarily for the oceanography and data that is used and analysed primarily back at Cambridge. All the data is saved in the PES pesto data storage system.

The JR57 cruise is the first core programme cruise to use the newly implemented SCS system. Traditionally a Virtual Data Management (VDM) system was used to split the data streams coming into the old level C, into 24 hour segments, and saved the files into the predefined PESTO data structure, corresponding to the logger used. The pesto data structure will still be implemented, but further work is required at Cambridge to full implement the new SCS system into the existing VDM system and scripts. The daily ASCII files for each of the binary RVS data streams will therefore be available shortly after returning to Cambridge.

All the collected onboard from the SCS, the RVS and the public network drive has been backed up to multiple tapes to return to Cambridge. Please refer to the Technical Services Instruction Manual: SCS System documentation (Ref BAS: TS0018) for a detailed list of the entire data streams and configurations etc.

Cruise Data

The cruise data is held in a general Quattro Pro spreadsheet called Event Log. The event log contains information on station events in the following fields (Table 12) and is updated daily from the ships scientific log. The scientific log is held on the bridge and only the bridge issue event numbers. This limits the chance of multiple numbers being issued to the same event.

Table 12: Definition on Event Log Fields

Name	**Type**	**Length**	**Description**
Event Number	Integer	3	Unique identifying code issued by the bridge.
Event Type	Character	not fixed	Name of equipment being used e.g. XBT, Bongo
Start JDay	Integer	3	Julian day of when the event started (GMT)
Start Date	Date	dd-mmm-	Start date of the event (GMT)
Start Time	Time	hh:mm	Start time of the event (GMT)
End JDay	Integer	3	Julian day of when the event ended (GMT)
End Date	Date	dd-mmm-	End date of the event (GMT)
End Time	Time	hh:mm	End time of the event (GMT)
Local Time Difference	Integer	1	Time difference between local and GMT
Station name	Character	not fixed	Identifying station name
Comments	Character	not fixed	Comments
Start Lat	Float	10	Start latitude of the event, obtained from the RVS using
Start Long	Float	10	Start longitude of the event, obtained from the RVS
End Lat	Float	10	Start longitude of the event, obtained from the RVS
End Long	Float	10	Start longitude of the event, obtained from the RVS
Scientist	Character	not fixed	Scientist who decided on event type protocol

The Quattro Pro event log also contains another table (Table 13) called Transect Log. This is used to record the information on when the transects were started and completed, and is held in the following fields.

Table 13: Definition of Event Log Fields

Name	Type	Length	Description
Name	Character	not fixed	Name of the transect leg being surveyed
Description	Character	not fixed	Short code to identify the transect
Activity	Character	not fixed	Type of survey work being done on transect
Start Lat	Float	10	Latitude of the transect way point
Start Long	Float	10	Longitude of the transect way point
Start JDay	Integer	3	Julian day of when the transect started (GMT)
Start Date	Date	dd-mmm-yy	Start date of the transect (GMT)
Start Time	Time	hh:mm	Start time of the transect (GMT)
End JDay	Integer	3	Julian day of when the transect ended (GMT)
End Date	Date	dd-mmm-yy	End date of the transect (GMT)
End Time	Time	hh:mm	End time of the transect (GMT)
Comments	Character	not fixed	Comments

Both the event log and transect log are checked and validated using RTMS GPS package developed by Andy Barker which plots the planned cruise track of the ship and the actual cruise track of the ship. The position information held in the event log and transect log is plotted in RTMS GPS and the actual cruise track is overlaid, and subsequently any discrepancies can be identified.

Recommendations:

To integrate the SCS system into an underway data management system and subsequently store the ASCII files the PESTO data structure. With this implementation, the web based data mining tool that is being developed for PESTO could be implement on the ship wide network. This will allow easier access by the ships' scientific personal to the underway data

Appendix 1 Crew List

Scientific Party

Andrew Barker	BAS	Computer Support
Doug Bone	BAS	Technical Engineer (Gear)
Andy Brierley	BAS	Acoustics
Juliette Butcher	BAS	Zooplankton
Richard Cable	BAS	Computer Support
Olga Crighton	BAS	Phytoplankton
Nick Crisp	SOC	Software Engineer
Nathan Cunningham	BAS	Data Manager
Sharon Grant	BAS	Underway Oceanography
Andrew Harris	SOC	Electronic Technical Support
Rebecca Korb	BAS	Phytoplankton
Mike Meredith	BAS	Physical Oceanography
Tony North	BAS	Fish Biology
Rachael Shreeve	BAS	Zooplankton
Sally Thorpe	BAS	Physical Oceanography
Peter Ward	BAS	Zooplankton/Principal Scientist
Jon Watkins	BAS	Krill Biology
Mike Whitehouse	BAS	Nutrient Chemist
Paul Woodroffe	BAS	Electronic Engineer
Rachel Woodd-Walker	BAS	AFI Post Doc

Ship's Company

Jerry Burgan	Master	Colin Lang	Bosun
Graham Chapman	Chief Officer	Dave Peck	Bosun's Mate
Justin McCarthy	2/O	Martin Bowen	SG1
Neil Mcleod	3/O	Kelvin Chappell	SG1
Steve Mee	R/O	Keith Dickson	SG1
Duncan Anderson	Chief Engineer	Luke Trussler	SG1
Colin Smith	2/Eng	Dave Bretland	MG1
Rag Macaskill	3/Eng	Erwin Allan	MG1
Gerard Armour	4/Eng	Danny McManamy	Chief Cook
Keith Rowe	Electrician	Tracey Macaskill	2/Cook
John Summers	Deck Eng	Lee Jones	Snr Stwd
Hamish Gibson	Cat/Off	Simon Hadgraft	Stwd
Pippa Bradbury	Doctor	Mike Weirs	Stwd
		Graham Raworth	Stwd

Appendix 2 Event Log

Appendix 3 Transect Log