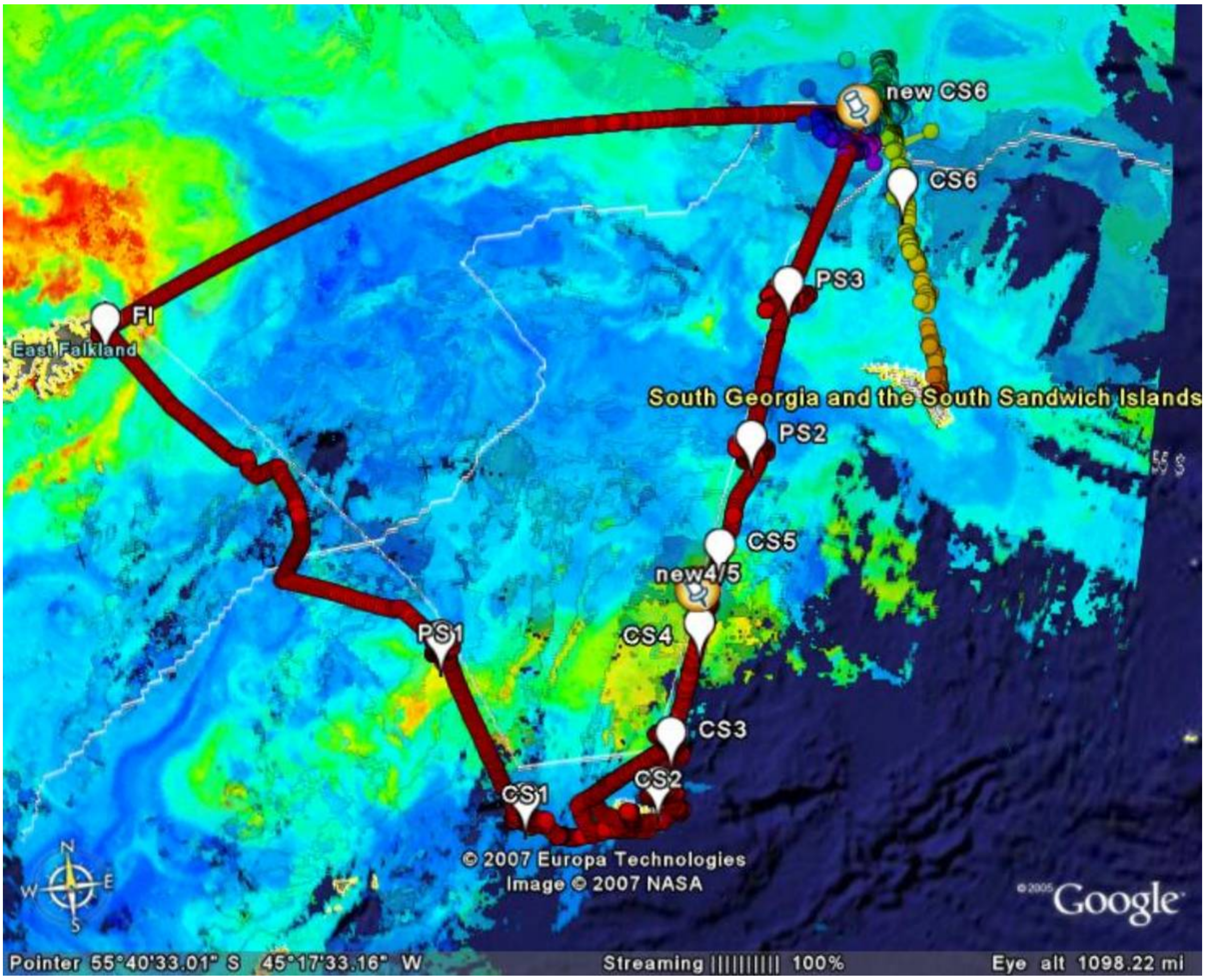
Discovery 2010 Spring Cruise



JR 161

October 24th – December 3rd 2006

A study of pelagic marine food web interactions and condition factors of zooplankton across the Scotia Sea

British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

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Rachael Shreeve PSO

Background

Three cruises, to be conducted in austral spring, summer and autumn, are planned as part of the Discovery 2010 programme. The remit of this programme is to investigate and describe the responses of the Southern Ocean ecosystem to climate variability, change and commercial exploitation. ‘Discovery 2010’ builds on the previous BAS programme DYNAMOE, a key finding of which was that highest primary production occurs down stream of South Georgia, almost certainly as a result of enhanced iron concentrations. It has also been demonstrated that this enhanced production has strong links to the mesozooplankton abundance and condition. During the next three field seasons we wish to investigate regions that contrast within this system, to enable us to understand the mechanisms that control productivity and how these affect the food web as a whole. Recent research has show that the idea of a simple foodweb dominated by krill is rather simplistic, and that other zooplankton groups do play an important role in secondary production. Their importance in the food web however, has yet to be fully quantified. The aim of this first cruise was therefore to broaden our understanding of carbon flux through different trophic pathways during austral spring, in contrasting regions.

For more information about the science planned during Discovery 2010 please see ‘Discovery 2010 programme statement’ (appendix 2).

Cruise Design

During the planning of this series of cruises we chose to occupy fewer stations than on previous surveys, but to study those we do in more detail. We spent up to 4 days at a location in order to fully characterise it and its associated variability. Sampling was planned to take place at nine stations in total. Three of which were to be occupied for 4 consecutive days (our main process stations) and six other for two days each (condensed stations).

The locations of the three main process stations were chosen on the basis of their contrasting primary productivity regimes. The first was located in an area that has historically been described as a typical High Nutrient Low Chlorophyll environment, in waters lying between the Polar Front and SACCF, in the western region of the Scotia Sea. The second station was placed in an area upstream of the Island of South Georgia that normally displays low productivity and the third was situated down stream of South Georgia, where the influence of the island creates areas of high productivity. At each location observations were made on ocean physics, micro and macronutrients, phytoplankton, zooplankton and higher predators. Repeat measurements on three consecutive days were made of the physical characteristics, nutrient and phytoplankton composition. Primary productivity incubation experiments were set up, and phytoplankton response to iron enrichment monitored. The iron limitation work was conducted in collaboration with students from NOC, and relied on equipment hired from UKORS (NMF Sea Systems).

Zooplankton were collected using a variety of nets that gave depth resolution of different size classes of plankton. The LHPR was deployed routinely to 1000 m to profile the water column with a high degree of resolution, mainly capturing the smaller zooplankton size classes, mainly copepods. The MOCNESS, and later in the cruise the Multinet which was used when the MOCENSS failed, were deployed to 1000m and nets fished in 125m intervals to capture copepods for CHN analysis, and to provide pteropods for studies of the condition on their shells. The RMT 25 net was used throughout to sample fish, krill and larger zooplankton. Finally the bongo net was used to collect live copepods in the top 400m for experimental purposes, principally *Oithona sp*. grazing and to describe community composition.

Mesoscale acoustic surveys were undertaken at each station and higher predator observations were routinely taken in daylight both whilst underway and at stations.

At the condensed stations a similar range of equipment was deployed, the main difference being that over two days there was less repetition. The condensed stations were aimed mainly at looking at the differences in community composition and body condition of copepods across a latitudinal range, from the ice edge to the Polar Front.

Cruise outline

The transect and station positions are given in Fig. Proposed Cruise Track. The first transect ran from the Falkland Islands to the ice edge near to Signy Island (South Orkneys). On the first part of this transect we ran the Continuous Plankton Recorder (CPR). This was recovered once we reached the position of the first main process station. This was sited in an area that was generally thought to be of a very High Nutrient and Low Chlorophyll regime. Having successfully sampled this station we moved off to our first Condensed station site. The position of this had to be changed slightly due to the original site being in uncharted waters, we also moved further south to be as close to the ice edge as possible. One of the logistics requirements of the cruise was to undertake the opening of the summer only base at Signy during the first third of the cruise. Signy relief was not possible at this time due to sea ice conditions which were too thin to allow a sea ice relief and too thick to allow the deployment of boats. Given that we had other stations in the area and also 12 hours of AFI fishing to do (AFI Rock/Carvalo) we moved off to sample these before heading back to Signy.

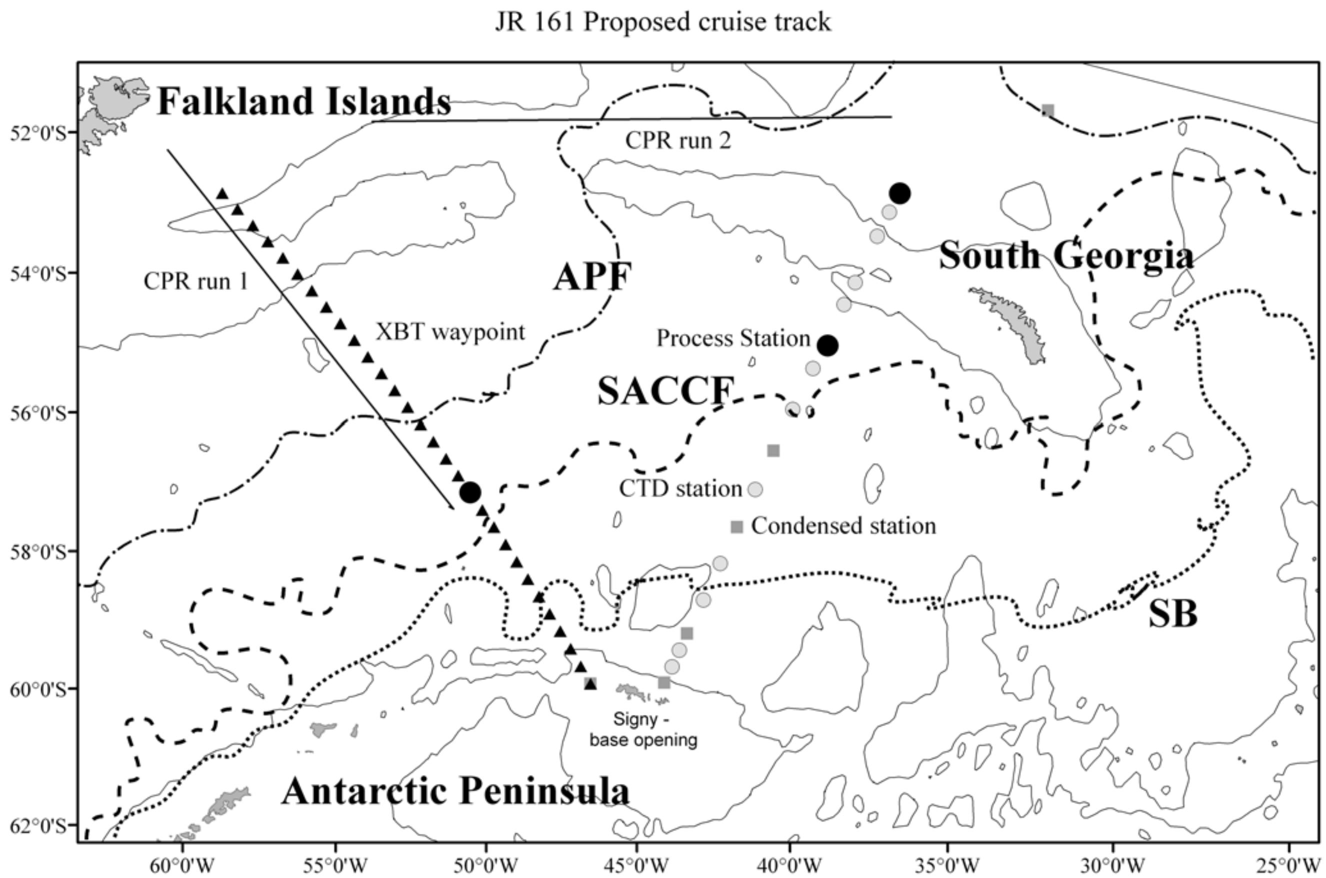
Eventually we managed to get all cargo ashore at Signy, but at a loss of 3.5 science days, which meant we lost 4 CTD stations, one full condensed station and had to reduce the sampling at another. We then moved off to sample the other stations along our main transect which ran from Signy towards the Polar Front to the North of South Georgia, under the path of a satellite altimeter track. Stations along this transect were between 40 and 180 nm apart. The location of the final condensed station was dictated by the position of satellite tagged king penguins out on a foraging trip from South Georgia earlier in November.

We were due to deploy 2 moorings with sediment traps, one in the unproductive waters upstream of South Georgia (PS2) and one downstream in the highly productive region (PS3). In the end we were only able to deploy 1 of these due to equipment not arriving in time. We deployed the sediment trap in the productive site (PS3) and have an agreement to deploy the other trap later in the season.

The CPR was deployed once again on the transect running from the final condensed station back towards Stanley, crossing over the Maurice Ewing Bank en route.

ADCP, SWATH and Acoustics. These three activities were not compatible on this cruise. There was interference that caused bad acoustic data whenever the ADCP or SWATH were turned on, equally the ADCP data was compromised when the SWATH was turned on. A decision was made to prioritise the Acoustic data along most of the transects. SWATH was only turned on when we were looking for a site in which to deploy the sediment trap mooring. ADCP data was collected on the way back to Stanley as this was needed in order to calibrate the oceanography data.

Figure: Proposed Cruise Track



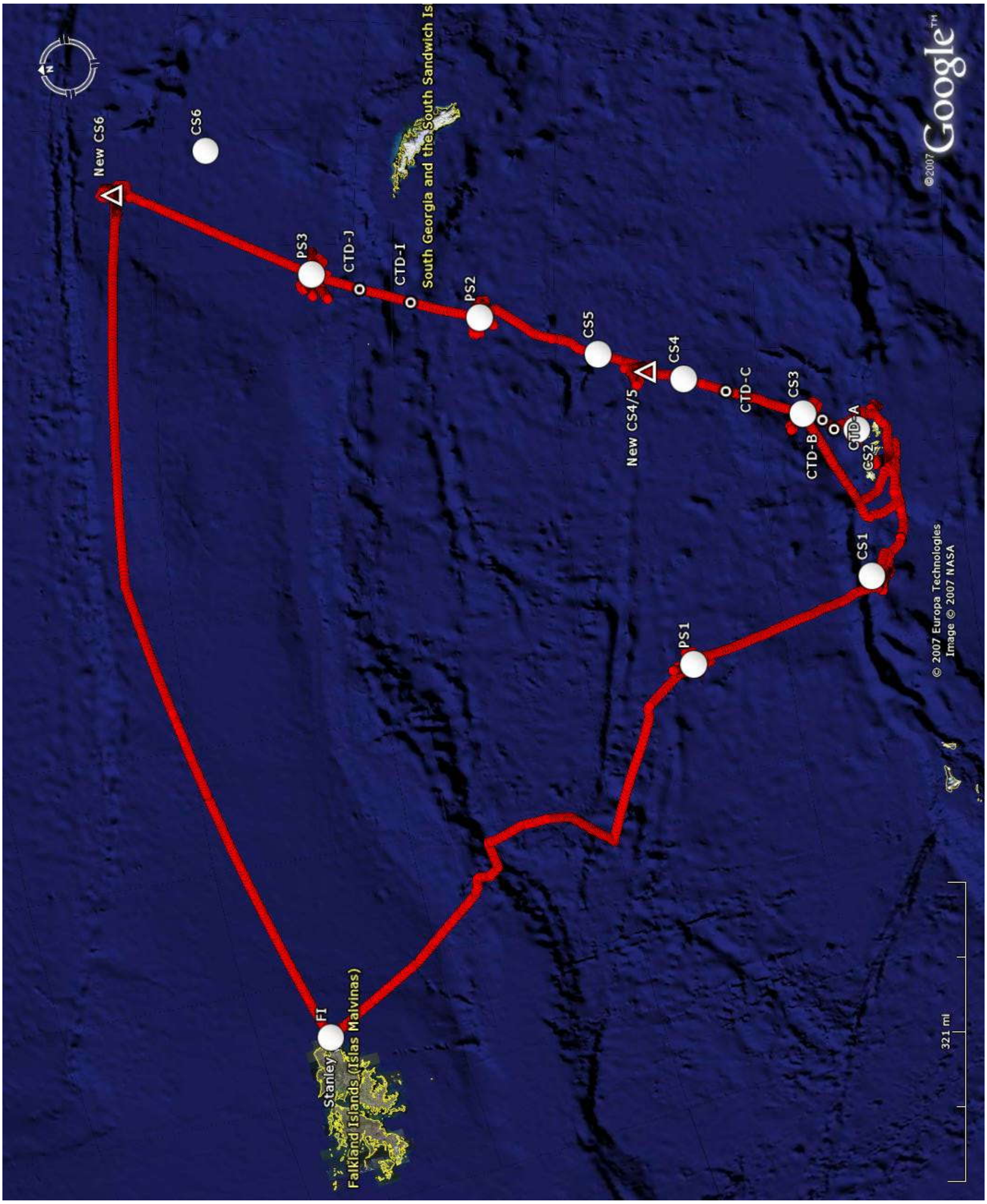
▲ XBT waypoint

● Process stations

■ Condensed stations

● CTD stations

Actual Cruise Track



Cruise Narrative

PSO Diary

19/10/2006 21:55
Thursday 19th October. All science party fly from Brize Norton to Falkland Islands. Arrived to a windy, cloudy FI, but on time. Moved onboard JCR straight away with a welcome from many familiar faces and a few new ones.

20/10/2006 21:57
Friday 20th October. 08:00 hrs started mobilisation of cruise JR 161. Unpacked containers and now most of equipment for the cruise is onboard and distributed around the labs. There are some issues with equipment not being delivered by UKORS that are we are looking into. Assembling of all nets systems has begun.

21/10/2006 22:01
Saturday 21st October. 08:00 hrs continued mobilisation. There have been problems finding all chemicals for the cruise, some of which have been packed in large crates too big for the chemical lockers onboard and different hazard classes mixed together. All chemicals were found by the end of the day. We are experiencing a number of problems with the equipment from UKORS. Firstly we cannot locate the lowered ADCP that we were expecting. In addition there are no bottles or release mechanisms for the 24 CTD frame either. Finally the clean chemistry container laboratory is not suitable for use on deck. There are large gaps in the doors which have leaked on the way down causing some internal damage, we are looking into how we can make this seaworthy for our cruise.

22/10/2006 22:10
Sunday 22nd October. 08:00 hrs continued mobilisation. 13:00 hrs safety brief from shipside followed by brief introduction for all science party on the running of the cruise and ship.

23/10/2006 22:11
Monday 23rd October. LADCP arrived unexpectedly from UKORS. Assembly of 24 CTD frame with the LADCP and 12 BAS water bottles started.

24/10/2006 22:13
Tuesday 24th October. Shore leave expired at 13:30 followed by general emergency drill for all scientists. Sailed from FIPAS at 16:00. Trialed the CTD 12 bottles on the 24 bottle frame, all working OK. Got underway and deployed the magnetometer and CPR. Bit of a swell.

25/10/2006 22:14
Wednesday 25th October. Started XBT's in the early hours. Most failed to deploy properly. XBTs are type T5, for which we need to deploy at a ship speed of 5 knots. This alone would slow us down, but in addition the swell is against us we are also changing course for their deployment. We will no longer slow down for their deployment as we are loosing 20 mins every 2 hrs for them. Currently there is a large swell against us with winds around force 7. There have been 2 false fire alarms in the

UKORS clean chemistry container. The current system has been replaced by JCR engineers and is now working properly.

26/10/2006 22:26
Thursday 26th. Bad weather has impeded our progress and we have diverted off course to allow a more comfortable passage to the first process station. This has allowed the repair of the mid ships gantry and the marking and loading of wire for the bongo net. We bought in the magnetometer, which allowed us to turn whilst still towing the CPR. PM, we started making our way back towards our transect line. Once we rejoined the cruise track we brought in the CPR, and continued on our way to process station 1. Around 22:00 we arrived at first station, the sea swell had gone down as had the wind, so we began the station fishing with the MOCNESS system. We lost contact with this at 300m and the haul was aborted, however this was a minor cable problem that was easily rectified once it was back on deck.

27/10/2006 13:00
Friday 27th. Station activities continued as planned, weather much abated. CTD water bottles put on in reverse order, but now rectified. Some minor changes made to the running order of equipment deployment to make a more efficient use of time. A lot more production was found at this station than expect for an area believed to be of a high nutrient low chlorophyll profile. There has been a failure of the RMT 25 release mechanism for which we have no spares or up to date documentation. This has now been resolved using the spare RMT 8 mechanism, however this remains a major cause of concern, as without this we can't undertake the science we have planned. This should be addressed promptly when we return to Cambridge.

28/10/2006 13:01
Saturday 28th. Started off rather badly with the LHPR not spooling gauze on correctly, this again is a result of an old net monitoring system for which we have few spare parts and little documentation. Thorough review of this system is urgently needed. We lost communications with the CTD whilst it was at 3000m. The fault was traced to the deck unit that had blown both fuses. At present we do not know why this happened and we are now using the only spare deck unit we have onboard. MOCNESS and RMT 25 currently working OK. Bongo, go flo and FRRF also working OK at present, although the UKORS winch for the go flo bottles is leaking hydraulic oil.

29/10/2006 20:01
Sunday 29th. Third day of Process Station 1. Work continued according to the station plan. LHPR worked OK on the daytime deployment and the failed night time deployment was repeated. The Bongo frame came loose from its lashing and fell to the deck. This caused some damage to the frame but no one was hurt, however this is a major safety concern.

30/10/2006 22:53,
Monday 30th October. RMT 25 fishing continued, little was caught in the upper layers during daylight. Acoustic survey undertaken in a box pattern around the waypoint. More water was collected via Go flo and tow fish for the Iron limitation work because there seems to be some contamination of the water. The failed MOCNESS night time haul was repeated.

31/10/2006 22:53
Tuesday 31st October. On passage to the first condensed station that will be at the ice edge to the west of Signy. XBTs have worked much better without the Magnetometer out, although are still not giving full depth profiles at 12 knots, reduced to 8 knots for one XBT and got a good deep profile. After breakfast had a safety brief for the opening of Signy, and after lunch a brief science meeting. Nathan gave an overview of using the L drive to archive all data for the cruise, and also the polar view google earth project which maps ice cover, JCR track and a few other links. Summary of station so far, high nutrients and low primary productivity and chlorophyll as was expected, the water column being well mixed. Zooplankton higher in the water column than may have been expected and some species showing signs of reproduction, full ovaries and some nauplii stages present. Myctophid layer showing most of the time but no krill swarms in the area. There is a 0.6 degree change in temperature, from - 0.2 to + 0.4 oC as we go backwards and forwards fishing, which may be due to an eddy of sorts; the myctophids are only found in the colder water. Myctophids had little in their guts and showed a high level of net avoidance in daylight in the shallow nets. Arrived at Condensed station 1 at 17:45, the location of this station has been moved to a. avoid uncharted waters and b. to get nearer to the ice edge. Started the station activities with an RMT haul.

01/11/2006 11:51
Wednesday 1st November. MOCNESS computer failed but a replacement has been put together and the system is now up and running again. Sea is being very kind to us and we have been able to deploy all instruments today.

02/11/2006 11:50
Thursday 2nd November. All net sampling went according to plan and we had 2 extra hours for Acoustic survey. Summary for the first condensed station; good contrast with first process station in that much of the zooplankton was still at depth still displaying overwinter characteristics. A few krill marks have been seen acoustically, too small and infrequent to target fish, but a shallow trawl did catch a few hundred krill, a mixture between small juveniles and larger adults. The station was completed at 17:00 and we made our way towards Signy. Hit ice towards dark and we heaved to awaiting daylight. A quiz in the bar in the evening was enjoyed by all.

03/11/2006 10:58
Friday 3rd November. Pushed through ice all day towards Signy, arrived late afternoon. The fast ice covers the whole of Borge Bay from the east, running right in to the Base. It was too late to begin assessing the pack ice, this will happen first thing tomorrow.

04/11/2006 19:03
Saturday 4th. November. Sea ice was tested by Matt Jobson and Dave Routledge and found to be too thin to support a sea ice relief. As the ice is also too thick to allow the deployment of boats, we have elected to move out to the west and do the AFI 6/16, JR 152, fishing for fish larvae, followed by condensed station 2, CTD station A & B and Condensed station 3, before reassessing the situation. Spent 10 hours fishing for fish larvae with the RMT 25 and Neuston net. Caught only 6 fish larvae of the species required, also numerous krill. Moved off towards Condensed station 2.

05/11/2006 11:09
Sunday 5th. November. Undertook day one of the second condensed station, starting with deep CTD cast. Ice hindered fishing to some extent and hauls had to be undertaken in a restricted manner or cut short.

06/11/2006 11:50
Monday 6th. Continued with condensed station 2. Ice has restricted what fishing can be done, but we now have at least one profile of each net type. The phytoplankton is very healthy around here, but there is not a great concentration of chlorophyll, whilst krill seem to be feeding well and there are lots of faecal pellets in the water. There were some nice patterns between krill acoustic targets and birds diving for food, observed whilst running the acoustic transect.

07/11/2006 19:05
Tuesday 7th. Moved off to Condensed station 3. Started activities with RMT target fishing at around 18:00. RMT mechanism not working properly – this has now been resolved.

08/11/2006 19:05
Wednesday 8th. Continued with activities on CS3.

09/11/2006 19:06
Thursday 9th. Continued with final day of condensed station 3, finishing with acoustic survey. Made our way back towards Signy18:00.

10/11/2006 19:06
Friday 10th. Off Signy. Conditions suitable to run Humbers but not cargo tender, into landing point near hut. Put Signy personnel ashore and ran some essential cargo ashore that could be hand carried across the hill and down to the base.“ Signy personnel returned to ship late afternoon to stay the night on the ship. Remained offshore all night.

11/11/2006 19:07
Saturday 11th. Conditions suitable to run Humbers with essential and light weight cargo. Cargo runs continued all day, and now most of the cargo that can be hand carried over the hill has been done. The sun came out around lunchtime and gave us one of the best days we could expect at Signy.

12/11/2006 19:07,Sunday 12th. Weather conditions deteriorated, winds high although ice is starting to break out form around the island. Remained in the vicinity all day.

13/11/2006 20:10,Monday 13th. November. Weather conditions again unsuitable for cargo relief to Signy. Remained in vicinity all day.

14/11/2006 20:12
Tuesday 14th. November. Weather conditions suitable to run the cargo tender. We shipped all cargo to the base, finishing around 18:30. After making the ship ready for sea we departed to continue with the science.

15/11/2006 20:17

Wednesday 15th. November. Having lost 3.5 days to Signy relief we have steamed back to the track from where we broke off on the 9th. We will have to cut 4 CTD stations and most of condensed station 4 and possibly all condensed station 5 in order to preserve Process stations 2 & 3 and condensed station 6. We should arrive at the first CTD station at 19:00 this evening. We will continue to CTD station E where we will also undertake condensed station 4.

16/11/2006 14:14
Thursday 16th. Deployed XBTs on way to CTD station E. Started Condensed station 4 at around 08:00 with a bongo net. Followed by rest of station activities.

17/11/2006 14:14
Friday 17th. Condensed station 4 – There was a huge quantity of phytoplankton at this station, Centric diatoms, Thallassiotrix antarctica and Nitzschia fragilariopsi. Stage CV Calanoides acutus dominated the upper layers with very few males or females compared to previous stations at any depth. Krill were in the area and their faecal pellets were of various colours and consistencies. Fin whales were also observed in the area.

18/11/2006 14:14
Saturday 18th. Finished CS 4 and moved off to CTD station F. Conditions were too bad to deploy the CTD here, so we deployed XBTs and moved off to Process station 2. This station started with a Deep CTD at around 03:30 ship time. Activities continued, communication with the LHPR was poor, especially upon recovery. The MOCNESS was deployed in the night and a similar failure happened during hauling. A krill swarm was targeted in the late evening with the RMT 25 that yielded a 150kg haul of E. superba. This ripped the net and needs repairing before we can re-deploy.

19/11/2006 11:34
Sunday 19th. One of the Bottles on the CTD has cracked and has been replaced. The RMT 25 net is repaired. Peter is looking into the termination of the Biowire as a source of the problem with both the LHPR and MOCNESS.

20/11/2006 11:34
Monday 20th. The linking ring on the biowire has been replaced and LHPR is working OK on deck now. The MOCNESS has stopped all communications. There is nothing obvious at fault and without wiring diagrams and spares it is almost impossible to rectify at sea. The Mulitnet has been made ready for deployment, and we will use this to characterise the water column at 5 depths (1000 – 700, 700 – 500, 500 – 400, 400 – 200m, 200 – 125 and the top 125 will be sampled with the bongo net.

21/11/2006 11:35
Tuesday 21st. Both Down Wire Net Monitors (DWNM) appear to have minor faults. These are being repaired as best we can but these units are living on borrowed time. They are very flaky and we are loosing time with having to repeat hauls, some of these repeated hauls are still not working. The Multinet and RMT are working OK with the DWNM's but the communication with the LHPR is intermittent. The fault appears to occur once we start hauling on the Biowire. This wire has now been re-terminated.

22/11/2006 11:44
Wednesday 22nd. Finished station with the FRRF in the dark and proceeded to CTD station I. Full depth CTD. Proceeded to CTD station K, undertook full depth CTD there too. Moved off towards Process station 3. Started station activities with a targeted RMT, which very successfully caught krill. Waiting for the biowire re-termination to set before use.

23/11/2006 11:44
Thursday 23rd. Started the day with an FRRF and moved through the normal station activities. Bad weather stopped deck work around 13:00. We tried to run acoustics, but the data was poor, so we switched to SWATH and surveyed the area for a suitable area for the mooring site. Whales everywhere, mostly fin whales.

24/11/2006 11:45
Friday 24th. Around 8:00 weather conditions had calmed sufficiently to deploy the CTD. Station work continued as the sea continued to subside. Biowire was tested and OK. LHPR deployed followed by RMT.

25/11/2006 13:39
Saturday 25th. Station work continued at around 05:30 with CTDs and Bongo nets. SWATH was used to find a suitable area to deploy the mooring. We were lucky to have a very calm sea, the mooring deployment went well and it now sits at.

26/11/2006 17:25
Sunday 26th. Continued with PS3 activities.

27/11/2006 17:26
Monday 27th. Moved off towards CS 6 at around 02:00.

28/11/2006 17:26
Tuesday 28th. Arrived at CS6 later afternoon and started with an RMT deployment.

29/11/2006 17:26
Wednesday 29th. Continued with Station activities, a few King Penguins have been spotted. Bad weather stopped play around 15:00.

30/11/2006 17:26
Thursday 30th. Weather improved by around 07:00. Fault finding deployment of LHPR to 500m. Software still registering more gauze advances than have actually occurred. This is possibly due to net monitor problems, but needs to be addressed before next season. A targeted RMT 25 haul finished the station activities at CS6 and we set a course of 270 back to Stanley. The magnetometer was deployed at CS6. The CPR was deployed at 16:00 to be towed across the Maurice Ewing Bank up to 500 Nm.

01/12/2006 23:35
Friday 1st. Starting demobilisation, dismantling net systems and generally packing. There was a fire drill for all science personnel followed by safety videos. An evening buffet and quiz was a pleasant evening to mark the end of the cruise.

02/12/2006 23:35
Saturday 2nd. Continued demobilisation. Recovered the CPR, magnetometer and tow fish at 10am. Intensive report writing and packing,

03/12/2006 18:37
Sunday 3rd. Docked at 8am to a glorious Falklands day. Got straight into cargo and finished all by 16:00.

Daily Activities and Timings

Wednesday 25th October science

XBTs deployed at waypoints, ship speed 6 knots.
Bongo wire to be marked and put onto winch.
Deploy tow fish – pm.
Go flo bottles to be trialed on deck.

Thursday 26th October Science – weather permitting

Start activity which is scheduled for that time of day on the timetable for Process station.

Complete all activities for that day, this may mean looping back on the timetable to the start of that day. Before starting day 2, again at whatever activity we are due to do at that time.

Target fishing for krill – We will only fish for targets if we see good ones! Sophie will mark any we see on the way into the station. We will go back to these and try and fish them if there is any chance of finding them again. Failing this will adopt a search for krill targets. This will consist of travelling down wind looking for targets, once targets are located we will make the bridge aware, we can then turn the ship around and fish. The amount of time we can spend looking for targets will be variable and will be determined nearer the time.

Thursday 26th October Science – second entry

Sort out cable on tow fish for easy deployment

If XBT's continue to fail we can try bringing in the magnetometer. We will no longer slow down and change course for their deployment.

ETA to first process station currently 5pm Thursday 26th (as of 19:00 Wednesday)

Based on this, science will proceed on Thursday as follows going into Friday

Mini bongo 2* 400 m
RMT 25 (or 8) target fishing and Tow fish (if method of deployment of tow fish sorted and ship side happy)
MOCNESS (Recover tow fish or bring to near surface as ship side dictates)
FRRF (must be in the dark)
CTD * 2 for phytoplankton
Go flo bottles
FRRF (must be in the light)
CTD * 2 for DP
Bongo 2* 400 m
CTD for Oithona 1*400m
RMT 25 target fishing
LHPR

When we get to station - start which ever activity is scheduled for that time of day on the timetable for Process stations

Complete all activities for that day, this may mean looping back on the timetable to the start of that day. Once the whole of the activities for day 1 are complete start day 2 again at whatever activity we are due to do at that time of day.

Target fishing for krill – We will only fish for targets if we see good ones! Sophie will mark any we see on the way into the station. We will go back to these and try and fish them if there is any chance of finding them again. Failing this will adopt a search for krill targets. This will consist of travelling down wind looking for targets, once targets are located we will make the bridge aware, and ask them to turn the ship around and start fishing. The amount of time we can spend looking for targets will be variable and will be determined nearer the time. We must be ready and in place down wind of the way point to start fishing the next piece of equipment at the set time on the plan.

Friday 27th science and rest of Process Station 1

Continue though the activities on the station plan.

CTD, go flo, FRRF, bongo and mini bongo all undertaken at the waypoint. Reposition where necessary to be at waypoint, but if short of time do not waste time getting to the exact position.

RMT target fishing – fishing location to be advised based on where the targets are, or we head down wind searching for targets and fish as soon as we find some. Watch leader to advise bridge

LHPR, MOCNESS, RMT depth profile – all to be fished into wind through the way point. Reposition as far as a possible to allow this but do not waste time getting to the exact location.

Acoustic survey – aim is to survey in relation to the prevailing current if other weather conditions allow good data in this direction. Sophie will advise nearer the time. The plan is to travel 1 hour with the prevailing current on our port side, turn and run 1 hour with the current, turn run 1 hour with current on starboard side, turn and run 2 hours though waypoint against the current, turn and run 1 hour with current on starboard side, turn run one hour with current. End of survey and pick up cruise track

NB there will be no mooring deployment at this station.
If the MOCNESS is fixed we will try again to do a night profile on the 4th day.

Saturday 28th Science plan

According to timetable for day 2 of Process station

LHPR – haul in dark
FRRF – in dark

CTD * 2– 1 * 10 m off bottom and 1 * shallow in daylight
Goflo – 1000m in light
FRRF – in light
CTD * 2– 1 * 2000m and 1 * 400m
MOCNESS – 1000m daylight
CTD – chl max.
RMT 25 target fishing. 1 or more deployments depending on target availability.

It is not necessary to stick to the times exactly on the timetable, so long as activities marked in 'dark' or 'daylight' are done in those light regimes and other activities follow in sequence.

Sunday 29th Science plan (day 3 of process station 1)

Continue with RMT 25 depth profiles (1000 – 0 m and 400 – 0m)
FRRF in dark
CTD * 1. Deep (10 m off bottom)
Bongo 1* 400m
CTD Shallow 140m.
Go flo bottles
FRRF daylight
CTD shallow for DP (chl max)
Bongo 1 * 400 m
Deep CTD 2000m for DP.
LHPR 1000m
Bongo 1*400m
RMT 25 target fishing

Tuesday 31st Activities

XBT's along transect at waypoints. Do not slow down or change direction for XBTs.
No magnetometer to be deployed.
Lizzy to advise bridge on waypoints wanted for XBTs on route to new position of Condensed Station 1. New position is required to avoid uncharted waters and get near ice edge.

Signy Brief , 9 am in bar Tue 31st.

Tuesday 2 pm in bar
Data management info from Nathan and brief science up date from anyone who has any interesting observations so far. All interested/ available science party to attend.

Physics.
Nutrients
Phytoplankton
Zooplankton & krill
Fish
Acoustics
Higher predators

Most likely situation is that we will go to Condensed station 1 tomorrow

ETA = 17:00 31 October

Given this ETA of 17:00 running order for Condensed station 1 is

RMT 25 target fishing
LHPR
MOCNESS
FRRF
CTD deep for phyto
CTD shallow for phyto
Go flo
FRRF
MOCNESS
Mini bongo
LHPR
RMT target fishing
RMT depth stratified hauls *2
CTD for Oithona (400 m)
Bongo 3 * 400 m
RMT 25 depth stratified * 2
Acoustic Survey.

End of Condensed station 1

Signy Relief – safety meeting Tuesday 9am in the bar.

Jerry and I have yet to decide if we will go straight to Signy or do Condenced station 1 first. This depends on weather conditions and how the ice looks when we leave this station. Whatever the final plan, we need to do a safety brief for Signy, including going out in the humbers etc.

So, there will be a meeting for all science personnel on Tuesday morning at 9am in the bar. If you attended a brief last leg then you do not need to attend, everyone else must attend – please let me know if you have a problem with this. I suspect a couple will, so please let me know and I will see what I can do about it.

Shift patterns and midnight meals.
The ship need as much help as possible during the day to run cargo ashore. I do not expect those on nights to come right round onto days, but if you can slip s few hours here and there to help it would be much appreciated. If we work hard and get done in time we may get chance to go for walks ashore, but the priority is work and getting cargo done quickly. Midnight meals of some sort will still be available, but please let me know if you do want one during Signy relief so I can let the galley know.

Once we get to Signy I am looking for 8 'volunteers' to help dig snow in the first instance, then everyone will be needed to help with cargo. Please sign up below for this.

That's about it for now, more info when I get it.
Rachael.

Rest of Condensed station 1.

MOCNESS – daylight – deploy 14:00
Reposition ship to station (latest position of)
If time allows deploy 1 bongo net to 400 m (no later than 18:20)

MOCNESS – dark – deploy at 19:00. can deploy in light conditions, but only start hauling from 1000m once we are into dusk

RMT 25 target fishing

RMT 25 depth stratified 400 – 0 m

start 04:00

CTD 400 m
Mini bongo 400m
CTD shallow (deep chla max)
Bongo 1* 400 m
RMT 25 1000m and 400 m day profiles
Acoustics

Wednesday 1st Science plan and rest of condensed station 1

Day 1 condensed station
Midnight MOCNESS dark
FRRF (in dark)
CTD deep (10 m off bottom)
Bongo 400 m *1
CTD shallow (140 m)
Go flo
FRRF (daylight)
MOCNESS (daylight)
LHPR daylight

Day 2 condensed station
RMT fishing
RMT depth stratified deep dark
RMT depth stratified shallow dark
CTD (400m oithona)
Mini bongo (400 m)
RMT depth stratified deep daylight
RMT depth stratified shallow daylight
Acoustic survey finish at 18:00 on Thursday

Move off station, head for Signy. ETA 05:30 Friday 3rd November

After Signy – Saturday 5th November

Target fishing for Rock AFI (fish larvae)

Locations. Neuston. Net and RMT 25 or 8 required.

200m depth of water – 2 ideal locations, but anywhere on shelf near Signy would be acceptable. Failing this, then possibility of fishing at Shag rocks or SG what is the diversion time off from transect to Shag rocks? Needs to be nighttime fishing.

New position of C6

Lat first degrees min decimal min
Long second degrees min decimal minutes

-50 lat
-38 long

Sundays science (5th November)

Start condensed station 2. water depth here will be around 800m!

Assuming arrival at station at 04:00
Day 1

CTD – 10 m off bottom
Bongo 400m
CTD – shallow (140m)
Go Flo bottles
FRRF (light)
MOCNESS
LHPR
RMT 25 target fishing
LHPR
MOCNESS
FRRF (dark)

Day 2
CTD – Oithona
Mini Bongo
CTD – to chlorophyll max.
Bongo
Bongo
RMT 25 depth profile 1 (light)
RMT 25 depth profile 2 (light)
Acoustic survey
RMT target fishing
RMT 25 depth profile 1 (night)
RMT 25 depth profile 2 (night)

Mondays 6th science plan

FRRF in dark	02:30
CTD – Oithona	04:00

Mini Bongo	04:45
CTD – Deep chl max	05:30
Bongo	06:00
Bongo	06:40
RMT deep (daylight)	08:00
RMT shallow (daylight)	
Acoustic Survey	14:00
RMT target	18:00
RMT deep (dark)	22:00

Tuesday 7th Finish CTD B. Deploy tow fish at station ready to tow to CS3

Condensed station 3

RMT 25 target fishing – aim to have back on board by 20:30.
LHPR 1000m
FRRF in dark
MOCNESS 1000m
CTD deep
Bongo
CTD shallow
Go Flo
FRRF
Mocness
LHPR

RMT 25 target fishing
RMT 25 deep (dark)
RMT 25 shallow (dark)
CTD - Oithona
Mini bongo
CTD – DCM
RMT 25 deep (day)
RMT 25 shallow (day)
Acoustic Survey.

Decision on Signy

Tuesday 7th Finish CTD B. Deploy tow fish at station ready to tow to CS3

Condensed station 3

RMT 25 target fishing – aim to have back on board by 20:30.
LHPR 1000m
FRRF in dark
MOCNESS 1000m
CTD deep
Bongo
CTD shallow
Go Flo
FRRF
Mocness
LHPR
RMT 25 target fishing

RMT 25 deep (dark)
RMT 25 shallow (dark)
CTD - Oithona
Mini bongo
CTD – DCM
RMT 25 deep (day)
RMT 25 shallow (day)
Acoustic Survey.

Decision on Signy

Wednesday 15th November and condensed station 4

CTD station D ETA around 19:00
Condensed station 4 taking place at CTD station E – ETA around 05:00

Approximate Time	Activity
04:00	CTD near bottom
07:00	Bongo 400 m
08:00	CTD shallow (140 m)
08:30	Go flo
10:00	FRRF (light)
10:30	MOCNESS
14:00	Acoustic survey
18:00	RMT target fishing
21:00	RMT deep stratified - dark
00:30	FRRF dark
01:00	RMT shallow Stratified
04:00	CTD Oithona
04:30	Mini bongo
05:20	CTD chl max
06:00	Bongo
06:40	Bongo
07:30	LHPR

Condensed stations 4 and 5, and CTD stations.

We have lost some science time due to Signy relief and will therefore have to cut activities accordingly to fit in with the time we have left.
I want to preserve Process stations 2 and 3 intact and also Condensed 6. Therefore the cuts will be made in condensed 4 & 5 and some CTD stations.

Condensed station 4 will take place at CTD E station position and will have cuts as follows: all daylight stratified RMT hauls, 1 LHPR, 1 MOCENSS, 1 RMT targeted haul. I will reassess after this station, we may have to cut CS 5 altogether, or we may be able to run a reduced sampling protocol.

CTD stations, C, G, H and K will be cut.

Sequence of activities at the condensed stations will change slightly depending on what time of day we arrive at station (before or after 14:00) to maximise the use of time.

Revised Condensed – start before 14:00 – start at whatever time we arrive and work through list, then back to the top to finish off.

Time	Activity
04:00	CTD near bottom
07:00	Bongo 400 m
08:00	CTD shallow (140 m)
08:00	Go flo
10:00	FRRF (light)
10:30	MOCNESS
14:00	Acoustic survey
18:00	RMT target fishing
21:00	RMT deep stratified - dark
00:30	FRRF dark
01:00	RMT shallow Stratified
04:00	CTD Oithona
04:30	Mini bongo
05:20	CTD chl max
06:00	Bongo
06:40	Bongo
07:30	LHPR

Start after 14:00 start at whatever time we arrive and work through list, then back to the top to finish off.

Time	Activity
15:00	CTD oithona
15:30	Mini bongo
16:20	CTD chlo max
17:00	Bongo
18:00	Bongo
21:00	RMT deep stratified - dark
00:30	FRRF dark
01:00	RMT shallow Stratified
04:00	CTD near bottom
07:00	Bongo 400 m
08:00	CTD shallow (140 m)
08:00	Go flo
10:00	FRRF (light)
10:30	MOCNESS
14:00	Acoustic survey
18:00	RMT target fishing
22:00	LHPR

Thursday night and Friday 17th November

Approximate Time	Activity

18:00 Thursday	RMT target fishing
21:00	RMT deep stratified - dark
00:30 Friday	FRRF dark
01:00	RMT shallow Stratified
04:00	CTD Oithona
04:30	Mini bongo
05:20	CTD chl max
06:00	Bongo
07:00	LHPR
10:00	CTD near bottom

Leave station at 13:00
Head to CTD Station F
CTD full depth
Head to Process station 2.

Deploy XBT's at 8 knots at sites as follows
Half way between CTD E and CS5,
CS5 position
Half way between CS5 and CTD station F
CTD station G

Thursday night and Friday 17th November

Approximate Time	Activity
18:00 Thursday	RMT target fishing
21:00	RMT deep stratified - dark
00:30 Friday	FRRF dark
01:00	RMT shallow Stratified
04:00	CTD Oithona
04:30	Mini bongo
05:20	CTD chl max
06:00	Bongo
07:00	LHPR
10:00	CTD near bottom

Leave station at 13:00
Head to CTD Station F
CTD full depth
Head to Process station 2.

Deploy XBT's at 8 knots at sites as follows
Half way between CTD E and CS5,
CS5 position
Half way between CS5 and CTD station F
CTD station G

Saturday 18th November Science ETA to PS2 06:00

Approx time	Activity

06:00	Bongo 400 m
06:40	CTD shallow
07:30	Go flo
09:30	FRRF (light)
10:00	Shallow CTD (for DP)
10:30	Bongo 400m
11:20	CTD 2000m
13:20	Mini bongo 400 m
14:00	LHPR (if time allows)
16:30	RMT target fishing mainly for krill – swap with MOCNESS slot if darker conditions wanted
22:00	MOCNESS - night
01:30 Sunday 19th	FRRF dark
03:00	CTD – full depth
06:00	Shallow CTD
06:30	Go flow
08:30	FRRF light
09:00	CTD 2000m (DP)
11:00	CTD Oithona
11:30	MOCNESS - day
15:00	CTD shallow (DP)

20 /21st November science plan

16:00 20 Nov	LHPR –day
19:30	LHPR - night
22:15	FRRF - night
22:30	RMT – dark Shallow
01:30 21st Nov	Acoustic survey II
08:30	RMT – day deep
	RMT – day shallow
	relocate
16:00	Multinet - day
19:30	Mutlinet - night
23:00	RMT - targets
02:00	FRRF dark

End of PS2.

PS3

Approx time	Activity
04:00 day 1 Saturday 18th	CTD - full depth
06:00	Bongo 400 m
06:40	CTD shallow
07:30	Go flo
09:30	FRRF (light)

10:00	CTD Shallow (for DP)
10:30	Bongo 400m
11:20	CTD 2000m
13:20	Mini bongo 400 m
14:00	LHPR - day - (if time allows)
16:30	RMT 25 target fishing mainly for krill
22:00	MOCNESS – night -
01:30 day 2 Sunday 19th	FRRF dark
03:00	CTD – full depth
06:00	CTD - Shallow
06:30	Go flow
08:30	FRRF light
09:00	CTD 2000m (DP)
11:00	CTD Oithona
11:30	CTD shallow (DP)
12:00	Acoustic Survey
19:00	RMT 25 - Target fishing based on acoustic survey
23:00	RMT 25 - Deep stratified
03:00 day 3 Monday 20th	CTD – full depth
05:30	Bongo 400 m
06:10	CTD - shallow
07:00	Go flo
09:00	FRRF –light-
09:30	CTD shallow (DP)
10:00	Bongo 400 m
10:40	CTD 2000m (DP)
12:30	Bongo 400 m
13:10	Mooring deployment
19:00	LHPR – night -
22:00	RMT 25 - shallow Stratified
01:00 day 4 Tuesday 21st	FRRF - dark-
04:00	MOCNESS – day
07:30	RMT 25 – day, shallow stratified
10:30	RMT 25 Deep
14:30	LHPR – day (if not done already)
17:00 – 03:00	RMT target fishing.

Science 24nd November Process Station 3.

Approx time	Activity
16:30 22nd November	RMT 25 target fishing mainly for krill
23:00	Multinet night – biowire not working - postponed
02:00 23rd November	FRRF dark
03:00	CTD - full depth
06:30	Bongo 400 m
07:20	CTD shallow

07:50	Go flo
09:50	FRRF (light)
10:20	CTD Shallow (for DP)
11:00	Bongo 400m
11:40	CTD 2000m
13:20	Bad weather stopped deck work – too rough for Acoustics too.
14:00	
20:00	
23:00	
02:00 24th November	
03:00	
06:00	
06:30	
08:15	CTD 2000m (DP)
09:45	Mini bongo 400 m
10:40	CTD - Shallow
11:20	FRRF light
11:50	CTD Oithona
12:20	Bongo 125 m
12:40	CTD shallow (DP)
13:15	Go flow
14:45	CTD – full depth
17:15	LHPR - day -
20:00	LHPR – night -
22:30	FRRF - dark-
23:00	RMT 25 - Deep stratified –dark -
03:00 25th November	CTD – full depth
05:30	Bongo 400 m
06:10	CTD - shallow
06:40	Go flo
08:20	FRRF –light-
08:50	CTD shallow (DP)
09:20	Bongo 400 m
10:00	CTD 2000m (DP)
11:30	Bongo 400 m
12:10 – as long as it takes	Mooring deployment
18:00	Multinet – day (postpone if necessary) or RMTs if Moorings went well and Peter E OK to do RMTs
21:00	Multinet – night (or RMT's)
24:00	FRRF –dark-
00:30 26th November	Bongo – 125 m dark -
05:00	RMT 25 – day, shallow stratified
08:00	RMT 25 day deep stratified
12:00	Acoustic Survey
19:00	RMT 25 - Target fishing based on acoustic survey
22:00	RMT 25 - shallow Stratified – dark (or multinet – depending on what was deployed last night)
01:00 27th November	RMT 25 target fishing. (or multinet depending on what was deployed last night))

Science 23nd November Process Station 3.

Approx time	Activity
11:00 23rd November	Mini bongo 400 m cancelled – bad weather. Run SWATH
12:00	Acoustic Survey
20:00	RMT 25 - Target fishing based on acoustic survey if conditions allow, If not then LHPR if conditions allow this– night -
23:00	RMT 25 - shallow Stratified - dark
02:00 24th November	FRRF - dark-
03:00	CTD – full depth

06:00	CTD - Shallow
06:30	Go flow
08:30	FRRF light
09:00	CTD 2000m (DP)
11:00	CTD Oithona
11:30	CTD shallow (DP)

We'll see from there! Weather permitting!

Move off around 02:00 ETA to CS 6 1st activity RMT deep stratified	18:00 27th Nov
19:00 27th Nov	RMT - deep stratified - dark

23:00	FRRF – dark.
23:30	RMT - shallow stratified- dark
Reposition to station 28th Nov	
03:00	CTD near bottom
06:00	Bongo 400m
06:40	CTD shallow
07:20	Go Flo
09:20	FRRF – day-
09:50	LHPR - day
13:00	RMT shallow day
relocate	
17:00	RMT deep stratified - day
21:00	LHPR night
00:30 29th Nov	MULTINET night
Reposition to station	
04:00	CTD oithona
04:30	Mini bongo
05:20	CTD (DP) chl max
06:00	Bongo
06:40	Bongo
07:20	Acoustic survey
14:20	Target fishing based on Acoustics
16:20	Multinet day
19:30	RMT – dusk haul?
23:00	RMT target fishing
02:00 30th Nov	RMT – dawn haul?
05:00	LHPR trial deployment
08:00	Repeat any failed hauls
12:30	End of CS 6. Deploy CPR head back to Stanley. Run SWATH and Magnetometer
	Deploy CPR on route (2 deployments in total)

Condensed 6 - and transect back to Stanley

End of PS 3

RMT stratified	fishing
RMT target	23:30
FRRF	01:00
Bongo 400m!	01:30

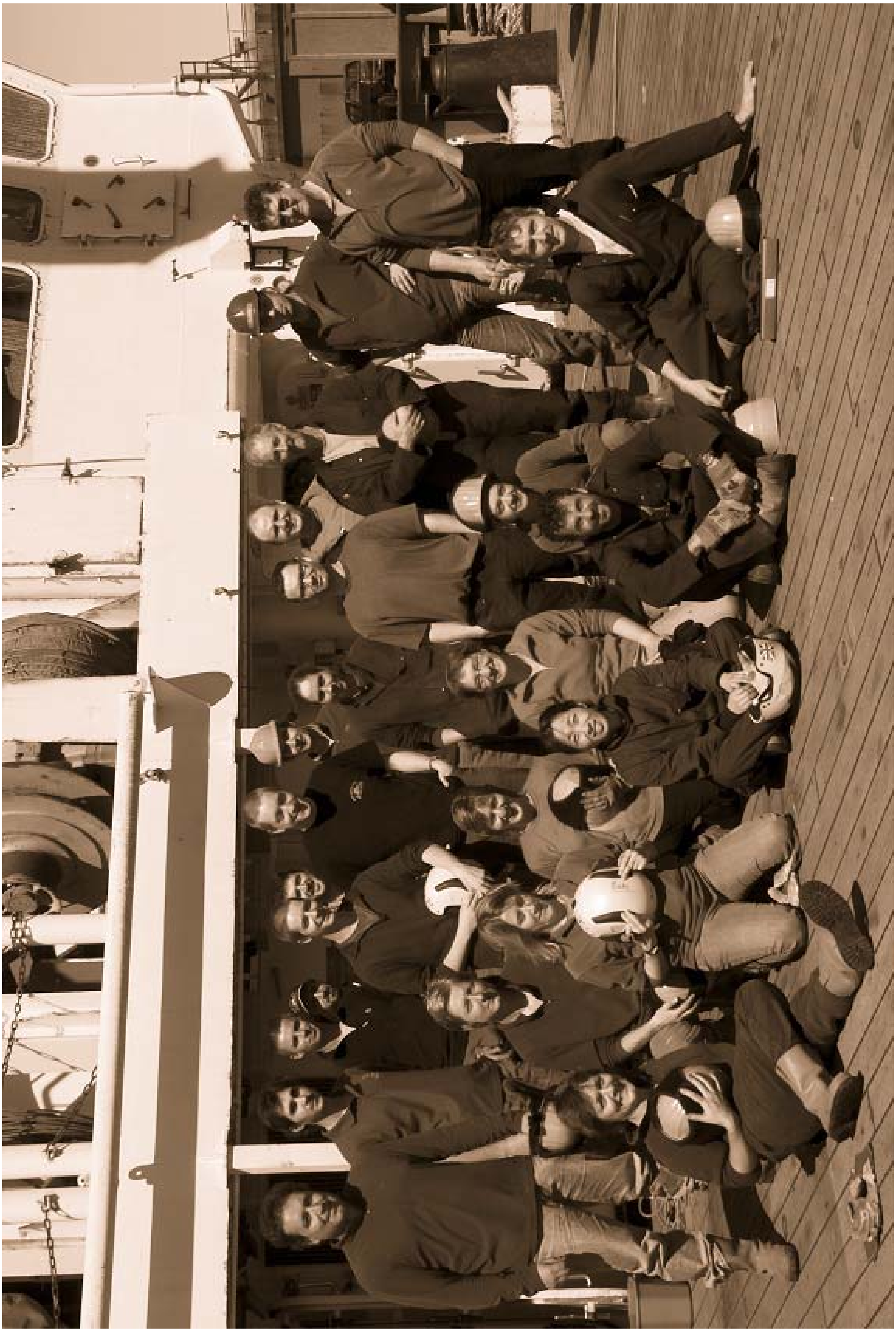
Process Station Timings

Time	Day 1	Day 2	Day 3	Day 4
01:00	MOCNESS	RMT 25	RMT 25	RMT 25 target fishing
02:00	0 – 1000 m	Target fishing	Depth stratified	
03:00		LHPR	1000 – 400 m	Mooring
04:00	Tow Fish	0 – 1000m	400 – 0 m	Deployment
05:00	FRRF darkness 120 m			
06:00		FRRF 120 m		
07:00	CTD – 10 m off sea bed	CTD – 10 m off sea bed	CTD – 10 m off sea bed	
08:00				
09:00	CTD 140 m	CTD 140 m	CTD 140 m	
10:00				RMT 25
11:00	Go Flo	Go Flo	Go Flo	Depth stratified day
12:00				
13:00	FRRF – daylight 120 m	FRRF – daylight 120 m	FRRF – daylight 120 m	
14:00	CTD – HPLC 2000 m	CTD – HPLC 2000 m	CTD – HPLC 2000 m	
15:00				Acoustic Survey
16:00	CTD 140 m	MOCNESS 0 – 1000m	LHPR - daylight	
17:00	Bongo 3 * 400 m			
18:00	Mini bongo 1 * 400 m			
19:00	RMT 25	Bongo 3 * 400 m	Bongo 3 * 400 m	
20:00	Target fishing			
21:00		RMT 25	RMT 25	RMT 25
22:00		Target fishing	Target fishing	Target fishing
23:00		RMT 25		
24:00		Depth stratified night		

Condensed Station Timings

Time	Day 1	Day 2
01:00	LHPR	RMT 25
02:00	Tow fish	Depth stratified
03:00	MOCNESS	
04:00		
05:00		
06:00	FRRF	
07:00	CTD	CTD
08:00		
09:00		Bongo
10:00	Go Flo	
11:00	FRRF	RMT 25
12:00		Depth Stratified
13:00		
14:00	MOCNESS	
15:00		
16:00		
17:00	Minibongo	Acoustic Survey
18:00	LHPR	
19:00		
20:00		
21:00	RMT 25 Target fishing	RMT 25 Target fishing
22:00		
23:00		
24:00	LHPR	

Cruise Photo



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Greenwood	Steward
Raworth Graham	Steward
Weirs Michael	Steward
Gill Andrew D	Dk Cadet

Acknowledgments

I would like to sincerely thank Captain Jerry Burgan, his Officers and Crew for all their support during this cruise. Whilst having spent numerous seasons in the field on the RRS James Clark Ross as a junior scientist, it was not until this season as the PSO that I truly appreciated all the expertise onboard. We are dependant on their cooperation and knowledge to successfully complete a cruise. Having lost only a handful of days to Signy relief and rough weather we completed pretty much all the science we had planned and so have a great start to the shipboard field work that underpins the Discovery 2010 programme.

Rachael Shreeve PSO

JR161 and JR152, JR159 Recommendations

1. Meterology

1.1. We recommend that some time is spent producing a solution whereby SMG and CMG for the RVS truewind calculation can be obtained from one of the other GPS instruments, ideally the Seapath or Ashtech ADU5.

2. ADCP

2.1. During the trials cruise, it was noted that the OS75 causes interference with most of the other acoustic instruments on *JCR,* including the EM120 swath bathymetry system. To circumvent this, all acoustic instruments were set to ping sequentially through the SSU, however this acts to reduce the ping rate. As noted by Dr. Sophie Fielding, when in deep water the swath can take 20 to 30 seconds from ping to end of listening, as a result this means the ADCP only pings once every 25 or so seconds.

2.2. A further problem is that the ADCP appears to "time out" every other ping when it has to wait a long time between pings (i.e when running in deep water alongside the EM120). This results in it rebooting and waking the ADCP instrument up every other ping, which simply exacerbates the problem. A fix is promised by BAS AME, but requires a firmware upgrade from RDI which is not presently available.

2.3. During Jr161 the swath bathymetry system was not turned on because of the severe effects on data sampling rate and data quality. Several trial setups were undertaken to try to synchronise the ADCP with the EK60 (these are recorded in the setup log files (within the cruise ADCP directory) and within the EK60/Acoustic cruise log)), the final setup established using the SSU was to ping the ADCP synchronously with the EK60 and EA600. The EK60 was the master instrument (this was established using the command CX1,3 in the ADCP setup script) and was set to a constant ping rate of 2.5 seconds, the ADCP and EA600 were slaves. The SSU setup is described in the EK60 methods section of this cruise report. This created good data for both the ADCP and the EK60, only when the ADCP was set in narrowband – bottom tracking off mode. This method **does not work** with the ADCP in bottom tracking mode. More effort is required to establish how to interface all these instruments together with a minimum of interference to all.

3. CTD

3.1. At first there were problems with the new external pump that draws the sample into the salinometer. It was introducing many microbubbles into the cell causing the readings to be highly unstable and fluctuate abnormally. As a result the analysis of the first crate of salts lasted well over 3.5 hours. It was found that the clamps holding the tube inside the pump were too tight. After loosening the clamps the bubbles ceased to flow into the cell, however the salinometer readings continued to be highly unstable, taking a very long time to stabilize. The reading would regularly creep up or down 30-40 digits before stabilizing at a particular value (eg. 1.98321 – 1.98365). This occurred typically in all three readings per bottle, causing the analysis of an entire crate to take over 3.5 hours each time. Several attempts at solving the problem were made, including re-calibrating the salinometer & varying the pump flow speed. Neither of these had any effect, therefore the majority of bottles were analysed successfully despite unusual behaviour and instability of the salinometer.

3.2. The solution was finally found by replacing the new pump by one of the old peristaltic pumps. After the replacement the salinometer readings stabilized much quicker, with the first reading typically varying less than 10 units, and subsequent readings usually only oscillating 3-5 units. This reduced the "crate analysis time" to a more normal two hours.

3.3. The possible problem of the new pump was the right sized tubing had not been delivered with the pump for this cruise, therefore a thinner diameter tube had to be used. It is believed that with such a small tube, the pump would vaporize the water inside the tube causing micro-bubbles which were not visible to the naked eye, but were seriously affecting the salinometer readings. The old tried and tested peristaltic pump caused the salinometer to behave in its usual manner.

3.4. A small problem was found with the peristaltic pump; the highest flow setting was producing too much pressure on the outgoing tube causing it to pop out releasing water into the pump casing. The only solution that was found for this problem was to use superglue to physically stick the two tubes together. After this, everything worked fine.

4. LADCP

4.1. Initially the master/slave command files used were adjusted from those found on the LADCP PC, and did not appear to work successfully. As described below the correct command files were used from CTD cast 015 onwards and only data from this point onwards has bee processed

4.2. Communication with the LADCP was flaky. Although appearing to successfully go through the pre-deployment tests, on some casts data could only be recovered from one or other of the master and slave. Additionally, when data was recovered after a cast a variable number of files (instead of the expected one file) were found. Since the LADCP memory was cleared before every deployment, these files were all belonging to the cast in question. The initial processing (reported by scan.prl) often showed that these files were apparently empty - giving nonsense depths and times.

4.3. The scan.prl step (results recorded in *~/proc/proc.dat*) revealed that for a number of casts the start and end times and depths did not match those recorded in the CTD log. On some casts only the downcast appeared to be recorded, or part of the downcast. The initial processing steps were carried out as far as possible, although for a number of cases the *do_abs* matlab script failed due to the mismatch between downcast and upcast.

4.4. The scripts will need adjusting back at BAS for any further processing of the data to be completed.

5. Gear Report

5.1. Replacing the current DWNM is still top priority. Doug Bone and myself have raised this issue for many years. The system is old, flaky and needs replacing. Finally there is now some money made available to replace the system and AME has agreed to develop the new system. Jim Fox has been tasked with the Job. The idea is that we have a prototype on board for next season to use it along with the old one and then replace the old system in the following season.

5.2. It seems that the non-filtering cod-ends are getting more and more preferred against the filtering. In the moment we have only one pair of these cod-ends, therefore more RMT non-filtering cod-end should be bought.

5.3. If the old MOCNESS is used again a new deck unit and a new PC as well as spares are needed. Also some kind of documentation would be quite helpful. If BSD is going for a new one, again spares and documentation should be bought with it.

5.4. If the intension is to use the AMPS again – either as the main net or as a back up to the MOCNESS - a decision has to be made sooner then later to give time to sort out the issues encountered on this trip. Also proper non-filtering cod-ends for the AMPS should be designed and get made.

5.5. The LHPR spooling mechanism needs to be sorted to overcome the mismatch between fired commands and the real amounts of turns. Also the catch diverter device (opening and closing mechanism), which doesn't work with the existing DWNM, has to be incorporated into the new system with a second command and feed back line.

5.6. If we continue with the amount of RMT 25 fishing we need another new RMT 25 net. Also the existing new net has to go back to the net maker to get holes for dropping wires made.

5.7. The old RMT 25 nets have been deployed more than 50 times on this trip. They need some major refurbishing and have to go back to the net maker.

5.8. Due to the amount of deployments the RMT 25 side wires suffered quite a bit and had to be replaced, to increase the life expectancy freely.

5.9. The feedback on the RMT25 release mechanism needs checking. Also it has to be replaced in one of the RMT8 release from where it had been taken out. Further a couple of new ones should be made to take as spares.

5.10. By next season the new USBL tracking system will be fully implemented and this should further improve any fishing activity regarding position and depth of gear in the water.

5.11. On a more general note mobilisation and demobilisation relied on good weather condition during passage from and to the Falklands. If the weather would have been unworkable the time given for mobilisation and demobilisation would not been sufficient. More time should be allocated for future cruises especially if the same amount of gear will be used. swivels should be put on top of the side wires to allow the side wires to rotate

6. RMT 25 Fishing

6.1. It is essential to carry a full set of spares for the RMT 25 release mechanism and net monitors. Fortunately we were able to remove parts from the RMT8 release to keep the RMT25 system working. With the exception of one haul the net monitor worked reliably with the RMT25, but given the problems that were encountered with other gears, a new net monitoring system is essential.

6.2. The current set of nets is extremely worn out, with lots of rips that have been hurriedly repaired. We have one spare net, which needs slight adjustment to fit to the bars and a second net is on order. The old nets will be OK as emergency spares.

6.3. The RMT25 is clearly unable to catch fish in the surface waters during daylight, so to get any idea of fish abundance night time hauls must be used. This may present problems during summer cruises, when darkness is limited and there is pressure from other gears for darkness slots.

7. MOCNESS

7.1. We had problems with this net system though, and on most deployments around half the nets failed to actually fire, even though the software indicated all was well. Therefore we are unsure about which depth horizons were sampled with the Multinet, however samples were taken to give some indication of the condition of *C. acutus* at the different sites.

7.2. Failure of the MOCNESS system half way through the cruise caused us to substitute this sampling with the Mulitnet. This system proved to be flakey, possibly linked to the net monitor system has caused problems with collecting samples. It is essential that before next cruise that we have a fully operating system to collect multiple samples on one deployment of plankton that is in good condition. Sea trails during summer 2007 will be essential to test this system out prior to the main cruise.

8. LHPR

8.1. With a new net monitor being planned for use on future cruises it is important to ensure that it incorporates a better (more precise) way of disabling the LHPR motor during fishing, rather than further reliance on the reed-switch.

8.2. It also needs to take into account the requirements to be able to increase the time period that gauzes fish (presently 99 seconds max) as well as incorporating a flow diverter in the cod-end allowing the net to be vented until it is appropriate to switch.

8.3. A specification needs to be drawn up before work progresses much further on this project.

9. POC2 Activities

9.1. Breakdown in communication at a number of points, both technical and personal, have been behind a number of the problems encountered. If near-real time (NRT) e-mail communications between the pCO_2 system and Dartcom/PML had been established on departure from Immingham, the water ingress problems could have been spotted earlier and the severe damage to the system potentially avoided. A gap in the communication of the need for ship's underway data logging meant that valuable data collected by the pCO_2 instrument on the leg south cannot be processed to the highest possible standards. Conversely, good communications between the ship, PML and Dartcom during this cruise have allowed for many of the problems encountered to be adequately dealt with and repairs made where necessary. Good communications between the ship and Dartcom/PML, by telephone and e-mail, must be maintained if this trial is to succeed.

9.2. Another contributing factor to the problems encountered has been the lack of adequate training so far. This was looked into and accepted as not feasible before the cruise, but must be prioritised for the future. Simon Wright (shipside, Deck Engineer)was given very basic level training before departure from Immingham, which he passed on to Doug Trevy (shipside, Deck Engineer) when the crew changed over. Mark Preston has been trained in operation of the system for this season during this cruise but should attend further training at Dartcom if he is to be responsible for the instrument over future seasons. Ideally, more than one responsible person needs to be trained so operations are not dependent on one person and it would also be useful if both BAS technical personnel and the ship's Deck Engineers could be trained.

9.3. Expense precludes providing a full set of spare parts for each pCO_2 system, but provision of a basic set of Swagelok fittings, tubing, Snoop leak detector, filters and regulator as a minimum has proved useful on this cruise. Spare gas cylinders should also be provided in future (these have been ordered). Other (small) parts can be transported by scientific personnel heading south, as has been undertaken during the changeover between this cruise and JR161.

9.4. These risks are well known and the diagnostic sensors in the tray have worked adequately in alerting to these. These failure modes are the most likely to cause full system shutdown so must be avoided at all costs. Any evidence of these must be treated with the utmost urgency.

9.5. So far, the harsh Southern Ocean environment has not caused significant problems for the instrument. The freezing-up of the marine air line may be partly attributable to negative air temperatures, but this has only been a minor issue and appropriate procedures have been established to deal with it. The cruise has not encountered blockage by large diatoms but these may become an issue later in the season. It has also not been exposed to the lowest temperatures or sea ice. Ongoing assessment of these possible issues needs to be undertaken throughout the season.

10. GENE Flow in the Antarctic

10.1. During the transect from Stanley to South Georgia the EK60 38 kHz signal was extremely noisy. This feature was also noted during cruise JR129 and was discovered to have been solve by replacing the 38 kHz GPT (Serial No. 00907203400b). This process was undertaken during this cruise also. The serial number of the 38 kz GPT being used during this season is 009072033fa5

10.2. Echolog appeared to be extremely temperamental this trip and stalled regularly if used to compress files in real time, although live viewing could be run permanently if no compression was used. Ultimately, Jeremy discovered that there was a problem with new Samba software Ver. 3.0.23c loaded onto the Sun server. Reloading the older version (Ver. 2.2.12) fixed the problem and normal Echolog saving could resume.

10.3. Both the EK60 main processor and the EK60 workstation computers were networked differently this cruise – onto a more secure network. There were some teething problems after this that were fixed by Jeremy Robst actually.

10.4. A comcontainer.exe error arose on several occasions with the ER60 software, crashing the EK60 echosounder. This seems to arise when there is a conflict between the SSU and the EK60 and requires the power cycling of the EK60 and turning the trigger off on the SSU.

11. Macronutrient Analysis

11.1. It can't be overemphasised how much more efficient and reliable our water sampling operation would have been with a Ti CTD together with a 24 bottle rosette. Instead of one 24 bottle CTD cast it was necessary to make two 12 bottle casts and deploy 6 Go-flo bottles to collect sufficient water for macro- and micronutrient analysis. Also note that Go-flo bottle deployment required five people, the depths of water collection were nominal, there is no concurrent oceanographic measurements and the bottles didn't always close correctly.

11.2. Throughout the cruise there were black soot or dust particles coming out of the ship's deckhead vents in the chemistry and the prep lab. Can the system be cleaned during refit?

11.3. All hazardous chemicals for the cruise were shipped in one case. I'm pleased to see minimal packing used and presumably the mix of chemicals met with shipping regulations. However, in future, might it be a good idea to separate flammables from corrosives and labelling cases on several sides with cruise, full contents list and consigners names would be mighty useful when they're being searched for in a ship's hold.

11.4. Requested chemical waste drums were not labelled specifically enough and were left in Stanley. Fortunately there were enough surplus drums onboard to suffice otherwise we would have had big problems.

12. Primary Productivity

12.1. On of the major problems with the cruise was that we were unable to borrow the UKORS titanium CTD. Instead of one 24 bottle CTD, we had to deploy a 12 bottle CTD twice and collect "clean" water with GoFlo bottles. As noted by Whitehouse, the GoFlo bottle deployment required five people, the depths of water collection were nominal, there is no concurrent oceanographic measurements and the bottles didn't always close correctly.

12.2. At the beginning of the cruise the lab was cleaned out to remove soot or dust particles. However, after this the lab was repeatedly covered with dust/soot from the deckhead vents. It seems pointless to clean bottles etc thoroughly and follow clean techniques if the lab is so badly and regularly contaminated with dirt from the vents.

12.3. It was noted that one of the chemical waste drums from the rad lab containing seawater with 14C leaked whilst being moved to the CTD annex. The leak came from one side of the drum lid, which may have been faulty. Whilst the rad leak from this one drum was contained and did not present a danger to anyone, there may have been other incidences of leaky drums (this was never confirmed to me) which could present a real hazard to those moving the waste drums.

12.4. The BAS FRRF died near the very end of the cruise at condensed station 6. The problem most likely lies with the flashcard. Due to the death of the FRRF, an instrument response function test could not be performed on the instrument whilst at sea.

12.5. Internet access was often annoyingly slow. At times, it was difficult to download the satellite images that were sent to me which makes near real time cruise support a bit pointless!

12.6. To end this report on a positive note, I would like to say how useful the online event logs were for finding out both event numbers and underway oceanographic parameters e.g. PAR and fluorescence. Well done Nathan and Jeremy!

13. ARPS

13.1. Mooring weights and chains could not be found in FIPASS.

13.2. Mooring riggings for the ARPs were considered amateurish and need complete re-rigging.

13.3. Future redeployments of ARPs will require a sufficiently powerful vacuum pump to be onboard the JCR.

13.4. Concern was raised that the ARPs are small and very difficult to see and may be difficult to locate during recovery. It is suggested that future ARP deployments should be equipped poles and flags to ensure successful recovery.

13.5. Management of data from the ARPs requires careful consideration as no provision for backing up the ARP data had been made prior to JR152, 159. Jeremy Robst therefore created a copy of each disk for security. These backups will be transferred to BAS via LTO tape and restored to SAN. Nathan Cunningham will ensure that Tony Martin is aware of where the data resides. For future cruises it is recommended that an external coupling mount for the 2.5" hard disks is purchased to ease the data transfer/backing up process and a copy of the software is available so the data can be transferred from binary format to ASCII and appropriately tagged with metadata as soon as possible.

14. Study of phytoplankton response to naturally iron enriched regions of the Scotia Sea

14.1. In future cruises it is highly recommend that these stations are selected with respect to real-time satellite chlorophyll data and data obtained during the cruise. This is essential to ensure the maximal potential scientific output of such cruises.

14.2. Also, the on-deck bioassay incubation experiments provide a valuable demonstration of the limiting nutrients in selected regions of the Scotia Sea and an insight in the response of the phytoplankton community to these inputs. However, owing to the low-temperatures responses can be slow (> 10 days). It would be beneficial if cruise logistics would ensure time for the completion of these experiments. During JR161 the cooling of the bioassay work was achieve by the pumping surface sea water – this is not ideal when the ship is moving through diverse bodies of water and it is recommended that a self contained water cooling system be used in future.

15. A study of the iron distribution in the Scotia Sea

15.1. The initial results show that the first Process station was not as HNLC condition as planned. Therefore it would be advisable for future cruises that the cruise line would be take into account the latest satellite images.

15.2. For future cruises in this region a more cold resistant kind of tubing should be used as the tubing became very brittle in the water and snapped in half when pressure was put on it. Also, gaffa tape is better as use as tape as the grey tape I had was too brittle for the cold weather.

15.3. Access to the container should be avoided when the wire for the net comes in again as during the winch time a brush is washing the wire coming in spraying iron water all over the place and onto the container. See picture 1

15.4. For future work, it would be a wish to bring at least one more person on the cruise to assist with the iron work and bioassay. This would improve the coverage of underway sampling and having an extra person would mean that a bigger suite of nutrient and light combinations for the bioassay experiments could be done.

15.5. The clean container: The UKORS clean container was used as a lab. The back and front door had both big visual gaps. Please see picture 2. The back door was sealed using silicon gel to avoid water, air and other contaminants to enter the clean space. The front door was left untouched.

15.6. The milli-Q system in the clean container had visual algal growth in the pipes and therefore it was decided to use the ships MQ system instead.

15.7. During the cruise on the 19.11.06 in the early morning it was noticed that one of the windows facing the afterdeck was cracked. There is no clue what has caused this accident.

15.8. The Go-Flos worked very well. Only comment for future cruises would to have a meter counter on the winch.

Picture 1, clean container covered in iron spray.

Front door

Back door

Picture 2, Cracks in door seals

16. Krill Studies

16.1. Comparisons of length-frequency distributions obtained with RMT25 and RMT8 net: possibility of under sampling small krill with RMT25 due to larger mesh size.

17. Acoustic Report

17.1. Investigate value of BAS1 Echoview dongle – should we replace parallel port dongle for USB dongle?

17.2. Real-time current information would be useful when deciding what direction to run the acoustic transect in.

17.3. The UOR should be brought on subsequent cruises. It is obvious from the underway TSG that the survey sites are regions of high variability. The vertical structure of this should be investigated.

17.4. The method of searching for targets downwind and then fishing on them upwind worked very well (typically also because of the responsiveness of all the crew and officers onboard – thank you). It is recommended that this method is used in the future.

17.5. The acoustic transects should occur at the beginning of the stations rather than at the end so that the viability of target fishing can be evaluated rather than wasting valuable fishing time doing non-target target fishing or not targeting the right location within the survey area.

17.6. THE ADCP AND EK60 NEED INTERFACING PROPERLY. THIS REQUIRES DEDICATED TIME ON BOARD THE JCR WITH AN ADCP EXPERT, MYSELF AND IT SUPPORT. Until this happens biological and physical data will be compromised.
17.7. A night time slot should be allocated to undertake a shallow RMT tow for live krill experiment catches.

17.8. The Doppler logger of the ship causes interference with the EK60 120 kHz data quality. An investigation into whether the Doppler logger is still required or whether it could be interfaced with the SSU would be desirable. This will be raised by Pete Enderlein in the STEG.

18. Predator Observations

18.1. The method of counting animals whilst on station was felt to be inadequate because it was only possible to systematically count animals close to the ship. These animals tended to be species that were attracted to the ship (although this tendency could be exploited as a sampling method). They usually congregated around the stern in the prop wash (while in station use of the ship's DP system to hold the vessel head to wind meant there was always some prop wash) or midway along the beam, where the ship's macerators discharged food waste. Counting animals from the stern and bow might have been preferable to counting from the sides as this would give some indication of which animals were attracted to the ship and which were simply passing by. Alternatively, animals in as area further from the ship could be counted using binoculars but this method would only be effective in low sea states and good visibility.

18.2. It was possible at most but not all times for an observer to collect and enter data simultaneously. This was due mainly to the use of the rugged laptop, which was invaluable and performed very well throughout the cruise (although see below). However, at times when the animal density was high a data recorder was necessary in order for the observer not to miss a significant number of animals. Furthermore, because there was only one observer data could not be collected continuously whilst underway. This meant that important features such as fronts were often crossed while no predator data was being collected. An ideal situation would be to have two trained observers working shifts assisted by data recorders drawn from the scientific party or people in transit.

18.3. The movement codes were over complicated. Flight type could have been more succinctly described as direct, turning or circling.

18.4. The laptop's touch-screen backlight occasionally switched off unexpectedly making it nearly impossible to use the screen. This seemed to happen if the laptop was left outside in the cold on standby during breaks, etc. Hence, it was always taken inside when not in use. Having spoken to the manufacturers it seems that this is a fault and should be fixed before the laptop is used on another cruise.

18.5. During underway observations all birds in flight passing through the transect were recorded (with some marked as in snapshot). For some studies this level of detail may be unnecessary and it may be acceptable to record only birds seen in the snapshot counts. Taking this approach would mean more time could be devoted to recording birds' behaviour.

18.6. Working from the bridge wings was effective and is common practice among predator observers. However, it did at times cause some disruption to the bridge officers. Given that cetacean or air-breathing predator surveys are often undertaken from the *RRS James Clark Ross* it might be worth considering fitting a permanent or removable shelter on the monkey island for observers. Such shelters have apparently been fitted to the *Polar Stern* and other research ships operating in the Southern Ocean.

19. AME

19.1. When working on slip rings it is very important that the cover is installed properly and that the cable that enters the cover is orientated and adjusted properly. At one point in the cruise the net monitor was behaving most erratically, this was eventually traced to the slip rings. The large multi-core wire that enters the cover was placed such that too much of the cable was inside the housing. This meant that over time several of the inner cores gradually rubbed on the rotating slip ring and eventually started to cause an intermittent short.

19.2. A 'last look' with a torch and mirror is a good idea before closing the cover after PPM or problems.

20. ITS

20.1. The SCS is suffering from age (it only just installed on a Windows 2000 machine), and is not a good fit for the way the data logged is used on board. A new data logging system should be investigated, possible for installation in Summer 2007.

20.2. The UPS situation in the Computer Office is very poor, both in the capacity and the lack of graceful shutdown ability. This needs to be investigated and proper UPS provisioning provided.

Oceanography

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

Elizabeth Hawker

1. Introduction

RRS James Clark Ross had a 75 kHz RD Instruments Ocean Surveyor (OS75) ADCP installed during August 2005, replacing the old 150 kHz RDI unit that had seen many years of service. The OS75, in principle, is capable of profiling to deeper levels in the water column, and can also be configured to run in either narrowband or broadband modes. As such, it represents a useful advance in the science capability of the *JCR*.

2. Instrument and configuration

The OS75 unit is sited in the transducer well in the hull of the *JCR*. This is flooded with a mixture of 90% de-ionised water and 10% monopropylene glycol. With the previous 150 kHz unit, the use of a mixture of water/antifreeze in the transducer chest required a post-processing correction to derived ADCP velocities. However, the new OS75 unit uses a phased array transducer that produces all four beams from a single aperture at specific angles. A consequence of the way the beams are formed is that horizontal velocities derived using this instrument are independent of the speed of sound (vertical velocities, on the other hand, are not), hence this correction is no longer required.

The OS75 transducer on the *JCR* is aligned at approximately 60 degrees relative to the centre line. This differs from the recommended 45 degrees. The hull depth was measured by Robert Patterson (Chief Officer), and found to be 6.47m. Combined with a value for the distance of the transducer behind the sea-chest window of 100-200mm and a window thickness of 50mm, this implies a transducer depth of 6.3m. This is the value assumed for JR161.

During the trials cruise, it was noted that the OS75 causes interference with most of the other acoustic instruments on *JCR,* including the EM120 swath bathymetry system. To circumvent this, all acoustic instruments were set to ping sequentially through the SSU, however this acts to reduce the ping rate. As noted by Dr. Sophie Fielding, when in deep water the swath can take 20 to 30 seconds from ping to end of listening, as a result this means the ADCP only pings once every 25 or so seconds. A further problem is that the ADCP appears to “time out” every other ping when it has to wait a long time between pings (i.e when running in deep water alongside the EM120). This results in it rebooting and waking the ADCP instrument up every other ping, which simply exacerbates the problem. A fix is promised by BAS AME, but requires a firmware upgrade from RDI which is not presently available. During Jr161 the swath bathymetry system was not turned on because of the severe effects on data sampling rate and data quality. Several trial setups were undertaken to try to synchronise the ADCP with the EK60 (these are recorded in the setup log files (within the cruise ADCP directory) and within the EK60/Acoustic cruise log)), the final setup established using the SSU was to ping the ADCP synchronously with the EK60 and EA600. The EK60 was the master instrument (this was established using the command CX1,3 in the ADCP setup script) and was set to a constant ping rate of 2.5 seconds, the ADCP and EA600 were slaves. The SSU setup is described in the EK60 methods section of this cruise report. This created good data for both the ADCP and the EK60, only when the ADCP was set in narrowband – bottom tracking off mode. This method **does not work** with the ADCP in bottom tracking mode. More effort is required to establish how to interface all these instruments together with a minimum of interference to all.

The heading feed to the OS75 is the heading from the Seapath GPS unit. This differs from the previous ADCP setup on *JCR,* which took a heading feed from the ship's gyrocompass and required correction to GPS heading (from Ashtech) in post-processing.

The OS75 was controlled using Version 1.42 of the RDI VmDas software. The logging PC also had Version 1.13 of the RDI WinADCP software installed and running, to act as a realtime monitor of data. The OS75 ran in two modes during JR161: narrowband (with bottom-tracking on) and narrowband (with bottom-tracking off). Narrowband profiling with bottom-tracking on was enabled with sixty-five 16 meter bins, and with bottom-tracking off with seventy 16 meter bins. Narrowband profiling was also enabled with an 8 meter blanking distance. The time between pings was set to 2 seconds, again following advice from Dr. Deb Shoosmith (Note this 2 second rate was only during periods of bottom tracking where the ADCP was in control of itself. For the greater percentage of time the ping rate was 2.5 seconds as controlled by the SSU and EK60 master). Salinity at the transducer was set to zero, and Beam 3 misalignment was set to 60.08 degrees (see above discussion). The full configuration files for each of the modes used are given in the Appendix.

3. Notes for Instrument Setup

Set up the ADCP to run in narrowband mode

Open VMDAS
> file > collect data
> options > edit data options
ADCP setup tab: ADCP set up from file (using required command file)
set time between ensembles to 2 seconds
Recording tab: name: JR161_ (filenames will then update in correct format)
number:1
max size: 10
dueal output directories:
U: drive (making unix the primary drive)
C: local (as secondary drive)

Transform tab: heading source: nmea/prdid
tilt source: fixes tilts 0, 0

Command Files should have line of code added to run the ADCP through the SSU:
; Set Trigger In/Out [ADCP run through SSU]
CX1,3

ADCP needs to be pinging every five seconds or faster for decent data
- can be checked by looking at *N1R files and picking out lines starting $PADCP

4. Outputs

The ADCP writes files to a network drive that is samba-mounted from the Unix system. (Should the network fail, there is an alternative write path to the local ADCP PC hard drive to preserve data until the link is restored). When the Unix system is accessed (via samba) from a separate networked PC, this enables post-processing of the data without the need to move files.

Output files are of the form JR161_XXX_YYYYYY.ZZZ, where XXX increments each time the logging is stopped and restarted, and YYYYYY increments each time the present filesize exceeds 10 Mbyte.

ZZZ are the filename extensions, and are of the form:-

.N1R (NMEA telegram + ADCP timestamp; ASCII)
.ENR (Beam coodinate single-ping data; binary)
.VMO (VmDas configuation; ASCII)
.NMS (Navigation and attitude; binary)
.ENS (Beam coordinate single-ping data + NMEA data; binary)
.LOG (Log of ADCP communication and VmDas error; ASCII)
.ENX (Earth coordinate single-ping data; binary)
.STA (Earth coordinate short-term averaged data; binary)
.LTA (Earth coordinate long-term averaged data; binary)

5. Post-processing of data

OS75 data were processed on JR161 using Matlab code originated by IFM Kiel. This was adapted by Dr. Mark Inall and Dr. Deb Shoosmith for use with the *JCR* system. The master file for the processing is “OS75_JCR_FINAL_JR161.m”, which calls a lengthy sequence of routines to execute the following steps:-

1. Read RDI binary file with extension .ENX and ASCII file with extension .N1R into Matlab environment.

2. Remove missing data and data with bad navigation

3. Merge Seapath attitude data with single-ping ADCP data.

4. Correct for transducer misalignment and velocity scaling error (calculated during first run-through of code, applied during second)

5. Derive ship velocity from Seapath navigation data

6. Perform quality control on data, such that four-beam solution is only permitted. Other screening is performed based on maximum heading change between pings, maximum velocity change between pings, and the error velocity.

7. Average data into ensembles of pre-defined length (120 seconds for JR139)

8. Calculates transducer misalignment and velocity scaling error (computation done on first run-through of code, to be applied during second)

9. Velocities from depths deeper than 86% of the bottom-tracking depth are set to missing.

10. Determine absolute velocities from either bottom-track ship velocity or Seapath GPS.

Final data are stored in Matlab format. Filenames are of the form:

1) JR161_000_000000_A_hc.mat, where A is the highest number of the user-incremented files. (This is the number that VmDas increments every time logging is stopped and restarted). This contains structured arrays “c” (ensembled-averaged data), and “b” (absolute velocities)

2) JR161_00A_00000Bd.mat, where A is as above, and B is the number VmDas increments every time filesize exceeds 10 Mbyte. This contains single-ping data in structured array “d”.

3) JR161_00A_00000Bd_ATT.mat. As (2), but containing ship’s attitude data rather than ADCP data.

4) JR161_00A_000000_ATT.mat. As (3), but for the whole section of data in the user-incremented series A

Appendix 1: Command File without Bottom Tracking

```
;-----------------------------------------------------------------------------\
; ADCP Command File for use with VmDas software.
;
; ADCP type:     75 Khz Ocean Surveyor
; Setup name:    default
; Setup type:    low resolution, Long range profile(Narrowband)  deep water
;
; NOTE:  Any line beginning with a semicolon in the first
;        column is treated as a comment and is ignored by
;        the VmDas software.
;
; NOTE:  This file is best viewed with a fixed-point font (e.g. courier).
; Modified Last: 28August2005
;----------------------------------------------------------------------------/

; Restore factory default settings in the ADCP
cr1

; set the data collection baud rate to 38400 bps,
; no parity, one stop bit, 8 data bits
; NOTE:  VmDas sends baud rate change command after all other commands in
; this file, so that it is not made permanent by a CK command.
cb611

; Set for narrowband single-ping profile mode (NP), seventy (NN) 16 meter bins
(NS),
; 8 meter blanking distance (NF), 390 cm/s ambiguity vel (WV)

; Switch Narrowband ON   NP1
NP1
nn70
ns1600
nf0800


; Switch Broadband  OFF   WP0

WP000
WN065
WS800
WF0200

WV390

; Disable single-ping bottom track (BP),
; Set maximum bottom search depth to 1200 meters (BX)
```

```
; Bottom track OFF
BP00
BX12000


; output velocity, correlation, echo intensity, percent good
WD111100000

; One and half seconds between bottom and water pings
TP000150

; Two seconds between ensembles
; Since VmDas uses manual pinging, TE is ignored by the ADCP.
; You must set the time between ensemble in the VmDas Communication options
TE00000200

; Set to calculate speed-of-sound, no depth sensor, external synchro heading
; sensor, no pitch or roll being used, no salinity sensor, use internal transducer
; temperature sensor
EZ1020001

; Output beam data (rotations are done in software)
EX00000

; Set transducer misalignment (hundredths of degrees)
EA6008

; Set transducer depth (decimeters) [= 6.5m on JCR]
ED00063

; Set Salinity (ppt) [salinity in transducer well = 0]
ES0

; Set to trigger by SSU
CX1,3

; save this setup to non-volatile memory in the ADCP
CK
```

Appendix 2: Command File with Bottom Tracking

```
;---------------------------------------------------------------------------\
; ADCP Command File for use with VmDas software.
;
; ADCP type:     75 Khz Ocean Surveyor
; Setup name:    default
; Setup type:    low resolution, Long range profile(Narrowband)  1000 m
;
; NOTE:  Any line beginning with a semicolon in the first
;        column is treated as a comment and is ignored by
;        the VmDas software.
;
; NOTE:  This file is best viewed with a fixed-point font (e.g. courier).
; Modified Last: 28August2005
;---------------------------------------------------------------------------/

; Restore factory default settings in the ADCP
cr1

; set the data collection baud rate to 38400 bps,
; no parity, one stop bit, 8 data bits
; NOTE:  VmDas sends baud rate change command after all other commands in
; this file, so that it is not made permanent by a CK command.
cb611

; Set for narrowband single-ping profile mode (NP), sixty five (NN) 16 meter bins
(NS),
; 8 meter blanking distance (NF), 390 cm/s ambiguity vel (WV)

; Switch Narrowband ON  NP1
NP1
nn65
ns1600
nf0800


; Switch Broadband  OFF  WP0

WP000
WN065
WS800
WF0200

WV390

; Enable single-ping bottom track (BP),
; Set maximum bottom search depth to 1200 meters (BX) (decimeters)
BP01
```

```
BX12000


; output velocity, correlation, echo intensity, percent good
WD111100000

; Two seconds between bottom and water pings
TP000200

; Three seconds between ensembles
; Since VmDas uses manual pinging, TE is ignored by the ADCP.
; You must set the time between ensemble in the VmDas Communication options
TE00000300

; Set to calculate speed-of-sound, no depth sensor, external synchro heading
; sensor, no pitch or roll being used, no salinity sensor, use internal transducer
; temperature sensor
EZ1020001

; Output beam data (rotations are done in software)
EX00000

; Set transducer misalignment (hundredths of degrees)
EA6008

; Set transducer depth (decimeters) [= 6.5m on JCR]
ED00063

; Set Salinity (ppt) [salinity in transducer well = 0]
ES0

; Set Trigger In/Out [ADCP run through SSU]
; CX0,0
CX1,3

; save this setup to non-volatile memory in the ADCP
CK
```

CTD Data Acquisition and Deployment

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1. Introduction

A Conductivity-Temperature-Depth (CTD) unit was used on JR161 to vertically profile the temperature and salinity of the water column. In total 63 CTD casts were completed. The method of acquisition and calibration of the data are described below. A test of the CTD was performed before the first process station.

A summary of all CTD deployments is given is Table ctd1. During the cruise we carried out three 4-day Process Stations, five 2-day Condensed Stations, and five full depth Transect Stations. The CTD protocol for these stations were as follows:

Process Station:
Day 1 full-depth cast, shallow cast, shallow cast to chl max, cast to 2000m
Day 2 full-depth cast, shallow cast, shallow cast to chl max, cast to 2000m, 400m cast for Oithona
Day 3 full-depth cast, shallow cast, shallow cast to chl max, cast to 2000m
Day 4 no CTD casts

Condensed Stations:
Day 1 full-depth cast, shallow cast
Day 2 400m cast for Oithona

Transect Stations:
Full depth CTD cast

The bottle firing protocols for these stations were:
a) full depth cast: 10m off bottom, 3000m, 2500m, 2000m, 1500m, 1000m, 800m, 600m, 400m, 200m, 180m, 160m
b) shallow cast: 140m, 120m, 100m, 80m, 60m, 50m, 40m, 30m, 20m, 10m, 5m, final bottle at chl. max
c) shallow cast to chl max.: all bottles to be fired at depth of chl. max
d) cast to 2000m: all bottles to be fired at depth of 2000m
e) 400m cast for Oithona: 400m, 400m, 300m, 300m, 200m, 200m, 100m, 100m, 50m, 50m, and two bottles as close to surface as possible

On all full-depth casts salinity samples were taken, and samples for O18 were also collected on all full-depth casts during the transect (detailed in Table ctd1).

2. CTD unit and deployment

A full sized SBE 24 carousel water sampler, holding 12 bottles, connected to an SBE 9 plus CTD and an SBE 11 plus deck unit was used to collect vertical profiles on the water column. The deck unit provides power, real time data acquisition and control.

The underwater SBE 9 plus unit featured dual temperature (SBE 3 plus) and conductivity (SBE 4) sensors, and a *Paroscientific* pressure sensor. A TC duct and a pump-controlled flow system ensure that the flow through the T-C duct is constant to minimize salinity spiking. Used in conjunction with the SBE 32 and SBE 911, the SBE 35 Deep Ocean Standards Thermometer makes temperature measurements each time a bottle file confirmation is confirmed. A file containing the time, bottle position and temperature is recorded allowing comparison of the SBE 35 record with the CTD and bottle data.

In addition, an altimeter, a fluorometer, an oxygen sensor and a PAR sensor were attached to the carousel. The altimeter gave real time accurate measurements of height off the sea-bed once the instrument package was within approximately 100 m of the bottom. The Simrad EA600 system would sometimes lose the bottom or give erroneous readings on station, so care was needed to interpret these digitised records.

Although collected, the fluorometer, PAR and oxygen data have not been processed beyond the initial SBE data processing package and will thus not be discussed further.

For all stations two UKORS LADCPs (one upward looking, the other downward looking) were attached to the main CTD frame. A fin was also added to the frame to reduce rotation of the package underwater (see LADCP section of this cruise report).

The CTD data were logged via the deck unit to a 1.4GHz P4 PC, running Seasave Win32 version 5.37b (Sea-Bird Electronics Inc.). This new software is a great advance on the DOS version, allowing numerical data to be listed to the screen in real time, together with several graphs of various parameters. The data rate of recorded data for the CTD was 24 Hz.

The CTD package was deployed from the mid-ships gantry and A-frame, on a single conductor torque balanced cable connected to the CTD through the BAS conducting swivel. This CTD cable was made by Rochester Cables and was hauled on the 10T traction winch. The general procedure was to start data logging, deploy, and then to stop the CTD at 10 m cable out. The pumps are water activated and typically do not operate until 30-60 seconds after the CTD is in the water. If the word display on the Deck Unit is set to ‘E’ then the least significant digit on the display indicates whether the pumps are off (0) or on (1). After a 2 minute soak, the package was raised to just below the surface and then continuously lowered to near bottom, with the Niskin bottles being closed during the upcast. The final CTD product was formed from the calibrated downcast data averaged to 2 db intervals.

3. Data Acquisition

At the end of each CTD cast, four files were created by the Seasave Win32 version 5.28e module:

161_[nnn].dat a binary data file
161_[nnn].con an ascii configuration file containing calibration information
161_[nnn].con an ascii header file containing the sensor information
161_[nnn].bl a file containing the data cycles at which a bottle was closed on the rosette

where *[nnn]* refers to the CTD cast number. These files were saved directly to the \\samba\\pstar drive.

The CTD data was converted to ascii and calibrated by running the Sea-Bird Electronics Inc. Data Processing software version 5.37b *Data Conversion* module. This program was used only to convert the data from binary, although it can be used to derive variables. This outputted an ascii file *161_[nnn].cnv.*

The pressure sensor was calibrated following:

$$P = C\left(1 - \frac{T_0^2}{T^2}\right)\left(1 - D\left(1 - \frac{T_0^2}{T^2}\right)\right)$$

where *P* is the pressure, *T* is the pressure period in µ*S*, *U* is the temperature in degrees Centigrade, *D* is given by *D = D1 + D2U, C* is given by *C = C1 + C2U + C3U2*, *T0* is given by *T0 = T1+ T2U + T3U2 + T4U3 + T5U4*.

The conductivity sensor was calibrated following:

$$cond = \frac{\left(g + h f^2 + i f^3 + j f^4\right)}{10\left(1 + \delta t + \varepsilon p\right)}$$

where *p* is pressure, *t* is temperature, and δ = *CTcorr* and ε = *Cpcorr*.

The temperature sensor was calibrated following:

$$Temp\,(ITS-90) = \left\{\frac{1}{g = h\,(\ln(f_0/f) + i\,(\ln^2(f_0/f) + j\,(\ln^3(f_0/f))}\right\} - 273.15$$

where *f* is the frequency output by the sensor.

The Sea-Bird Electronics Inc. Data Processing software version 5.37b was then used to apply the following three processing steps:

• *Filter module*. A low pass filter was applied to the conductivity and pressure to increase the pressure resolution prior to the *loopedit module*. Output file is of the form *161_[nnn]_f.cnv*.

• *Cell Thermal Mass module*. This was used to remove the conductivity cell thermal mass effects from the measured conductivity. This takes the output from the data conversion program and re-derives the pressure and conductivity to take into account the temperature of the pressure sensor and the action of pressure on the conductivity cell. The output file is of the form *161_[nnn]_fc.cnv*. This correction followed the algorithm:
Corrected Conductivity = c + ctm
where,
*ctm = (-1.0 * b * previous ctm) + (a * dcdt * dt),*
dt = (temperature - previous temperature),
*dcdt = 0.1 * (1 + 0.006 * (temperature - 20),*
*a = 2 * alpha / (sample interval * beta + 2*)

and *b = 1 - (2 * a / alpha)* with *alpha = 0.03* and *beta = 7.0*

• *Loopedit module*. This routine marks scans where the CTD package is moving less than minimum velocity or travelling backwards due to ship roll. Minimum velocity was fixed, and set to 0.25 m/s. Output file is of the form *161_[nnn]_fcl.cnv*.

All processed files were saved to the \\samba\\pstar drive, and the *_fcl.cnv*, *.ros* and *.bl* files also copied to *~/pstar/JR161/jr161_ctd/processed/161_[nnn]/*

4. SBE35 High Precision Thermometer

The BAS SBE35 high-precision thermometer was fitted to the CTD frame. Each time a water sample was taken using the rosette, the SBE35 recorded a temperature in EEPROM. This temperature was the mean of 8 * 1.1 seconds recording cycles (therefore 11 seconds) data. The thermometer has the facility to record 157 measurements but the data was downloaded approximately every few casts.

To process the data, communication was established between the CTD PC and the SBE35 by switching on the deck unit. The *SeaTerm* programme was used to process the data. This is a simple terminal emulator set up to talk to the SBE35. Once you open the program the prompt is ">". The SBE35 will respond to the command '*ds*' (display status) by telling you the date and time of the internal clock, and how many data cycles it currently holds in memory. A suitable file name can be entered via the 'capture' toolbar button, and the data downloaded using the command '*dd*' (dump data).
The data currently held in the memory is listed to the screen. This can be slow due to the low data transfer rate. Once the download is completed the 'capture' button should be clicked to close the open file, and the memory of the SBE 35 cleared using the command **"*samplenum=0*".** To check the memory is clear the command '*ds*' should again be entered before shutting down the system.

The SBE35 data files were divided into separate files for each station with up to 12 records (one level for each bottle, see section) called jr161*sbe[nnn].txt*. These files were saved directly to the \\samba\\pstar drive *~/pstar/cruise/ctd/jr161_sbe35/.*

5. Salinity Samples

At each full-depth CTD station 12 Niskin bottles were closed at varying depths through the water column and then sampled for salinity analysis. Salinity samples were not collected on the shallower casts.

The primary purpose of collecting salinity samples is to calibrate the salinity measurements made by the CTD sensors. Samples were taken in 200 ml medicine bottles. Each bottle was rinsed three times and then filled to just below the neck, 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, a plastic seal was inserted into the neck of the bottle and the screw cap was replaced. The bottle crates were colour coded and numbered for reference. The salinity samples were placed close to the salinometer and left for at least 24 hours before measurement. This allowed the sample temperatures to equalise with the ambient temperature of the lab.

The samples were then analysed on the BAS Guildline Autosal model 8400B, S/N 63360 against Ocean Scientific standard seawater (hereafter OSIL) from batch P146. At the start of the cruise the salinometer was standardised with OSIL P146. At the beginning, and at the end of each crate of samples one vial of OSIL standard seawater was run through the salinometer enabling a calibration offset to be derived and to check the stability of the salinometer.

Once analysed, the conductivity ratios were entered by hand into an EXCEL spreadsheet and converted to salinities. This spreadsheet was used by the matlab scripts for further CTD data processing.

Problems:

At first there were problems with the new external pump that draws the sample into the salinometer. It was introducing many microbubbles into the cell causing the readings to be highly unstable and fluctuate abnormally. As a result the analysis of the first crate of salts lasted well over 3.5 hours. It was found that the clamps holding the tube inside the pump were too tight. After loosening the clamps the bubbles ceased to flow into the cell, however the salinometer readings continued to be highly unstable, taking a very long time to stabilize. The reading would regularly creep up or down 30-40 digits before stabilizing at a particular value (eg. 1.98321 – 1.98365). This occurred typically in all three readings per bottle, causing the analysis of an entire crate to take over 3.5 hours each time. Several attempts at solving the problem were made, including re-calibrating the salinometer & varying the pump flow speed. Neither of these had any effect, therefore the majority of bottles were analysed successfully despite unusual behaviour and instability of the salinometer.

The solution was finally found by replacing the new pump by one of the old peristaltic pumps. After the replacement the salinometer readings stabilized much quicker, with the first reading typically varying less than 10 units, and subsequent readings usually only oscillating 3-5 units. This reduced the “crate analysis time” to a more normal two hours.

The possible problem of the new pump was the right sized tubing had not been delivered with the pump for this cruise, therefore a thinner diameter tube had to be used. It is believed that with such a small tube, the pump would vaporize the water inside the tube causing micro-bubbles which were not visible to the naked eye, but were seriously affecting the salinometer readings. The old tried and tested peristaltic pump caused the salinometer to behave in its usual manner.

A small problem was found with the peristaltic pump; the highest flow setting was producing too much pressure on the outgoing tube causing it to pop out releasing water into the pump casing. The only solution that was found for this problem was to use superglue to physically stick the two tubes together. After this, everything worked fine.

6. Samples for O^{18} analysis

Samples were taken for O^{18} analysis on all full depth CTD casts along transect T (ie all stations except PS1 and C1). The relevant stations are detailed in table ctd1. Samples were collected in 50ml glass bottles. Each bottle was rinsed three times and then filled to just below the neck. A plastic seal was inserted into the neck of the bottle, and a metal cap fixed in place using a crimper in order to seal the bottle. The bottles were labeled with the CTD cast number scratched on to the glass and marked in permanent pen. A further label (written on duct tape) was placed on each bottle with cruise name, CTD cast number, and station description. The bottles were then boxed up for return to the UK at the end of the season for analysis.

7. CTD data processing

Further processing of the CTD data was completed using matlab scripts written by Mike Meredith and modified by Deb Shoosmith. No use has been made of IPTS-68 temperatures, instead all calculations are done using version 3.0 of the CSIRO seawater toolbox using ITS-90 temperatures.

The MATLAB routines applied are as follows and are an amalgamation of those used on JR116, JR139 and JR151:

1. *ctdread.m* reads the status stored in the **jr161_*nnn*_fcl.cnv** file into MATLAB matrices by invoking *cnv2mat.m* routine, and names them accordingly. Output is of the form **ctd*nnn*.cal**.

2. *offpress.m* applies an offset pressure based on CTD deck pressure (using the median value of all negative pressure data). It sets variables to missing (NaN) if pumps were not operational. Output is of the form **ctd*nnn*.wat**.

3. *spike.m*: removes the larger spikes in the CTD datastreams. Output is of the form **ctd*nnn*.spk**.

4. *interpol*.m: interpolates missing data in the CTD datastreams. Outputs to **ctd*nnn*.int**.

5. *makebot.m* reads the SeaBird **ctd*nnn*.ros** file and the **ctd*nnn*.wat** to create a bottle file of the form **bot*nnn*.1st**. CTD data corresponding to the bottle firings are derived as the median values between the start and stop scans given in the **.ros** file. Temperature on the IPTS-90 scale is derived (used for input to MATLAB seawater routines), and salinity and potential temperature calculated using *ds_salt.m* and *ds_ptmp.m*. Warnings are written if large standard deviations in the CTD data corresponding to the bottle firings are obtained.
6. *readsal.m* loads the Niskin bottle numbers and corresponding salinities from the excel spreadsheet (**Salinity_Master_jr161.xls**). Missing samples are represented as NaNs. Output is of the form **sal*nnn*.mat**.

7. *addsal.m* reads the **bot*nnn*.1st** file and adds the sample salinity. Output is of the form **bot*nnn*.sal**.

8. *setsalflag.m* sets the salinity flag in the **bot*nnn*.sal** file to zero for instances when the standard deviation of any of the conductivity or temperature data (from either sensor) at the bottle firing levels is greater than 0.002.

9. *salplot.m* produces plots of: 1. CTD and bottled salinity with depth, 2. Difference between the CTD and bottled salinities with depth. This can be used to determine which bottles should be selected to compute offsets to be applied to the CTD data to reconcile them with the bottle data, however for preliminary processing, no salinity samples were excluded. This is a visual check and no output is generated. Further bottles can be excluded from the calibration by adjusting *salflag*.

10. *salcal.m* calculates the adjustment to nominally calibrated CTD salinity required to get the best fit to (non flagged) bottle data. It calls the *sw_cndr.m* routine to calculate conductivity from the bottle salinities at the temperature and pressure of the corresponding CTD salinities. The derived offsets are placed in the **bot*nnn*.sal** file.

11. *salcalapp.m* applies the derived offsets to the CTD conductivities, and then calculates salinity, potential temperature, and potential densities. Output is of the form **ctd*nnn*.var** and **bot*nnn*.cal** .

12. *splitcast.m* divides the CTD cast into an upcast and downcast, with the dividing point being determined by the maximum value of pressure. Output is of the form **ctd*nnn*.var.dn** and **ctd*nnn*.var.up** .

13. *gridctd.m* reads the downcast profile and derives 2 dbar averages of all properties. Output is of the form **ctd*nnn*.2db**.

The above programmes were run for each station in two stages using:
m00_jr161_runCTDprocessing.m
followed by

m00_jr161_runCTDprocessing.m	for full depth casts with salinity samples
or **m00_jr161_runCTDprocessing.m**	for casts without salinity samples

The procedure explained above was used for calculating the derived conductivity offsets for calibration of casts with salinity samples. This calibration was then used for the shallower casts on that station. The calibration offsets are given in Table ctd1.

Table ctd1: Summary of JR161 CTD deployments. The test station is not listed.

STATION	Event	Date	JDay	Time at bottom (GMT)	Longitude	Latitude	Water depth	Max CTD pressure	Station Description	Samples	Conductivity offset (calibration)
001	019	27/10/2006	300	08:11:33	50 26.31	57 44.52	4116	4139	PS1.1 full depth	salts	-0.0025
002	020	27/10/2006	300	10:35:00	50 26.30	57 44.51	4116	144	PS1.1 shallow phyto		-0.0025
003	023	27/20/2006	300	14:01:00	50 26.20	57 44.55	4118	22	PS1.1 shallow to chl max (DP)		-0.0025
004	026	27/10/2006	300	16:10:00	50 25.27	57 44.58	4134	2033	PS1.1 to 2000m (DP)		-0.0025
005	032	28/10/2006	301	08:12:12	50 26.30	57 44.42	4115		Lost communication on upcast		
006	035	28/10/2006	301	12:04:30	50 25.30	57 44.57	4135	143	PS1.2 shallow phyto		-0.0025
007	036	28/10/2006	301	14:22:06	50 25.30	57 44.57	4134	4192	PS1.2 full depth	salts	-0.0020
008	037	28/10/2006	301	16:40:00	50 23.58	57 44.48	4164	406	PS1.2 shallow Oithona		-0.0020
009	040	28/10/2006	301	20:48:00	50 23.57	57 41.70	4176	43	PS1.2 shallow to chl max (DP)		-0.0020
010	045	29/10/2006	302	09:38:35	50 26.19	57 44.53	4117	4150	PS1.3 deep	salts	-0.0020
011	047	29/10/2006	302	11:58:00	50 25.96	57 44.60	4124	143	PS1.3 shallow phyto		-0.0020
012	050	29/10/2006	302	14:50:51	50 24.80	57 44.66		42	PS1.3 shallow to chl max (DP)		-0.0020
013	052	29/10/2006	302	17:02:50	50 24.01	57 44.72	4164	2035	PS1.3 to 2000m (DP)		-0.0020
014	075	01/11/2006	305	09:20:45	48 41.80	60 38.89	1709	1676	CS1.1 full depth	salts	-0.0035
015	077	01/11/2006	305	10:54:00	48 41.85	60 38.95	1703	143	CS1.1 shallow phyto		-0.0035
016	086	02/11/2006	306	07:17:52	48 41.91	60 38.88	1703	404	CS1.2 shallow Oithona		-0.0035
017	088	02/11/2006	306	08:23:38	48 42.03	60 38.85	1698	40.3	CS1.2 shallow to chl max(DP)		-0.0035
018	099	05/11/2006	309	11:49:05	44 40.18	60 25.22	1205	1192	CS2.1 full depth	salts, O^{18}	-0.0010
019	101	05/11/2006	309	13:31:53	44 40.75	60 25.13	1213	143	CS2.1 shallow phyto	O^{18}	-0.0010
020	109	06/11/2006	310	07:12:11	44 36.99	60 26.40	748	405	CS2.2 shallow Oithona		-0.0010
021	111	06/11/2006	310	08:29:30	44 37.17	60 26.30	800	61	CS2.2 shallow to chl max (DP)		-0.0010
022	120	07/11/2006	311	11:15:41	44 31.00	60 05.87		5201	T-A full depth	salts, O^{18}	-0.0035

023	121	07/11/2006	311	16:12:47	44 14.09	59 56.44	4740	4780	T-B full depth	salts, O^{18}	-0.0045
024	127	08/11/2006	312	09:24:58	44 03.58	59 40.81	4100	4128	CS3.1 full depth (stopped on downcast due to wrong EA600 depth readings)	salts, O^{18}	-0.0037
025	129	08/11/2006	312	11:48:30	44 03.57	59 40.79	4109	143	CS1.2 shallow phyto		-0.0037
026	137	09/11/2006	313	07:12:00	44 03.58	59 40.70		404	CS3.2 shallow Oithona		-0.0037
027	139	09/11/2006	313	08:12:43	44 03.49	59 40.69	EA600 off	31	CS3.2 shallow to chl max (DP)		-0.0037
028	148	15/11/2006	319	23:51:00	43 19.79	58 35.50	3098	3094	T-C full depth	salts, O^{18}	-0.0025
029	152	16/11/2006	320	09:48:09	42 37.03	57 26.29	3289	142	CS4.1 shallow phyto		-0.0025
030	161	17/11/2006	321	08:56:06	42 36.99	57 26.27	3289	404	CS4.2 shallow Oithona		-0.0025
031	163	17/11/2006	321	10:04:00	42 37.04	57 26.29	3289	10	CS4.2 shallow to chl max (DP)		-0.0025
032	166	17/11/2006	321	14:20:20	42 40.38	57 31.98	3113	3111	CS4.2 full depth	salts, O^{18}	-0.0025
033	173	18/11/2006	322	07:29:40	41 14.77	55 12.35	3241	3236	PS2.1 full depth	salts, O^{18}	-0.0055
034	175	18/11/2006	322	09:35:11	41 14.62	55 12.36	3233	143	PS2.1 shallow phyto		-0.0055
035		18/11/2006	322	12:13:22	41 14.56	55 12.44	3233	41	PS2.1 shallow to chl max (DP)		-0.0055
036		18/11/2006	322	13:48:56	41 14.5	55 12.50	3235	2030	PS2.1 to 2000m (DP)		-0.0055
037	189	19/11/2006	323	05:30:00	41 14.76	55 12.36	3236	3232	PS2.2 full depth	salts	-0.0042
038	190	19/11/2006	323	07:33:00	41 13.07	55 12.83	3203	2032	PS2.2 to 2000m (DP)		-0.0042
039	191	19/11/2006	323	08:58:00	41 12.80	55 12.84	3199	43	PS2.2 shallow to chl max (DP)		-0.0042
040	194	19/11/2006	323	11:38:00	41 12.42	55 13.18	3199	143	PS2.2 shallow phyto		-0.0042
041	195	19/11/2006	323	12:36:10	41 12.39	55 13.22	3199	406	PS2.2 shallow Oithona		-0.0042
042	202	20/11/2006	324	06:27:00	41 14.80	55 12.49	3234	3241	PS2.3 full depth	salts	-0.0021
043	203	20/11/2006	324	08:37:00	41 14.18	55 12.78	3233	2029	PS2.3 to 2000m (DP)		-0.0021
044	204	20/11/2006	324	09:40:30	41 14.43	55 12.60	3236	141	PS2.3 shallow phyto		-0.0021
045	207	20/11/2006	324	12:27:00	41 14.04	55 12.91	3233	63	PS2.3 shallow to chl max (DP)		-0.0021
046	225	22/11/2006	326	11:32:48	40 48.82	54 14.29	2013	2045	T-I full depth	salts, O^{18}	-0.0030
047	226	22/11/2006	326	17:28:30	40 27.82	53 31.41	2058	2044	T-J full depth	salts, O^{18}	-0.0031
048	232	23/11/2006	327	06:48:00	40 05.83	52 51.54	3792	3807	PS3.1 full depth	salts, O^{18}	-0.0040

049	234	23/11/2006	327	08:55:55	40 05.81	52 51.62	3792	142	PS3.1 shallow phyto		-0.0040
050	237	23/11/2006	327	11:36:30	40 05.58	52 52.40	3795	32	PS3.1 shallow to chl max (DP)		-0.0040
051	239	23/11/2006	327	13:08:55	40 05.47	52 52.52	3795	2036	PS3.1 to 2000m (DP)		-0.0040
052	241	24/11/2006	328	11:51:00	40 08.35	52 52.21	3812	2034	PS3.2 to 2000m (DP)		-0.0044
053	243	24/11/2006	328	12:23:09	40 08.35	52 52.21	3811	144	PS3.2 shallow phyto		-0.0044
054	245	24/11/2006	328	14:47:03	40 08:35	52 52.51	3793	405	PS3.2 shallow Oithona		-0.0044
055	247	24/11/2006	328	15:53:15	40 08.35	52 52.21	3800	32	PS3.2 shallow to chl max (DP)		-0.0044
056	249	24/11/2006	328	18:50	40 08.38	52 52.21	3793	3813	PS3.2 full depth	salts	-0.0044
057	254	25/11/2006	329	08:38:00	40 05.81	52 51.54	3792	142	PS3.3 shallow phyto		-0.0044
058	257	25/11/2006	329	11:08:16	40 05.60	52 51.71	3792	31	PS3.3 shallow to chl max (DP)		-0.0044
059	259	25/11/2006	329	12:40:25	40 05.47	52 51.81	3793	2033	PS3.3 to 2000m (DP)		-0.0044
060	276	28/11/2006	332	08:07:40	49 59.97	38 00.05	5132	5217	CS6.1 full depth	salts, O^{18}	-0.0039
061	278	28/11/2006	332	10:44:46	50 00.25	37 59.56	5133	142	CS6.1 shallow phyto		-0.0039
062	286	29/11/2006	333	06:19:10	50 00.00	37 59.99	5134	403	CS6.2 shallow Oithona		-0.0039
063	288	29/11/2006	333	07:26:50	50 00.32	38 00.02	5134	25	CS6.2 shallow chl max (DP)		-0.0039

Table ctd2: JR161 CTD setup and calibration details

Date: 10/28/2006

ASCII file: D:\data\JR161\jr161cal.con

Configuration report for SBE 911/917 plus CTD

Frequency channels suppressed : 0
Voltage words suppressed : 0
Computer interface : RS-232C
Scans to average : 1
Surface PAR voltage added : No
NMEA position data added : No
Scan time added : No

1) Frequency, Temperature
Serial number : 4302
Calibrated on : 1/06/06
G : 4.37187000e-003
H : 6.40301000e-004
I : 2.08044000e-005
J : 1.58065000e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency, Conductivity
Serial number : 2875
Calibrated on : 1/06/06
G : -1.04861000e+001
H : 1.44287000e+000
I : 2.44973000e-003
J : -1.00114000e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

3) Frequency, Pressure, Digiquartz with TC
Serial number : 93686-0771
Calibrated on : 15/04/04
C1 : -4.785925e+004
C2 : -3.416160e-001
C3 : 1.442400e-002
D1 : 3.781000e-002
D2 : 0.000000e+000
T1 : 3.011158e+001
T2 : -3.924450e-004
T3 : 4.201770e-006
T4 : 2.250320e-009
T5 : 0.000000e+000
Slope : 1.00000000
Offset : 0.00000
AD590M : 1.284610e-002
AD590B : -8.492756e+000

4) Frequency, Temperature, 2
Serial number : 2191
Calibrated on : 1/06/06
G : 4.31887000e-003
H : 6.37084000e-004
I : 2.15409000e-005
J : 1.88209000e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency, Conductivity, 2

Serial number : 1912
Calibrated on : 1/06/06
G : -4.15313000e+000
H : 5.34134000e-001
I : -1.87130000e-004
J : 3.35086000e-005
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

6) A/D voltage 0, Altimeter

Serial number :
Calibrated on :
Scale factor : 15.000
Offset : 0.000

7) A/D voltage 1, Free

8) A/D voltage 2, Oxygen, SBE 43

Serial number : 0676
Calibrated on : 23/3/04
Soc : 4.1960e-001
Boc : 0.0000
Offset : -0.4840
Tcor : 0.0004
Pcor : 1.35e-004
Tau : 0.0

9) A/D voltage 3, Free

10) A/D voltage 4, Fluorometer, Chelsea Aqua 3

Serial number : 88249
Calibrated on : 22/06/06
VB : 0.433200
V1 : 2.011100
Vacetone : 0.432300
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

11) A/D voltage 5, Free

12) A/D voltage 6, PAR/Irradiance, Biospherical/Licor

Serial number : 7274
Calibrated on : 30/05/06
M : 1.00000000
B : 0.00000000
Calibration constant : 67114093959.73153700
Multiplier : 1.00000000
Offset : -0.02119270

13) A/D voltage 7, Free

LADCP

Elizabeth Hawker with additional support from Nathan Cunningham, Data Manager

1. Introduction

Cruise JR161 used two RDI Workhorse WH300 ADCP (WH) units to collect direct current velocity (LADCP) data. A single 300 kHz RDI WH unit (*DWH; serial number 4908*) was deployed in a downward facing position mounted off-centre at the bottom of the CTD frame. A second WH unit was deployed in an upward facing position on the side of the CTD. These were used in a master and slave configuration respectively. A fin was added to the CTD frame to reduce spinning.

Between stations, each ADCP was connected to a controlling PC in the Underway Instrument Control (UIC) room through a serial cable for delivery of pre-deployment instructions and post-deployment data retrieval. The battery package was recharged after each deployment, by connection to a charging unit via a power lead.

The LADCP deployments and processing are summarized in Tables ladcp1 and ladcp2.

2. Problems

We unfortunately had a number of problems with the LADCP on JR161. A summary of the CTD casts on which the LADCP was deployed is given in Table ladcp1.

1. Initially the master/slave command files used were adjusted from those found on the LADCP PC, and did not appear to work successfully. As described below the correct command files were used from CTD cast 015 onwards and only data from this point onwards has bee processed

2. Communication with the LADCP was flaky. Although appearing to successfully go through the pre-deployment tests, on some casts data could only be recovered from one or other of the master and slave. Additionally, when data was recovered after a cast a variable number of files (instead of the expected one file) were found. Since the LADCP memory was cleared before every deployment, these files were all belonging to the cast in question. The initial processing (reported by scan.prl) often showed that these files were apparently empty - giving nonsense depths and times.

All raw files were saved to U:\cruise\ladcp\JR161\jr161_[*nnn*]\ where *nnn* is the CTD cast number. They were named **jr161_[*nnn*]m[*X*].000** or **jr161_[*nnn*]s[*X*].000** where ***nnn*** is the CTD cast number, **m** or **s** refers to master or slave and ***X*** denotes a letter of the alphabet to identify between the multiple files recovered.

The initial processing required the files to be copied placed in *~/raw/jr0610/ladcp* and to be of the format **j[*nnn*]_02.000** or **j[*nnn*]_03.000** where *nnn* is the station number and the digit 2 represents master or the digit 3 represents slave.

For deployments were more than one file was recovered, each file was copied to *~/raw/jr0610/ladcp* in turn and investigated using scan.prl (see processing details below). Since only one file for each cast was found to contain data that file was retained in the directory *~/raw/jr0610/ladcp* and used in the further steps of the initial processing.

The scan.prl step (results recorded in *~/proc/proc.dat*) revealed that for a number of casts the start and end times and depths did not match those recorded in the CTD log. On some casts only the downcast appeared to be recorded, or part of the downcast. The initial processing steps were carried out as far as possible, although for a number of cases the *do_abs* matlab script failed due to the mismatch between downcast and upcast.

The scripts will need adjusting back at BAS for any further processing of the data to be completed.

3. JR161 LADCP configuration files

The initial configuration files used (found on the LADCP PC from a previous cruise using master/slave configuration) did not appear to work successfully. After helpful discussions with Dr. Brian King (NOC) the correct configuration files were emailed to the ship, and used from CTD cast 015 onwards. Each station consisted of a single down- and upcast without pause except for bottle firing. For such stations the priority is to obtain the best possible current estimates despite package motion and a short observation period for each part of the water column. As is usual for this purpose, the ADCPs were operated with 16 large (10 m) bins and short ensembles (1 ping per ensemble; average 1 ping/second).

Table ladcp3: LADCP command files used on JR161

Command File: whm_jr161_cmd	Command File: whs_jr161_cmd
PS0	PS0
CR1	CR1
CF11101	CF11101
EA00000	EA00000
EB00000	EB00000
ED00000	ED00000
ES35	ES35
EX11111	EX11111
EZ0011111	EZ0011111
TE00:00:01.00	TE00:00:01.00
TP00:01.00	TP00:01.00
LD111100000	LD111100000
LF0500	LF0500
LN016	LN016
LP00001	LP00001
LS1000	LS1000
LV250	LV250
LJ1	LJ1
LW1	LW1
LZ30,220	LZ30,220
SM1	SM2
SA001	SA001
SW05000	ST0
CK	CK
CS	CS

Instructions for LADCP deployment and recovery during JR161

This set of instructions is based on the LADCP section of previous NOC cruise reports (including JR139 Stansfield et al., 2005). It can be used in conjunction with the LADCP log sheet included in the present report.

4. JR161 LADCP DEPLOYMENT

Connect the communications and battery leads for both instruments.

Go to controlling PC:

A) MASTER (downward looking workhorse DWH)

1. Open BBTALK window for COM1
Press <**F3**> to create log file for all output: filename of the form
c:\ladcp\jr161\log_files\WHM###m.txt
where ### is ctd cast number, and m refers to master status

2. Press <**END**> to wake up DWH
If this fails, check communications lead

3. Type **TS?** <**ENTER**> to check DWH clock against scientific clock
gives time in form YYMMDDhhmmss

Type **TSYYMMDDhhmmss** <**ENTER**> if required to reset DWH clock

4. Type **RS?** <**ENTER**> to check available memory of DWH

If you need to clear memory, type **RE ErAsE** <**ENTER**>
Only clear if backed up to UNIX drive

5. Type **PA** <**ENTER**> to run diagnostic checks

6. If batteries were recharged, switch off battery charge unit and check battery voltage.

7. Press <**F2**> select DWH master configuration file

8. Press <**F3**> to stop log file

The master DWH should now be pinging.

B) SLAVE (upward looking workhorse UWH)

Repeat steps 1 - 8 in adjacent window noting:

1. UWH log file should be called **c:\ladcp\jr161\log_files\WHS###s.txt** (s refers to slave)
2. Select slave UWH configuration file

Detach communication and charger cables and fit blanks to cable ends.

5. JR161 LADCP RECOVERY

Remove Blanks and attach communications and charger cables.

1. Open BBTALK COM1 window (for master) and COM2 window (for slave)

   Press <END> in both windows to wake up the LADCPs

2. Check battery voltage and switch on charger if needed.

3. type RA? <ENTER> to check number of deployments

   Reset Baud rate to 115200 to allow for faster recovery of the data by typing CB811

   To transfer data to PC:
   Go to FILE, RECOVER RECORDER
   Select c:\ladcp\jr161\master\ for DWH and c:\ladcp\jr161\slave for UWH as destination files

   Reset Baud rate by typing CB411

   Type CZ <ENTER> once data are transferred to power down LADCPs

4. Rename the default filenames to
   c:\ladcp\jr161\master\jr161m###.000 and
   c:\ladcp\jr161\slave\jr161s###.000

6. LADCP data processing

LADCP data was processed following the instructions laid out in the JR115 and JR139 cruise reports (Sparrow and Hawker, 2005 and Stansfield and Meredith, 2005). The required software was provided by Dr Brian King (NOC) prior to the cruise. The directory structure and environment variables were set up at the start of the cruise. Helpful discussions with Dr Brian King by email during the early part of the cruise helped to troubleshoot problems with the initial set up and the processing paths were successfully set in place.

Initial Data Processing

The initial steps of data processing on JR161 were as follows:

(i) Log onto one of the UNIX machines as pstar, password pstar.
You must be logged on to jruh to get access to the matlab licence

(ii) *cd ladcp* (ensures you're in the correct directory)
setup jr115matlab (set up matlab)
source LADall (set up paths)

(iii) *perl –S scan.prl NNN_02* (allows the user to check the start and end times for the downcast and upcast. The duration of the downcast and upcast should be similar. The minimum and maximum depths should also be checked).

(iv) *putpos2 NNN 02* (collects start and stop times, positions, and gets the magnetic variation correction using a matlab routine. Updates stations.asc and magvar.tab. Note that if you run this more than once for the same station then you should go into these files and delete the invalid entry. You may wish to check the files for duplicates, test file entries, etc. before you proceed.)

(v) *perl –S load.prl NNN_02* (loads data into the CODAS database, correcting for magvar.tab. It is very important that this step is only done once. If you need to do it again, for example if you discover an error in step 5, then you must delete the database files first. For JR161 these are found in proc/casts/jNNN_02/scdb).

(vi) *perl –S domerge.prl –c0 NNN_02* (merge single pings into long shear profiles)

(vii) *cd Rnav*
setup files for retrieving location data from ship's navigation streams; see readme file for more detailed instructions. For JR161, data from the NMEA GPS stream was used.
updatesm.exec (updates a navigation file)
cd proc

(ix) In matlab the data can be plotted and checked using the following command:
do_abs setting *plist = NNN.02* or *NNN.03* to give cast and master/slave information

This generates five plots showing the various velocity components and information about the sensor such as its heading, tilt and angle).

Secondary Processing (absolute velocities)

Any further processing of the data will be done at BAS. The following procedures can be used to calculate the absolute velocities, once the CTD data has been processed as far as a 1 Hz file:

(i) In UNIX:
cd proc
cd Rctd (copy your CTD 1Hz files into this directory)
ctd1hz_links (creates links so ctd_in can find the files)

(ii) In Matlab:
cd to proc/Pctd (Matlab doesn't seem to be able to use the $cdpath shell variable to find its way around, so you will have to use pwd liberally)
ctd_in(NNN,02)
cd to proc/Fitd (as above)
plist = NNN.02 (set the cast and master/slave information)
fd (check vertical velocities from CTD (line) and LADCP (x) agree)

(iii) In UNIX:
cd proc
perl –S add_ctd.prl NNN_02 (add the CTD data to the CODAS database)
perl –S domerge.prl –c1 NNN_02 (merge the ping profiles using the CTD data)

(iv) In Matlab:
plist = NNN.02
do_abs (When the velocity profiles are plotted they should be a similar shape to the profiles at the end of the 'first look' data processing, but with a mean velocity, so that the U and V velocities have a mean offset).

STATION	Event	Date	JDay	Time at bottom (GMT)	Longitude	Latitude	Water depth	Max CTD pressure	Station Description	Data Recovery	Processing Notes
001	**019**	**27/10/2006**	**300**	**08:11:33**	**50 26.31**	**57 44.52**	**4116**	**4139**	**PS1.1 full depth**	**none**	
005	**032**	**28/10/2006**	**301**	**08:12:12**	**50 26.30**	**57 44.42**	**4115**		**Lost communication on upcast**	**jr161_005mA.000** **jr161_005mB.000** **jr161_005sA.000** **jr161_005sB.000**	**not processed**
007	**036**	**28/10/2006**	**301**	**14:22:06**	**50 25.30**	**57 44.57**	**4134**	**4192**	**PS1.2 full depth**	**jr161_007mA.000** **jr161_007mB.000** **jr161_007mC.000** **jr161_007mD.000** **jr161_007mE.000** **jr161_007sA.000** **jr161_007sB.000** **jr161_007sC.000** **jr161_007sD.000**	**not processed**
010	**045**	**29/10/2006**	**302**	**09:38:35**	**50 26.19**	**57 44.53**	**4117**	**4150**	**PS1.3 deep**	**jr161_010mA.000**	**not processed**

										jr161_010mB.000 jr161_010mC.000 jr161_010mD.000 jr161_010mE.000 jr161_010mF.000	
014	075	01/11/2006	305	09:20:45	48 41.80	60 38.89	1709	1676	CS1.1 full depth	jr161_014mA.000 jr161_014mB.000 jr161_014mC.000	not processed
015	077	01/11/2006	305	10:54:00	48 41.85	60 38.95	1703	143	CS1.1 shallow phyto	jr161_015m.000	MASTER processed
016	086	02/11/2006	306	07:17:52	48 41.91	60 38.88	1703	404	CS1.2 shallow Oithona	jr161_016m.000	
018	099	05/11/2006	309	11:49:05	44 40.18	60 25.22	1205	1192	CS2.1 full depth	jr161_018m.000 jr161_018s.000	
022	120	07/11/2006	311	11:15:41	44 31.00	60 05.87		5201	T-A full depth	jr161_022m.000	

023	**121**	**07/11/2006**	**311**	**16:12:47**	**44 14.09**	**59 56.44**	**4740**	**4780**	**T-B full depth**	**jr161_023mA.000** **jr161_023mB.000** **jr161_023mC.000** **jr161_023mD.000** **jr161_023mE.000** **jr161_023sA.000** **jr161_023sB.000** **jr161_023sC.000**	
024	**127**	**08/11/2006**	**312**	**09:24:58**	**44 03.58**	**59 40.81**	**4100**	**4128**	**CS3.1 full depth (stopped on downcast due to wrong EA600 depth readings)**	**jr161_024mA.000** **jr161_024mB.000** **jr161_024mC.000** **jr161_024mD.000** **jr161_024s.000**	
028	**148**	**15/11/2006**	**319**	**23:51:00**	**43 19.79**	**58 35.50**	**3098**	**3094**	**T-C full depth**	**none**	
032	**166**	**17/11/2006**	**321**	**14:20:20**	**42 40.38**	**57 31.98**	**3113**	**3111**	**CS4.2 full depth**	**jr161_032mA.000** **jr161_032mB.000** **jr161_032s.000**	

033	173	18/11/2006	322	07:29:40	41 14.77	55 12.35	3241	3236	PS2.1 full depth	jr161_033mA.000 jr161_033mB.000	
037	189	19/11/2006	323	05:30:00	41 14.76	55 12.36	3236	3232	PS2.2 full depth	jr161_037mA.000 jr161_037mB.000 jr161_037mC.000 jr161_037mD.000 jr161_037mE.000 jr161_037mF.000 jr161_037s.000	
042	202	20/11/2006	324	06:27:00	41 14.80	55 12.49	3234	3241	PS2.3 full depth	jr161_042mA.000 jr161_042mB.000 jr161_042mC.000	
046	225	22/11/2006	326	11:32:48	40 48.82	54 14.29	2013	2045	T-I full depth	jr161_046mA.000 jr161_046mB.000 jr161_046s.000	

047	**226**	**22/11/2006**	**326**	**17:28:30**	**40 27.82**	**53 31.41**	**2058**	**2044**	**T-J full depth**	**jr161_047mA.000** **jr161_047mB.000** **jr161_047sA.000** **jr161_047sB.000**	
048	**232**	**23/11/2006**	**327**	**06:48:00**	**40 05.83**	**52 51.54**	**3792**	**3807**	**PS3.1 full depth**	**None**	
056	**249**	**24/11/2006**	**328**	**18:50**	**40 08.38**	**52 52.21**	**3793**	**3813**	**PS3.2 full depth**	**jr161_056mA.000** **jr161_056mB.000** **jr161_056s.000**	
060	**276**	**28/11/2006**	**332**	**08:07:40**	**49 59.97**	**38 00.05**	**5132**	**5217**	**CS6.1 full depth**	**None**	

Table ladcp1: LADCP deployments during JR161

Table ladcp2: Notes on LADCP processing during JR161

STATION	Event	MASTER Processing Notes	SLAVE Processing Notes
001	**019**	**not processed**	**not processed**
005	**032**	**not processed**	**not processed**
007	**036**	**not processed**	**not processed**
010	**045**	**not processed**	**not processed**
014	**075**	**not processed**	**not processed**
015	**077**	**times and depths match CTD, processed up to *do_abs***	**no data**
016	**086**	**times and depths match CTD, processed up to *do_abs***	**no data**
018	**099**	**times and depths match CTD, processed up to *do_abs***	**processed; times and depths match CTD, *do_abs* failed**
022	**120**	**downcast only , processed up to *do_abs***	**no data**
023	**121**	**half downcast, *do_abs* failed**	**half downcast, *do_abs* failed**
024	**127**	**times match CTD downcast only; *do_abs* failed**	**mismatched times and depths with ctd; *do_abs* failed**
028	**148**	**no data**	**no data**
032	**166**	**times and depths match CTD; *do_abs* failed**	**times match CTD, incorrect depth reading; *do_abs* failed**
033	**173**	**no data**	**no data**
037	**189**	**times match CTD, incorrect depth reading; *do_abs* failed**	**times match CTD, incorrect depth reading; *do_abs* failed**
042	**202**	**mismatch to CTD time, correct depth reading; *do_abs* failed**	**no data**

046	**225**	**mismatch to CTD time, correct depth reading; *do_abs* failed**	**times match CTD, incorrect depth reading; *do_abs* failed**
047	**226**	**times match CTD, incorrect depth reading; *do_abs* failed**	**times match CTD, incorrect depth reading; *do_abs* failed**
048	**232**	**no data**	**no data**
056	**249**	**times match CTD, incorrect depth reading; *do_abs* failed**	**times match CTD, incorrect depth reading; *do_abs* failed**
060	**276**	**no data**	**no data**

LADCP log sheet: – JR97

CTD CAST			Date:			JDAY		
Lat:			Long:			Depth:		

LADCP Deployment / Recovery Log Sheet

Pre-Deployment (Comms. and Charge leads should be in place)

In BBTALK:

	MASTER	SLAVE
1. Log file name (F3)	.txt	.txt
2. Time check (TS?) and time correction if necessary	: :	: :
3. Memory unused (RS?) and erase if necessary (RE ErAsE)	Mb	Mb
4. Run tests (PA)		

5. Battery Voltage | V | (max. 52V) measure across charger

Deployment

6. MASTER deployment time, from master clock | : : |

Recovery

In BBTALK

7. Time of stopping MASTER logging | : : | Stop SLAVE

8. Battery Voltage | V | Measure on charger

Data Transfer

In BBTALK

	MASTER	SLAVE
9. Number of deployments (RA?)		
10. Default filename	-RDI- .000	-RDI- .000
11. Renamed file	m.000	s.000

In BBLIST

	MASTER	SLAVE
12. File size	***Kb***	Kb
13. Number of ensembles		

16. Comments

Figure ladcp1: LADCP logsheet.

Underway measurements

Christos Mitsis (UEA)

Underway measurements during the scientific cruise JR161 fall into three categories; navigation data, oceanlogger/meteorological data, and echosounder depth data. The data are being logged by the SCS (Scientific Computer System) of JCR and are available for users under scs and rvs format for unix and scs format for PC. We used the unix-rvs format. The datastreams are available under *U:/cruise/rvs/raw_data* - */rvs/pro_data* by using a unix machine (i.e jrua) or any ssh client(i.e putty) in order to log on to the unix machine. The process of the data can be distinguished in two stages; the retrieval of the datastreams using unix based scripts (i.e get_underway) and the processing using matlab (scripts originally developed by Mike Meredith for the *Charles Darwin* cruise, CD160).

Navigation data

The navigation data that were logged and processed are:

- Ashtec ADU5 4 antennae GPS: Antenna 1 used to determine the ships position; antennae 2-4 used to determine roll, pitch and yaw.
- Ashtec GLONASS GG24: Positional information only.
- Seatex GPS (Seapath 200): Position and heading.
- GPS NMEA (Furuno GP32). Positional information only.
- Gyro (Seapath 200 heading). The best heading information available. The Sperry Mk 37 Gyrocompass is no longer recorded (discussed later).

The following texts name the scripts that describe the processing route for the above data.

`get_nav` Calls the unix scripts **`get_gyro`**, **`get_bestnav`**, **`get_gpsash`**, **`get_gpsglos`**, **`get_gpsnmea`**, **`get_seatex`** and **`get_tsshrp`**, which invoke the RVS `listit` command to retrieve 24 hours of heading (now fed from Seatex heading), bestnav(/rvs/pro_data), Ashtec (ADU5), Ashtec Glonass (GG24), GPS NMEA, Seatex and tsshrp (heave, roll and pitch) data, corresponding to JDAY XXX, and write to ascii files “gyro.XXX”, “bestnav.XXX”, “gpsash.XXX”, “gpsglos.XXX”, “gpsnmea.XXX”, “seatex.XXX” and “tsshrp.XXX”. Note that, although recorded and saved, the Ashtec Glonass and heave, roll and pitch (tsshrp) data, as also the Ashtec (ADU5) position information data from jday 308 and on were not processed further using matlab.

Gyrocompass

`loadgyro.m` Matlab code to read “gyro.XXX”, arrange into structure arrays and name accordingly. Saves output as “gyroXXX.mat”. Produces a rough plot of heading against time, for quick check of data completeness and integrity.

`gyroall.m` Matlab code to append “gyroXXX.mat” to the master file “gyro_all_jr141.mat”.

Bestnav

`loadbestnav.m` Matlab code to read "bestnav.XXX", arrange into structure arrays and name accordingly. Saves output as "bestnavXXX.mat". Produces a rough plot of ship's position over the 24 hour period, for quick check of data completeness and integrity.

`bestnavall.m` Matlab code to append "bestnavXXX.mat" to the master file "bestnav_all_jr141.mat"

Ashtech

`loadgpsash.m` Matlab code to read "gpsash.XXX", arrange into structure arrays and name accordingly. Saves output as "gpsashXXX.mat". Produces a rough plot of ship's position over the 24 hour period, for quick check of data completeness and integrity.

`gpsashall.m` Matlab code to append "gpsashXXX.mat" to the (raw data) master file "gpsash_all_jr141.mat"

GPS NMEA

`loadgpsnmea.m` Matlab code to read "gpsnmea.XXX", arrange into structure arrays and name accordingly. Saves output as "gpsnmeaXXX.mat". Produces a rough plot of ship's position over the 24 hour period, for quick check of data completeness and integrity.

`gpsnmea_all.m` Matlab code to append "gpsnmeaXXX.mat" to the master file "gpsnmea_all_jr141.mat"

Seatex

`loadseatex.m` Matlab code to read "seatex.XXX", arrange into structure arrays and name accordingly. Saves output as "seatexXXX.mat". Produces a rough plot of ship's position over the 24 hour period, for quick check of data completeness and integrity.

`seatex_all.m` Matlab code to append "seatexXXX.mat" to the master file "seatex_all_jr141.mat"

During the analysis of the navigation data for cruise JR161 starting from days 298 to 302 we realized that the gyrocompass stream was storing unequally the heading points for the two first days ending up with 86347-86394 respectively. The stored points for the next days were 86400 which are what we expected since the streaming of the heading is every second.
On jday 308 we have noticed the absence of data in the rvs system for the Ashtec gps. This was due to the instability of the instrument at the time. We stopped processing the Ashtec gps datastream after jday 314.

Minor changes applied to the matlab scripts to point to the directories used for this cruise.
An example of the datastream bestnav after the processing at the end of PS3 can be seen in ***figure 1***.

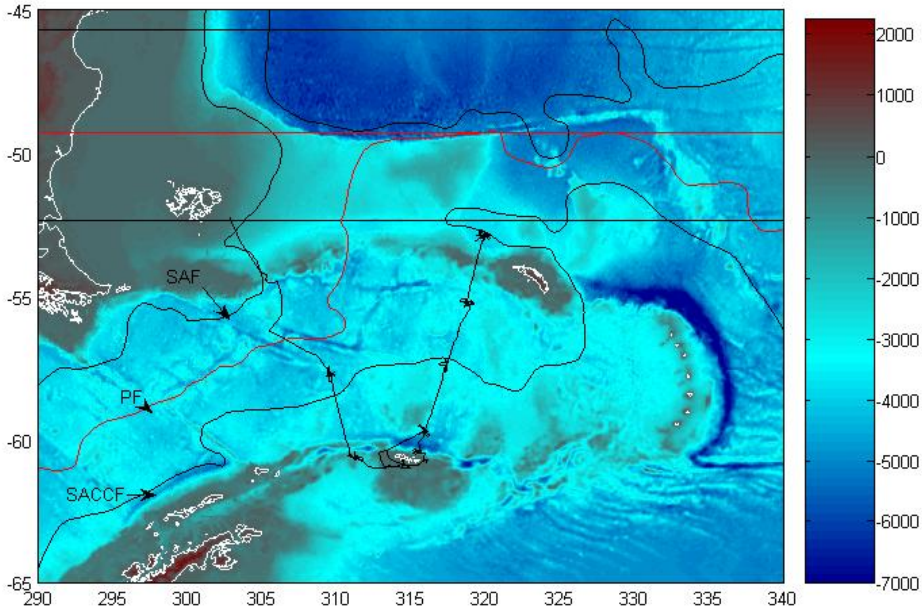

Figure 1: Bestnav data since the start of the cruise and until the end of PS3 after processing with the routines described above. The bathymetry used is from Smith & Sandwell ver.6.2.

Echosounder data

Depth information was retrieved from the Simrad ea600 single-beam echosounder.

Simrad ea600

`get_sim500` Invokes the RVS `listit` command to retrieve 24 hours of ea600 data, corresponding to JDAY XXX, and write to an ascii file "sim500.XXX".

`loadsim500.m` Matlab code to read "sim500.XXX", arrange into structure arrays and name accordingly. Saves output as "sim500_XXX.mat". Produces a rough plot of uncorrected depth over the 24 hour period.

`cleansim500.m` Loads "sim500_XXX.mat", removes large spikes with **`dspike.m`**, and launches basic interactive editor for further cleaning. A second run of **`dspike.m`** is enabled, followed by a 101-point median filter. Discarded depths are interpolated across, and output saved to "sim500_XXXclean.mat".

`sim500nav.m` Loads file "sim500_XXXclean.mat", interpolates across missing values and puts data on a regular 5 second interval, from which 2 minute averages are derived. The bestnav master file "bestnav_all_jr141.mat" is loaded, and latitudes and longitudes interpolated to the times of the sim500 timestamps. A quick plot of depth along the ship's track is produced, and data are saved to a file "sim500_XXXnav.mat".

`sim500all.m` Load "sim500_XXXnav.mat", and appends to master file "sim500_all_jr141.mat"

The bathymetry data have been processed using the m files *loadsim500.m* and *cleansim500.m* but without any interactive editing (or only where obvious editing needed) applied. Primarily,

we thought the navigation data (long, lat) should be appended to the bathy (*sim500nav.m*) in order a comparative approach with already consolidated high-resolution bathymetric databases to take place. Any interactive suppression could be applied afterwards.
The script *sim500nav.m* did not work with the data files *sim500_30[3,5].m.* This is due to the fact that both files after the conversion of the time using the matlab functions datenum and datevec seem to never have the condition *'datevector (5)/2==floor (datevector (5)/2 & datevector (6) =0'* satisfied. This occurs because although all the files have datastreams where time is being logged every 7 and 8 seconds sequentially a time interval decrease arises after a point which 'allows' the condition to be satisfied for the rest of the files but not for the two files mentioned above. To decipher the problem I used an interval of 1 second for the first interpolated time points and the new interpolated time file as the one from which the start and stop points are derived. The final script used is the *test_sim500_nav.m* (for comparisons with the sim500nav.m).

There were numerous times when the instrument was not logging. This can be seen as zero bathymetry at the final files produced (***figure 2***).

Again, as in cruise JR141 we did not use the routine "prodep", which applies corrections to the single-beam (EA600) echosounder depths based on Carter's tables. Instead of that we use the matlab script indicated below, at the end of the cruise. The following notes are appended here exactly as in cruise report JR141.

Note on correction of echosounder depths (Written by Mike Meredith, JR139?)

It was not possible on JR139 to run the RVS routine "prodep", which applies corrections to the single-beam (EA600) echosounder depths based on Carter's tables. (Depths returned by the EA600 assume that the speed of sound through the water column is 1500 m/s; use of Carter's tables corrects this using a more accurate speed of sound for the area in question). The problem was caused by a conflict with the RVS "bestnav" routine, but the exact source (and hence a solution) was not discovered, despite investigations by ITS. To circumvent this problem, a Matlab function ("carter.m") was written and applied to the final echosounder dataset. This function looks up the lat/long position for each echosounder datapoint in a digital version of Carter's tables, derives the Carter correction area, and returns this and a corrected depth. The lookup table is stored in two parts, "BOUNDARY2.DAT", and "CORRECTN2.DAT". Following execution of this function, the final EA600 file "sim500_all_jr139.dat" has two extra variables stored in the sim500 structured array, namely sim500.cordepth_ave (the corrected depths) and sim500.correction_area (the Carter correction area).

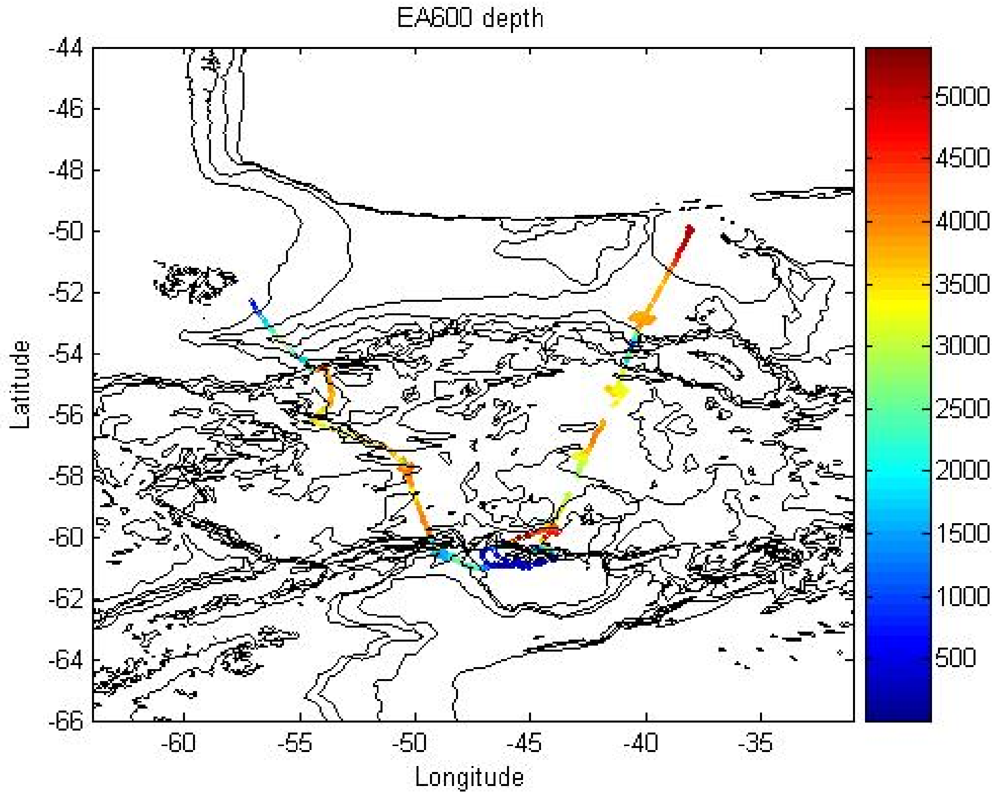

figure 2: EA600 bathymetry after applying the Matlab routines described above.

The oceanlogger and meteorological systems

The oceanlogger is comprised of a thermosalinograph and fluorometer connected to the ship's non-toxic pumped seawater supply, plus meteorological sensors measuring duplicate air pressure, duplicate air temperature, duplicate humidity, duplicate total incident radiation (TIR) and duplicate photosynthetically available radiation (PAR). The instruments and calibration information are detailed below. Any queries regarding calibration should be addressed to Pat Cooper (BAS, AME).

Oceanlogger

- SeaBird Electronics SBE45 CTD, s/n 4524698-0018, calibrated 5/3/04
- Turner Designs 10-AU Fluorometer, s/n 6465RTX

Meteorological Data

- Photosynthetically Active Radiation 1, Parlite Quantum Sensor, Kipp & Zonen, s/n 030335, calibrated 4/7/03
- Photosynthetically Active Radiation 2, Parlite Quantum Sensor, Kipp & Zonen, s/n 010224, calibrated 1/11/04
- Transmissometer 1, Proto1 SPLite, Kipp & Zonen, s/n 032374, calibrated 30/6/03
- Transmissometer 2, Proto1 SPLite, Kipp & Zonen, s/n 011403, calibrated

22/10/01

- Air temperature/humidity 1, Chilled Mirror Hygrometer MBW, PM-20251/1, Temperature Sensor Pt100, PM-20252/1, s/n 28552 023, calibrated 30/05/03
- Air temperature/humidity 2, Chilled Mirror Hygrometer MBW, PM-20251/1, Temperature Sensor Pt100, PM-20252/1, s/n 18109 036, calibrated 12/12/00
- Anemometer
-

The processing route for these data is given below.

`get_underway` Calls the unix scripts **`get_oceanlog`**, **`get_anemom`** and **`get_truewind`**, which invoke the RVS `listit` command to retrieve 24 hours of underway data, corresponding to JDAY XXX, and write to ascii files "oceanlog.XXX", "anemom.XXX" and "truewind.XXX".

`loadunderway.m` Matlab code, which calls functions **`loadoceanlog.m`**, **`loadanemom.m`** and **`loadtruewind.m`** to read "oceanlog.XXX", "anemom.XXX" and "truewind.XXX", arrange into structure arrays and name accordingly. Saves outputs as "oceanlogXXX.mat", "truewindXXX.mat" and "anemomXXX.mat". The program also calls **`cleanoceanlog.m`**, which uses **`dspike.m`** to remove large spikes in conductivity, housing (CTD) temperature and remote (hull) temperature. Interpolates across removed points, then launches basic interactive editor for further cleaning of conductivity, housing temperature and remote temperature. Calls **`ds_salt.m`** to calculate surface (uncalibrated) salinity from conductivity and housing temperature. Output saved to "oceanlogXXXclean.mat". Produces rough plots of sea surface conductivity, remote (hull) temperature and housing (CTD) temperature over the 24 hour period. Truewind, anemometer and cleaned oceanlog data are written to "underwayXXX.mat".

`truewind_derive.m` Loads file "underwayXXX.mat" and master file "gyro_all_jr141.mat". Interpolates gyro (Seapath) heading onto same time stamps as underway, and ensures that they lie in the range 0 to 360. Note that, on the JCR, the convention is that the underway wind direction is the direction the wind is blowing FROM. Real wind direction is obtained by adding underway direction to Seapath heading and then converting to the direction the wind is blowing TO. Underway wind speeds and (real) directions are broken into east and north velocity components and velocities are changed from knots to ms^{-1}. Ship's velocity is derived from position fixes, and this speed and angle are converted to ship's east and north velocities. These are interpolated to the same timestamps as the underway data. East and north components of real wind and derived by adding the east and north components of ship's velocity and wind velocity. These are converted back to true wind speed and direction, with direction forced to lie in range 0 to 360. Two direction variables are defined, one being the direction the wind is blowing to and the other being the direction the wind is blowing from. Output is file "underwayXXXtrue.mat".

`underwaynav.m` Loads file "underwayXXXtrue.mat" and master file "bestnav_all_jr141.mat", then interpolates latitude and longitude to timestamps of underway data. Produces quick plots of sea surface temperature, sea surface salinity (uncalibrated), and wind vectors along ship's track. Saves output to master file "underwayXXXnav.mat". Ensure that **`truewind_derive.m`** is run immediately before **`underwaynav.m`**.

`underwayall.m` Loads "underwayXXXnav.mat" and appends to master file "underway_all_jr141.mat". Produces quick plots of sea surface temperature, sea surface salinity and wind vectors along ship's track for the duration of the cruise to date.

The *truewind* datastream was not being logged to the rvs system. Hence, all the pre-processing of the data does not include truewind data. These can be appended to the file *underwayXXX.mat* later, after having evaluation of truewind from the relative direction of the wind (in respect of the ship's direction) and the heading of the ship. We appended the bestnav data to the oceanlog data but not the anemom data as these are also direction and speed comparative to the ship's position.

Minor changes applied to the matlab scripts, mainly during the editing of the oceanlog datastream, i.e plotting the flow rate in addition to the editing window in order to make a better decision during the interactive suppression of the data.
The editing was confined in deleting data points, which in comparison with the flow rate diagram, indicated the entry in the sea-ice region (***figure 3***).

During our passage in and out of the ice there were frequent periods where the oceanlog system did not function due to ice blockage of the intake pumps. Those days are still present in the final file and are being represented by a point or small intervals (most of the data were deleted and only small sections were retained in order to go on with the processing sequence of days). They should not be taken into account.

The jdays where the intake pumps are switched off are the following: 307, 314-318.
Also, during the start of the cruise on **jday298** there is an incident of high values of fluorescence, conductivity and housing (CTD) temp occurring at latitude, longitude position [-54.53, 305.7]. The event (fluorescence) which lasts for 310secs and is present at the Jday interval 297.705 to 297.715, presents a peak value of 6.218 (fluor) while the median for this dataset is 0.5580 excluding from the dataset all the values before 297.60 Jday where the value of fluorescence is constant at 0.241. It hasn't been removed during the despiking of the dataset.

The following notes are appended here exactly as in cruise report JR141.

Note on derivation of "truewind" (Written by Mike Meredith, JR139)

From the start of JR139, we logged anemometer wind speed and direction routinely, and also the RVS datastream "truewind", which consists of these same properties corrected for ship's heading and speed. It was noted, however, that the RVS truewind would oscillate wildly when the ship was stationary, and return realistic values only when the ship was in motion. Because of this problem, a Matlab script ("truewind_derive.m"; see above), originally written on CD160, was modified and implemented to derive useful wind data in earth coordinates even for periods when the ship was stationary. The source of the problem was investigated, and it is believed that it originates from the RVS truewind datastream deriving its ship's heading and speed (in terms of CMG and SMG) from the GLONASS GPS datastream. This is not a high-quality navigational datastream, and has been observed previously to offer substandard data when the ship is stationary. We consulted with ITS engineer on board, but there was no obvious fix for the RVS truewind that could be easily implemented, since other GPSs were not offering CMG and SMG for the calculation. Thus the RVS truewind data, although logged, should be regarded as poor, and the Matlab-derived truewind should be used in their place. We recommend that some time is spent producing a solution whereby SMG and CMG for the RVS truewind calculation can be obtained from one of the other GPS instruments, ideally the Seapath or Ashtech ADU5.

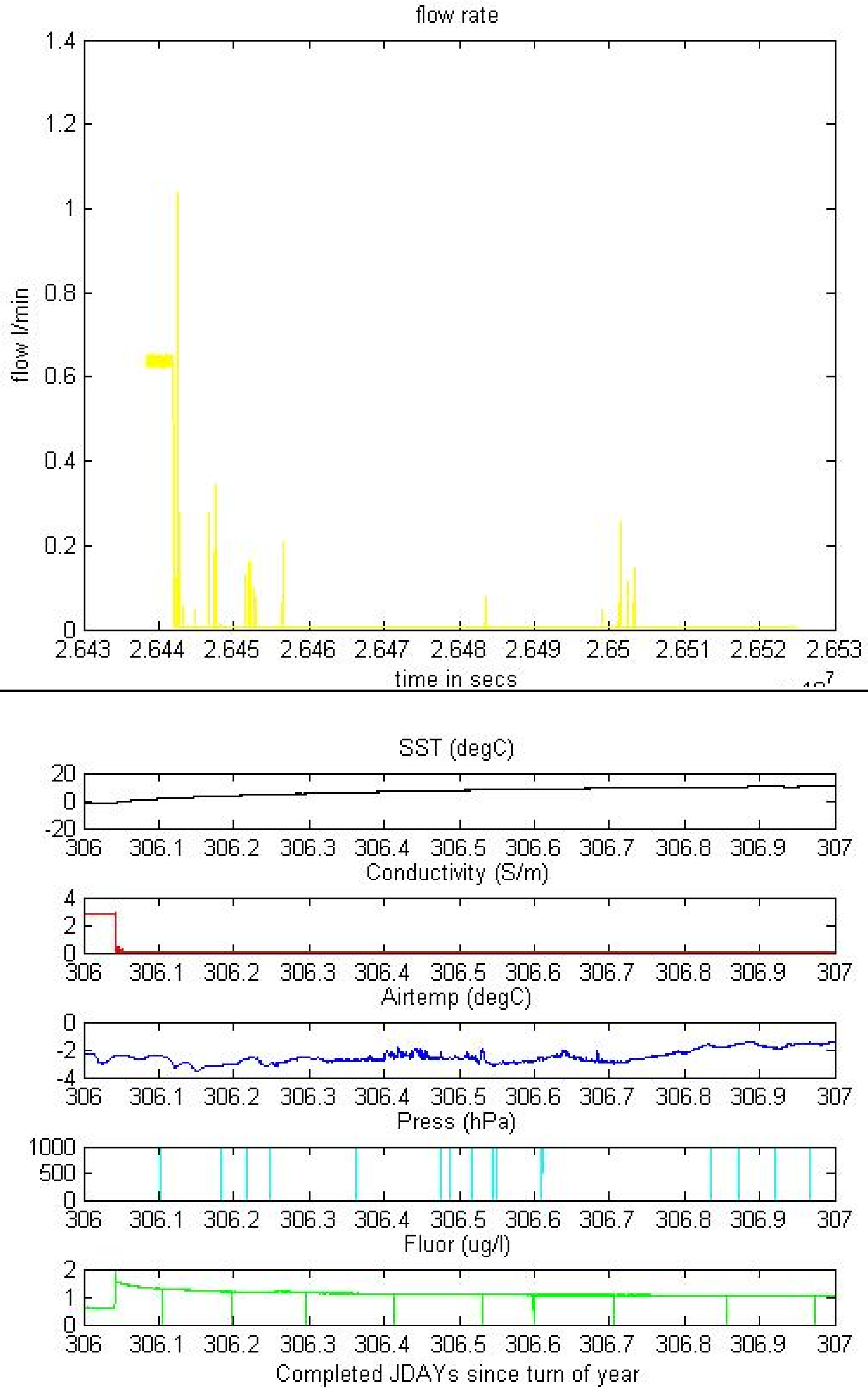

Figure 3: Diagrams of flow rate and datastreams from the oceanlogger during enter in the sea-ice region on jday 307.

Expendable Bathythermographs (XBTs)

Elizabeth Hawker, Christos Mitsis, Enrique Vidal with additional support from Nathan Cunningham, Data Manager

A sequence of XBT drops were performed from RRS *James Clark Ross* during JR161. The details of the XBT drops are listed in Table xbt1.

Sippican T5 probes were used and launched using a hand held launcher from the rear of the aft deck. The ship decreased its speed to 8 knots for deploying most probes. 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 samba to the central Unix system (jruf). The data was also streamed back to Cambridge in real time.

Further processing of the XBT profiles will take place at BAS using matlab scripts.

In general the XBT deployments were successful. However, during the passage from Falklands to Process Station 1 (PS1), the magnetometer was also deployed. This resulted in a number of XBTs successful only to a depth of about 600m. Excessive spiking or clearly unrealistic values were logged, identified mid-drop, and the drop aborted and restarted with a new probe. Ship speed was maintained at above 10 knots for a few deployments, unfortunately this resulted in data being collected to only a depth of 1000m. For future deployments of T5 probes it is advisable to slow to at least 8 knots.

Table xbt1: JR161 XBT deployments

EVENT No.	PC Filename	JDAY	DATE & TIME	Latitude	Longitude	Coment
227	T5_00033.EDF	326	22/11/06 20:26	-53.14892	-40.27139	Depth: 1692.7m (SUCCESS)
224	T5_00032.EDF	326	22/11/06 08:58	-54.57817	-40.99875	Depth: 1644.6m (SUCCESS)
173	T5_00031.EDF	322	18/11/06 03:33	-55.63362	-41.28801	Depth: 1308.0m
172	T5_00030.EDF	321	17/11/06 23:38	-56.22098	-41.82070	Depth: 560.7m (FAIL)
171	T5_00029.EDF	321	17/11/06 23:33	-56.22081	-41.82065	Depth: 525.4m (FAIL)
170	T5_00028.EDF	321	17/11/06 21:31	-56.52646	-42.03956	Depth: 1691.0m (SUCCESS)
169	T5_00027.EDF	321	17/11/06 19:44	-56.83958	-42.25923	Depth: 1657.0m (SUCCESS)
167	T5_00026.EDF	321	17/11/06 17:55	-57.14028	-42.44077	Depth: 1066.5m
150	T5_00025.EDF	320	16/11/06 07:21	-57.69293	-42.85154	Depth: 1603.3m (SUCCESS)
149	T5_00024.EDF	320	16/11/06 05:34	-57.97897	-42.94920	Depth: 1830.5m (SUCCESS)
147	T5_00023.EDF	319	15/11/06 20:45	-58.87562	-43.51105	Depth: 1810.3m (SUCCESS)
146	T5_00022.EDF	319	15/11/06 17:10	-56.52646	-42.03956	Depth: 1087.3m
70	T5_00021.EDF	304	31/10/06 19:19	-60.54269	-49.06830	Depth: 1636.9m (SUCCESS)
69	T5_00020.EDF	304	31/10/06 16:38	-60.04291	-49.31406	Depth: 1146.6m
68	T5_00019.EDF	304	31/10/06 14:31	-59.73530	-49.47017	Depth: 1640.5m (SUCCESS)
67	T5_00018.EDF	304	31/10/06 11:45	-59.73530	-49.47017	Depth: 1087.7m
67	T5_00017.EDF	304	31/10/06	-	-49.65940	Depth:

			11:40	59.35834		222.7m (FAIL)
66	T5_00016.EDF	304	31/10/06 09:32	- 58.92132	-49.87822	Depth: 1200.9m (SUCCESS)
65	T5_00015.EDF	304	31/10/06 07:35	- 58.53982	-50.05935	Depth: 1223.0m (SUCCESS)
64	T5_00014.EDF	304	31/10/06 05:06	- 58.12104	-50.22607	Depth: 1384.5m (SUCCESS)
15	T5_00013.EDF	298	25/10/06 20:38	- 54.70493	-53.81599	Depth: 87.1m (FAIL)
14	T5_00012.EDF	298	25/10/06 16:36	- 54.55091	-54.50433	Depth: 141.9m (FAIL)
13	T5_00011.EDF	298	25/10/06 16:30	- 54.55182	-54.52654	Depth: ~130m (FAIL)
12	T5_00010.EDF	298	25/10/06 13:59	- 54.55182	-54.52654	Depth: 118.3m (FAIL)
11	T5_00009.EDF	298	25/10/06 13:52	- 54.22310	-54.79378	Depth: 649.7m (FAIL)
10	T5_00008.EDF	298	25/10/06 12:08	- 54.07392	-55.17821	Depth: 1830.5m (SUCCESS)
9	T5_00007.EDF	298	25/10/06 11:59	- 54.05264	-55.20666	Depth: 597.2m (FAIL)
8	T5_00006.EDF	298	25/10/06 10:10	- 53.80429	-55.52188	Depth: 1830.5m (SUCCESS)
7	T5_00005.EDF	298	25/10/06 08:20	- 53.55108	-55.84499	Depth: 581.6m (FAIL)
6	T5_00004.EDF	298	25/10/06 08:13	- 53.53468	-55.86592	Depth: 559.4m (FAIL)
5	T5_00003.EDF	298	25/10/06 06:30	- 59.65189	-44.11644	Depth: 115.6m (FAIL)
4	T5_00002.EDF	298	25/10/06 06:23	- 53.29035	-56.17998	Depth: 143.3m (FAIL)

Gear Report JR161

Peter Enderlein

General

This was a cruise with one of the most deployments of towed gear during a single cruise. Because of the number of different towed gears and their different requirements the cable and the DWNM and its sensors needed lots of swapping over. This always causes certain wear and tear to the equipment and reduces its reliability. But overall it worked fine. All equipment was deployed to the maximum depth of 1000 m. At one point the ‘Bio wire’ was re-terminated because there seemed to be a fault in the first part of the cable. In the end the fault was found in the slip ring where due to wear on a few cables the insulation was sheered off shortening the cables.

Down Wire Net Monitor

During this cruise the DWNM has been used on the ‘Biological wire’ for the RMT8 the LHPR, the AMPS and the MOCNESS Net, and on the 17mm co-ax cable (ROV Cable) for towing the RMT25.

Considering the huge amount of nearly 100 deployments done during this cruise with all the change overs between the different gear overall the DWNM has performed satisfactorily, but it became clear that the system is at the edge of its lifetime and becomes more and more unreliable.

Apart from minor problems with connectors and some difficult to understand problems with no- advancing of the LHPR and the AMPS there was one major problem when one of the Net-Monitors stopped working completely. After replacing a blown relay on the circuit board the fault was finally identified by AME as a kind of short at the terminal block. Separating the two contacts finally solved the problem.

The designer of the net monitor electronics, and author of the current software has left BAS, much of the information required to modify both the electronics and the software (particularly), has been lost. In order to overcome these problems and enable the system to keep up with new requirements it is planned to develop a new version of the monitor, incorporating the best of the current system but also taking the opportunity to eliminate some of the problems. This is now in progress and hopefully the new system will be available for the next season as a trial and test version (see also recommendations).

RMT25

This net was used to make 56 hauls, more than on any previous cruise. It proved to be very effective, and gave only little trouble. Initially there was a problem with the release gear, when the fault was identified to be the broken feed back electronics. These were replaced with the similar ones from the second RMT 8 release unit. After that everything worked fine apart from another small problem with the release unit, when a cable came loose. Due to the number of deployments and the wear and tear in sometimes not ideal conditions the side wires were worn out and needed replacing with the spares. After a certain amount of deployments the side wires encounter a good amount of twisting and in the future swivels should be put on the top of the side wires so they can turn freely.

Also the nets suffered from the number of deployments and the use in sometimes not ideal conditions. The age of the nets is showing now. The nets need good refurbishing by the net maker. On several occasions a big krill swarm was caught (up to 150 kg) and to get the net in the support of the Gilson winch was required. On one of the recoveries the non-filtering cod-end was ripped completely and needed a serious amount of stitching it back together.

The new net was checked and the idea was to test it as well. Unfortunately the net came with no holes for the dropping wires and therefore could not be tested. It has to go back to the net maker in order to make the necessary changes.

RMT8

Use of the RMT8 was limited to some hauls during the previous cruise in the Western Core Box, and a limited number of target hauls for fish larvae for an AFI. The net was rigged in what has become the standard configuration for this work employing two nets, rigged so that the second does not open when the first closes but requires a further 'firing' of the release. Also the non-filtering cod-ends were used (see also RMT25). The net together with the DWNM worked fine and we encountered no problems.

LHPR

The LHPR was used 17 times. The idea was to use a catch diverter device to allow the descent to be done with the mechanism inactive. The diverter vents the catch from the cod-end of the net until the first advance command is sent, at that point it lines up with the recorder box and the catch enters. The electronics that allowed the catch diverter to respond just once to an advance command which were potted into the cable connection between the DWNM and the recorder box failed during JR 116. Subsequently these were replaced by a set built into the monitor housing by Vsevolod Afanasyev. Despite several tests during this cruise it seems that the replacement did not work any longer. Therefore the LHPR had to be used without the catch diverter.

Unfortunately the number of gauze advances often did not match the advances given by the software. There seems to be a problem with the mechanical turning in the spooling box and the use of relays on the spooling device not advancing properly giving wrong feed backs and stopping the spooling at the wrong time. This has to be addressed back in CB.

AMPS

The AMPS net was brought on board as a back up system for the MOCNESS Net and had to be used after the complete failure of the MOCNESS Net. The Net was deployed 6 times and never worked probably. The initial problems were with the new non-filtering cod-ends, which were not designed correctly and caused a strong backwash in the net as well as the cod ends ended up on top of the net. By changing the cod-ends to filtering cod-ends and putting a protective net on top of the frame this problem could be solved. Unfortunately the firing mechanism caused major problems on the reliability of nets fired in water. On deck the deck unit and the release mechanism worked fine and the firing could be repeated without any problems. Once deployed however the release mechanism did not work reliably and we had holes were we had command ok and feedback ok responses as expected but the release mechanism had only released 3 nets. This fault needs to be further investigated if the AMPS is to be used again on further cruises. One other small problem was the extension lead, which caused some connector problems. Because the other equipment were using the DWNM system as well, there was never enough time to do more testing of the system to make it more reliable.

MOCNESS Net

The MOCNESS Net was a loan from the Gatti Marine Lab in Oban. It was tested and trialled during the Summer trials cruise where it worked fine but was considered to be flaky due to improper storage and maintenance eg. PC was stored in damp place… back in the UK. During the cruise we made 11 deployments with the MOCNESS Net where it worked, in general, satisfactorily. There were some initial problems with the release wires breaking, but after replacing the worn out ones with new ones, they worked fine. On the 1.11.06 the very old main PC failed completely (not unexpected) but thanks to IT support we were able to build the PES PC with the required hardware, the old Windows 3.1 software and the MOCNESS control software. After that the Net worked fine until the 20.11.06 when the electronics in the main housing stopped responding. After testing all other possibilities like sea cable, modem, PC and connectors, the problem was clearly identified to be the deck unit and therefore prevented any further deployment of the MOCNESS. The complete failure was not to unexpected because it was an old system especially the PC, but without any documentation and spares there was no possibility to repair it on board.

For further cruises a new PC, documentation, spares and so on should be brought to be able to cope with any major problems with a complex system like the MOCNESS Net.

Bongo and Mini-Bongo Net

The Bongo and Mini-Bongo net were deployed 35 times and worked very well. On one occasion the Bongo wire slipped of the block and was damaged. Therefore the wire needed to be cut of by 30m and reterminated. Also on one occasion the Bongo Net was not lashed properly causing the Net to fall on deck. Fortunately nobody was in the vicinity and the only damage was to the net. All bars were bent and needed straightening. The wire of the spring system was damaged and had to be replaced by completely dismantling and rebuilding the spring mechanism. Further damage was done to the main studs holding the main bars to the top frame.

Neuston Sledge

The Neuston Sledge was deployed only two times to catch surface animals. The first time the conditions were marginal with lots of little ice bits in the water, the second time conditions were good and the Sledge caught lots of Themisto, unfortunately the wrong species, so no further deployments were made.

Recommendations:

1. Replacing the current DWNM is still top priority. Doug Bone and myself have raised this issue for many years. The system is old, flaky and needs replacing. Finally there is now some money made available to replace the system and AME has agreed to develop the new system. Jim Fox has been tasked with the Job. The idea is that we have a prototype on board for next season to use it along with the old one and then replace the old system in the following season.
2. It seems that the non-filtering cod-ends are getting more and more preferred against the filtering. In the moment we have only one pair of these cod-ends, therefore more RMT non-filtering cod-end should be bought.
3. If the old MOCNESS is used again a new deck unit and a new PC as well as spares are needed. Also some kind of documentation would be quite helpful. If BSD is going for a new one, again spares and documentation should be bought with it.
4. If the intension is to use the AMPS again – either as the main net or as a back up to the MOCNESS - a decision has to be made sooner then later to give time to sort out the issues encountered on this trip. Also proper non-filtering cod-ends for the AMPS should be designed and get made.
5. The LHPR spooling mechanism needs to be sorted to overcome the mismatch between fired commands and the real amounts of turns. Also the catch diverter device (opening and closing mechanism), which doesn't work with the existing DWNM, has to be incorporated into the new system with a second command and feed back line.
6. If we continue with the amount of RMT 25 fishing we need another new RMT 25 net. Also the existing new net has to go back to the net maker to get holes for dropping wires made.
7. The old RMT 25 nets have been deployed more than 50 times on this trip. They need some major refurbishing and have to go back to the net maker.
8. Due to the amount of deployments the RMT 25 side wires suffered quite a bit and had to be replaced, to increase the life expectancy swivels should be put on top of the side wires to allow the side wires to rotate freely.
9. The feedback on the RMT25 release mechanism needs checking. Also it has to be replaced in one of the RMT8 release from where it had been taken out. Further a couple of new ones should be made to take as spares.
10. By next season the new USBL tracking system will be fully implemented and this should further improve any fishing activity regarding position and depth of gear in the water.
11. On a more general note mobilisation and demobilisation relied on good weather condition during passage from and to the Falklands. If the weather would have been unworkable the time given for mobilisation and demobilisation would not been sufficient. More time should be allocated for future cruises especially if the same amount of gear will be used.

Whale Acoustic Recording Packages (ARPs)

Three freestanding ARPs were deployed during JR152, 159 (see event log for details). A fourth ARP was recovered from the shallow water mooring and this was replaced with a 5th ARP when the mooring was redeployed. It had been the intention to re-deploy the shallow mooring ARP as a freestanding unit but this was not possible as the vacuum pump onboard the JCR was unable to achieve the required vacuum. It is recommended that a number of issues regarding the management of the ARP project and deployments should be resolved before the next Discovery2010 cruise.

1. Mooring weights and chains could not be found in FIPASS.

2. Mooring riggings for the ARPs were considered amateurish and need complete re-rigging.

3. Future redeployments of ARPs will require a sufficiently powerful vacuum pump to be onboard the JCR.

4. Concern was raised that the ARPs are small and very difficult to see and may be difficult to locate during recovery. It is suggested that future ARP deployments should be equipped poles and flags to ensure successful recovery.

5. Management of data from the ARPs requires careful consideration as no provision for backing up the ARP data had been made prior to JR152, 159. Jeremy Robst therefore created a copy of each disk for security. These backups will be transferred to BAS via LTO tape and restored to SAN. Nathan Cunningham will ensure that Tony Martin is aware of where the data resides. For future cruises it is recommended that an external coupling mount for the 2.5” hard disks is purchased to ease the data transfer/backing up process and a copy of the software is available so the data can be transferred from binary format to ASCII and appropriately tagged with metadata as soon as possible.

Serial Number	Assigned HDD #	# Written on HDD	Location of Buoy	Date Recovered	Backup copy made
41YK4JTWH4H	26	184	KEP Mooring	9/06 rescued mooring by Norwegian vessel	Yes
N5AT4214126	76	70	WCB Mooring	12/10/2006	Yes

3700m Discovery2010 sediment trap mooring

Deployed at: 19:52:00 25/11/2006

Mooring position: -52.72321 S -40.14731 W

Water depth: 3779.13 meter

NOVATEC beacon: U07-029, Ch A, 154.585 MHz

Acoustic Releases:

Deck unit mode: **B FR2 – FR2,** to release press: s**afety + command**

Codes:

Release No: 572	release code: **15E0 + 1555**
Release No: 573	release code: **15E1 + 1555**

Acoustic releases: 572 + 573

ARGOS beacon: *SN 280, ID 60210*

NOVATEC Combo beacon: *U07-029*

CTD 37 SMP 43742: 4852 on main buoy

- ❑ set-up instrument for re-deployment
  - set real time clock to PC clock (p. 28)
  - check instruments is ok and clock is set properly by using "DS"command (p. 27)
  - set-up instrument for "Autonomous Sampling" following the instructions on page 24
  - samplenum=0 automatically makes entire memory available for recording
  - sample interval: 900 sec
- ❑ create a .txt file with instrument settings and save file in correct folder

CTD 37 SMP 43742: 4855 at estimated 500 m

- ❑ set-up instrument for re-deployment
  - set real time clock to PC clock (p. 28)
  - check instruments is ok and clock is set properly by using "DS"command (p. 27)
  - set-up instrument for "Autonomous Sampling" following the instructions on page 24
  - samplenum=0 automatically makes entire memory available for recording

- sample interval: 900 sec

- ❑ create a .txt file with instrument settings and save file in correct folder

ADCP WHS300 – I – UG26: 7522

- ❑ set-up instrument for re-deployment
  - erase data (p.16 WinSC)
  - start WinSC for set up instrument
  - set-up instrument
    - Number of bins: 30 (1-128)
    - Bin size (m): 8 (0.2-16)
    - Pings per Ensemble: 10
    - Interval: 15 min
    - Duration: 550 days
    - Transducer depth: 200 m
  - save deployment settings in prepared folder
  - set up ADCP real time clock to PC clock
  - don't verify the compass (needless on a ship)
  - run pre-deployment tests to check instrument
- ❑ check if instrument is working (you can hear it pinging)

PopUp unit 54

- The Cornell PopUp was taken out of the original mooring rigging and was placed in a stainless steel frame, which was put inline with the moorings just beneath the main buoy.
- the unit needed a new code which was loaded just before setting up the instrument.
- The old file: V7.2 was replaced with new file:BAS IK50. AHX V9.0 from 14.10.04

- **setup:**
  - DSM ID: 361
  - HDD model no: HTS421280H9AT00
  - HDD serial no: 334AKJU5XPE
  - Firmware: HA30A7OG
  - Total Sectors: 156235952
  - Recording Time: 462.92 days
  - pressure: 680 Mb
  - ID: ok
  - external piezo: ok
  - Hello command: ok
  - start recording: 14.26 GMT, 25.11.06

Sediment trap: Parflux No – on toolbox - at estimated 2000 m water depth

Parflux sediment trap deployment settings (21 cups)

McLane Research Laboratories, USA

```
        ParFlux 21-Cup Sediment Trap
      Version: pst-21_1.c   S/N: ML11966-01

      ÉÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ»
      º          Main Menu          º
      ÈÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ¼
          Wed Nov 22 20:04:08 2006

      <1> Set Time            <5> Create Schedule
      <2> Diagnostics         <6> Deploy System
      <3> Fill Containers     <7> Offload Data
      <4> Sleep               <8> Contacting McLane

        Selection  ? 5

Existing deployment data file will be
erased.  Continue (Yes/No) [N] ? y

Enter new deployment schedule (Yes/No) [N] ? n

Schedule Verification

Event   1 of  22 = 12/01/2006 00:00:00
Event   2 of  22 = 12/15/2006 00:00:00
Event   3 of  22 = 01/01/2007 00:00:00
Event   4 of  22 = 01/15/2007 00:00:00
Event   5 of  22 = 02/01/2007 00:00:00
Event   6 of  22 = 02/15/2007 00:00:00
Event   7 of  22 = 03/01/2007 00:00:00
Event   8 of  22 = 04/01/2007 00:00:00
Event   9 of  22 = 05/01/2007 00:00:00
Event  10 of  22 = 06/01/2007 00:00:00
Event  11 of  22 = 07/01/2007 00:00:00
Event  12 of  22 = 08/01/2007 00:00:00
Event  13 of  22 = 09/01/2007 00:00:00
Event  14 of  22 = 10/01/2007 00:00:00
Event  15 of  22 = 11/01/2007 00:00:00
Event  16 of  22 = 12/01/2007 00:00:00
Press any key to continue.
Event  17 of  22 = 12/15/2007 00:00:00
Event  18 of  22 = 01/01/2008 00:00:00
Event  19 of  22 = 01/15/2008 00:00:00
Event  20 of  22 = 02/01/2008 00:00:00
Event  21 of  22 = 02/15/2008 00:00:00
Event  22 of  22 = 03/01/2008 00:00:00

Modify an event  (Yes/No) [N] ?
```

Current meter: Aquadopp No A2L - 1792 at estimated 2000 m water depth

Aquadopp current meter deployment settings

Deployment → planning
Measurement intervals (s) 900
Average interval (s) 60
Measurement load (%) 4 tick in auto box
Blanking distance 0.35
Compass 900
Speed sound, measured 34 (appro salinity at 2000m)
Coordinate system ENU
Diagnostics do not tick enable
Deployment planning assumed duration 430 days
Bettery utilisation approx 200 % (can use up to 400% for Lithium battery).

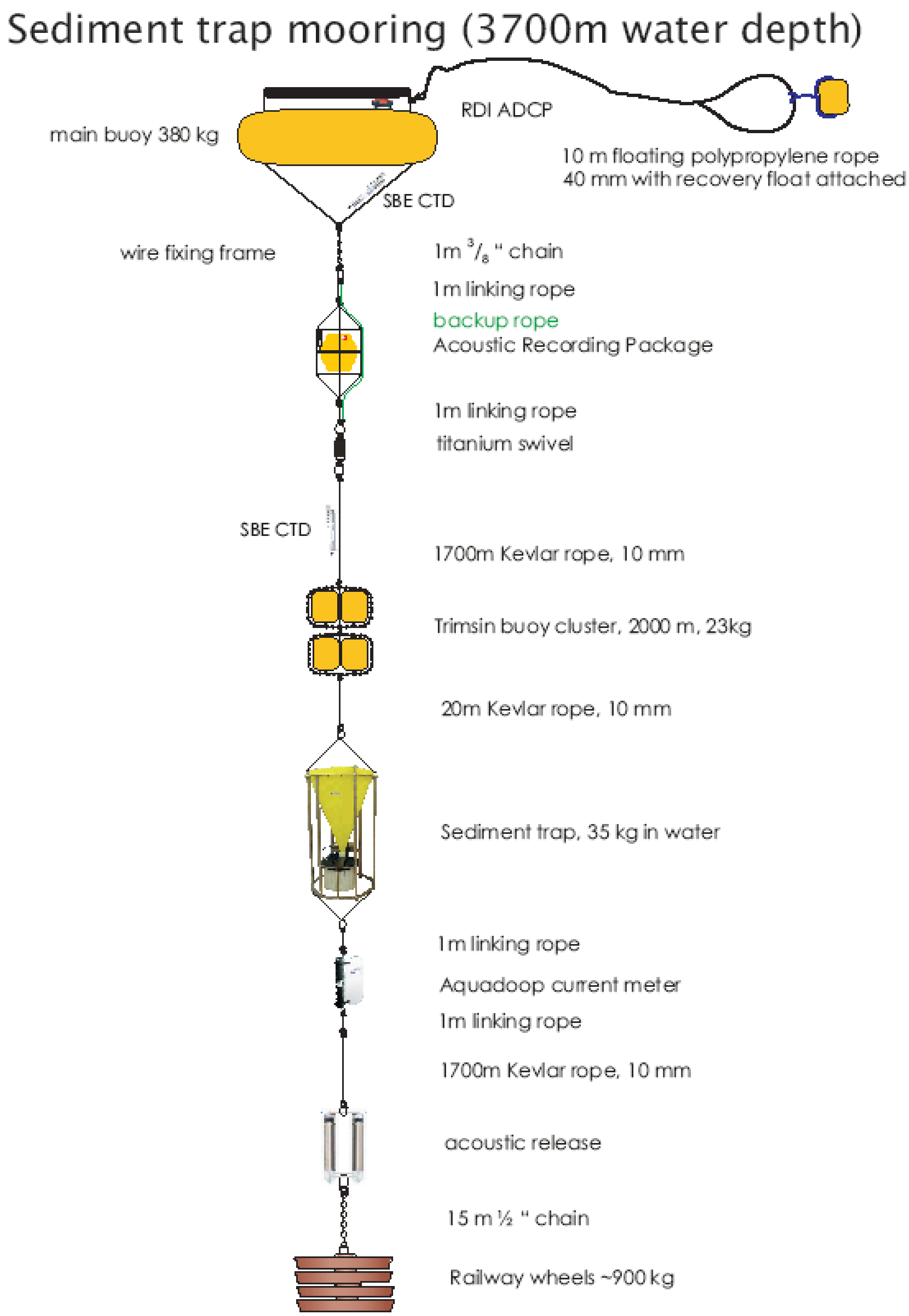

Figure of Sediment Trap Mooring

Cruise JR161 Macronutrient Analysis

Mick Whitehouse and Min Gordon

Introduction

Overall, the Southern Ocean is rich in macronutrients that are generally underutilized by phytoplankton. Scarcities of micronutrients, inadequate light and grazing are some of the factors that have been cited previously as potential controls on phytoplankton growth and thus macronutrient use. However, there are exceptions to this "high-macronutrient, low-chlorophyll" phenomenon, especially in the Scotia Sea. Among the explanations for this is the relief from Fe-stress brought about by natural Fe sources from sites at the Antarctic Peninsula and oceanic islands such as South Georgia. However, due to the Southern Ocean's latitudinal gradient of $Si(OH)_4$ abundance (low to the north, high to the south) diatom growth in the northern Scotia Sea is susceptible to silica-stress.

South Georgia's blooms regularly comprise chlorophyll *a* concentrations >10 mg m^{-3} and may be sustained for four months or more. They seed the ocean for hundreds of kilometres downstream and are associated with the strongest predicted carbon sink in the Southern Ocean. Furthermore, the enhanced primary production supports a rich food web. To sustain such substantial blooms, Fe is likely to be re-supplied to the euphotic layer throughout the growing season. The availability of $Si(OH)_4$ in the surface waters will determine whether the bloom is dominated by diatoms or whether a seasonal succession of other phytoplankton species occurs. Despite intense research, the dynamics of seasonal phytoplankton growth and nutrient utilization in the northern Scotia Sea remain poorly understood.

Aims

Three cruises are planned to examine seasonality in the Scotia Sea: the spring cruise JR161 is the first of these with summer and autumn cruises to follow. Macronutrient measurements are a component part of the examination of phytoplankton dynamics and will complement micronutrient and phytoplankton growth measurements. The Process stations are sited so that growth rate measurements can be made in Fe-poor, $Si(OH)_4$–rich waters and Fe-rich, seasonally $Si(OH)_4$–poor waters. Lugols-fixed sample will be examined to ascertain the seasonal taxonomic composition of the phytoplankton. Macronutrients were measured at other stations and during transects so as to help characterize these other localities.

Sample collection and analytical methods

Vertical profiles of macronutrient distribution were measured at all Process and Condensed stations where samples were taken from a shallow and a deep CTD cast (see physical oceanography section for depths) to give a full depth profile. Process station profiles were obtained on three successive days. Samples were also taken from all Go-flo bottle casts made to obtain "clean" water for Fe analysis (see Fe analysis section for details). Along major transects near-surface waters (~7 m depth) pumped through the ship's non-toxic seawater supply were monitored continuously for nutrient levels. For the bioassays initiated at the Process stations, nutrients were measured at intervals over the course of the experiments.

All samples were filtered through a cellulose nitrate membrane (Whatman WCN, pore size 0.45 μm), and the filtrate was analysed colorimetrically for dissolved nitrate+nitrite (NO_3+NO_2-N), ammonium (NH_4-N), silicic acid ($Si(OH)_4$-Si) and phosphate (PO_4-P) using a Technicon-based segmented-flow analyser (Whitehouse 1997). Data were logged to a PC once every ten seconds using a LabVIEW 6i (National instruments) acquisition programme and to a Kipp and Zonen BD300 data acquisition recorder.

The analyser was refurbished substantially leading up to the present cruise and details of this rebuild will be documented elsewhere. For this report it is worth noting that the instrument performed exceedingly well. The greatest improvements to the system's operation are the switch to programmable proportioning pumps (Ismatec) and the use of high durability ismaprene (PharMed) pump tubing. This allows much faster start-up and shut-down routines along with a low-speed standby mode and has virtually eliminated maintenance down time. As well as improving the analyser's efficiency, reagent use is more economical which in turn has reduced the volume of chemical waste produced.

Data analysis

Full data analysis and verification will be undertaken with subsidiary programmes (Whitehouse and Preston 1997) on our return to the UK. The data are subject to a variety of analytical corrections (eg. saline-freshwater RI adjustments), and the underway data require time-lag adjustments to individual chemistry lines. Additionally, for full verification of the vertical nutrient profiles the contemporaneous physical oceanographic measurements from the CTD are required. Therefore, a detailed evaluation of the data is not feasible for this report. However, a cursory glance at the raw data indicates that there were ample macronutrients for phytoplankton growth at all sites with the exception of Condensed station 6 where $Si(OH)_4$ concentrations were particularly low in the top 50 m of the water column. At most stations macronutrient concentrations were fairly uniform between the surface and >80 m. However, at Condensed station 4 depletion had occurred in the top 20 m of the water column. Depletion was evident in the top 30 m at Process station 3 but following a modest storm, the water column was more uniform a day later and nutrient concentrations had increased marginally. A full evaluation of all the data should be completed during summer 2007.

Problems

It can't be overemphasised how much more efficient and reliable our water sampling operation would have been with a Ti CTD together with a 24 bottle rosette. Instead of one 24 bottle CTD cast it was necessary to make two 12 bottle casts and deploy 6 Go-flo bottles to collect sufficient water for macro- and micronutrient analysis. Also note that Go-flo bottle deployment required five people, the depths of water collection were nominal, there is no concurrent oceanographic measurements and the bottles didn't always close correctly.

Throughout the cruise there were black soot or dust particles coming out of the ship's deckhead vents in the chemistry and the prep lab. Can the system be cleaned during refit?

All hazardous chemicals for the cruise were shipped in one case. I'm pleased to see minimal packing used and presumably the mix of chemicals met with shipping regulations. However, in future, might it be a good idea to separate flammables from corrosives and labelling cases on several sides with cruise, full contents list and consigners names would be mighty useful when they're being searched for in a ship's hold.

Requested chemical waste drums were not labelled specifically enough and were left in Stanley. Fortunately there were enough surplus drums onboard to suffice otherwise we would have had big problems.

Methods references

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

Whitehouse MJ, Preston M (1997) A flexible computer-based technique for the analysis of data from a sea-going nutrient autoanalyser. Analytica chimica Acta 345: 197-20.

Biochemistry/organic geochemistry

David Pond

Particlulate material was collected from the chlorophyll maxima to determine the food availablity for meso- and macro-zooplankton communities at each site (Table 1). Additional large volume samples of particulate material were collected from dedicated CTDs to provide sufficient material for the analysis of a wide suit of lipid biomarkers (Table 2). Krill, where present were sampled and these specimens will be analysed for PCBs to link with similar studies on higher predators (Table 3). *Calanoides acutus* were sampled from the depth horizon where they were most abundant. The lipid content and composition of the 205 individuals of stage V and females will be analysed to provide insights into their diapause and reproductive strategies (Table 4).

Table 1. Samples taken from bottle 12 of the shallow CTD. The downcast fluorescence trace was used to establish depth of the chlorophyll maxima.

Event	Date	Depth	Fatty acid (litres)	Stable isotope (litres)	POC, PON (litres)
20	27/10/2006	20	3	1	1
35	28/10/2006	20	3	1	1
47	29/10/2006	40	3	1	1
77	01/11/2006	40	3	1	1
101	05/11/2006	50	3	1	1
129	08/11/2006	40	3	1	1
152	16/11/2006	10	3	1	1
175	18/11/2006	40	3	1	1
194	19/11/2006	40	3	1	1
204	20/11/2006	60	3	1	1
234	23/11/2006	30	3	1	1
243	24/11/2006	30	3	1	1
254	25/11/2006	30	3	1	1
278	28/11/2006	40	3	1	1

Table 2. Large volume water collections from the chlorophyll maxima and 2000m to correspond with the depth of the sediment traps deployed at process stations 2 and 3.

Event	Date	Litres filtered	Depth
CS2	05/11/2006	125	non-toxic
23	27/10/2006	125	20
26	27/10/2006	125	2000
40	28/10/2006	125	40
50	29/10/2006	125	2000
20	29/10/2006	125	40
139	07/11/2006	125	30
163	17/11/2006	100	10
175	18?11?06	125	40
180	18/11/2006	125	2000
190	19/11/2006	125	2000
191	19/11/2006	100	40
203	20/11/2006	125	2000
207	20/11/2006	125	60
237	23/11/2006	125	30
239	23/11/2006	125	2000
241	24/11/2006	125	2000
247	24/11/2006	125	30
257	25/11/2006	125	30
259	25/11/2006	125	2000
288	29/11/2006	125	20

Table 3 Bulk samples of krill for lipid and PCB analysis.

Event	Date
Non-toxic seawater supply filter	01/11/2006
46	29/10/2006
76	01/11/2006
85	02/11/2006
92	02/11/2006
95	04/11/2006
96	04/11/2006
105	05/11/2006
106	05/11/2006
112	06/11/2006
127	08/11/2006
135	09/11/2006
153	16/11/2006
186	18/11/2006
197	19/11/2006
228	23/11/2006
229	23/11/2006
234	23/11/2006
253	16/11/2006
289	29/11/2006

Table 4. Individual stage V and female *Calanoides acutus* for lipid analysis. The prorosome and oil sac dimensions were determined for each copepod.

Event	Net	Stage	Number of individual copepods
E39	MOC 7	F	3
		V	5
E46	BONGO	F	6
		V	6
E63	MOC 2	V	1
E76	BONGO	F	10
		V	5
E81	MOC 7	F	10
		V	7
E104	MOC 4	F	10
		V	4
E112	BONGO	F	7
		V	8
E128	BONGO	F	10
		V	10
E149	BONGO	F	10
		V	10
E155	MOC 5	F	2
	MOC 7	F	3
E175	BONGO	F	4
		V	10
E197	BONGO	F	7
E220	MOC 1	F	1
	MOC 2	F	2
E233	BONGO	F	10
		V	10
E264	MULTINET	F	10
E272	BONGO	F	10
E277	BONGO	F	4
		V	10

Tissue sampling for stable isotope analysis

Gabi Stowasser

Study:

Trophic relationships and carbon flow in the Scotia Sea food web

Background:

This project targets key components within the food webs of the Scotia Sea. This area is of special importance since not only does it currently support the most valuable fishery in the Southern Ocean but it is also part of one of the fastest warming areas on the planet. In order to understand the impact commercial exploitation and climate change the Scotia Sea ecosystem we need to first understand the temporal and spatial functioning of trophic pathways in the system. The aim is to quantify regional and seasonal diets of key species and map the distribution and abundance of these species from phytoplankton and zooplankton groups up to higher predators.

The use of stable isotopes as dietary tracers is based on the principle that isotopic concentrations of consumer diets can be related to those of consumer tissues in a predictable fashion. It has been extensively applied in the investigation of trophic relationships in various marine ecosystems and has been used to determine feeding migrations in numerous species. The stepwise enrichment of both carbon and nitrogen in a predator relative to its prey suggests that the predator will reflect the isotopic composition in the prey and isotope values can be used to identify the trophic position of species in the food web investigated. Additionally ^{13}C values can successfully be used to identify carbon pathways and sources of primary productivity.

Together with results gathered from fatty acid and conventional gut content studies, stable isotope analysis will allow us to quantify spatial and temporal variability in resource use and energy flow within the Scotia Sea food web. The research will identify key trophic linkages both seasonally and geographically, and will contribute to the development of sustainable management policies for the natural resources in this region.

Sampling:

Whole specimens of invertebrate species were collected from the RTM 25, Bongo and Mocness nets during both day and night hauls. Animals were identified, bagged, labelled and frozen at – 80°C (species catalogue see Table 1). Muscle samples of the lateral region of several myctophid species were collected during the first half of the cruise (Stations PS1 – CS4). Samples were individually packed and frozen at – 80°C. The remainder of fish were frozen whole and tissue samples will be taken at BAS at the time when samples are returned to Cambridge and the fish will be processed for stomach content analysis. Particulate organic matter was sampled from shallow CTDs at each station by filtering samples onto glass fibre filters (see cruise report D. Pond). Samples were again stored at – 80°C prior to analysis in the laboratory. To gain insight into the feeding of higher predators both blood and feather samples will be collected at Bird Island and Signy parallel to the timing of the cruise.

Table 1: Species collected for stable isotope analysis at process, AFI and condensed stations during cruise JR 161.

Species	**PS1**	**CS1**	**AFI**	**CS2**	**CS3**	**CS4**	**PS2**	**PS3**	**CS6**
POM	x	x		x	x	x	x	x	x
Calycopsis borchgrevinki		x		x		x	x	x	
Diphyes sp.		x	x	x					
Atolla sp.	x			x		x	x	x	x
Periphylla sp.	x	x		x		x	x	x	x
Stygiomedusa gigantea	x	x		x		x			
Calanoides acutus	x	x		x	x	x	x	x	x
Calanus propinquus				x	x				
Calanus simillimus							x		x
Themisto gaudichaudi			x	x			x	x	x
Rhincalanus gigas	x	x			x	x	x	x	x
Euphausia frigida	x						x	x	x
Euphausia superba		x	x	x		x	x	x	
Euphausia triacantha	x					x	x	x	x
Thysanoessa sp.	x	x	x	x	x	x	x	x	x
Galiteuthis sp.				x					
Histioteuthis	x								
Chaetognata spp.	x	x		x		x	x	x	x
Salpa thompsoni	x					x	x	x	x
Electrona antarctica	x	x		x		x			
Electrona carlsbergi	x								
Krefthychthis anderssoni	x					x			
Gymnoscopelus braueri		x							
Gymnoscopelus nicholsii				x					

Cruise JR161 – Primary productivity

Beki Korb, Marina Gordon

Introduction:

Fe is a key factor limiting phytoplankton production in HNLC waters of the Southern Ocean. Whilst much of the Southern Ocean is characterized as HNLC type water, there are areas naturally enriched in Fe and highly productive. Within the Scotia Sea the generally easterly flowing ACC crosses a large number of ridges, plateaus and oceanic islands. These bathymetric features may introduce Fe into surface waters through upwelling or mixing with shelf sediments. Indeed some of the most spatially and temporally intense phytoplankton blooms in the Southern Ocean are found in the waters downstream of the island of South Georgia. However, these blooms are largely comprised of diatoms, which in addition to Fe, also require silicic acid for growth. During the austral summer, this macronutrient can become limiting near to South Georgia. Light is another important factor controlling phytoplankton growth. To date few direct measurements of Fe have been made in the Scotia Sea. Thus the exact role of Fe and/or the interactive effects with silicic acid concentrations and light in promoting or preventing primary production in this region is unclear.

Aim:

Through a collaborative research effort with NOC, we aim to examine the effect that iron, light and silicic acid have on natural phytoplankton populations in the Scotia Sea. We will measure ambient iron, light and silicic acid across a latitudinal gradient covering both areas of open ocean and shelf waters and relate these environmental parameters to differences in primary production rates, phytoplankton biomass, and photosynthetic efficiency. In addition, on deck experiments will be conducted (bioassays) with controlled additions of Fe and light.

Methods and data coverage:

The iron/bioassay component of this work is covered by the reports of Nielsdottir and Bibby, the macronuntrient component, including silicic acid measurements, by Mick Whitehouse. This cruise report will concentrate on primary production, chlorophyll a (biomass) and photosynthetic physiology (as measured by the FRRF).

Primary production: Primary production was measured using the radioisotope 14C (as NaHCO3) following the standard methods of Korb. This method basically follows the JGOFS protocol and uses an on deck incubator with incubations lasting 24 hours in tubes with100, 77, 54, 30, 10, 6, 1, and 0% surface irradiance. Trace metal clean techniques were followed. Bottles for incubations were cleaned at BAS (using HCl) and shipped south in plastic bags. Clean water samples were collected using a GoFlo bottle fired at 20m with the exception of the first station whereby clean water was collected using the towfish (see Nielsdotirs report). However, all radioisotope work was carried out in the rad lab and not in the clean container.

Measurements of primary production were also measured as PvsE curves (14C), using the photosynthetron in the rad lab. Incubations lasted for 2 hours.

Primary production rates using the on deck incubators were measured at least once at all CTD Process and Condensed stations (3 times at Process stations 2 and 3). PE curves were made once at all stations and at the end of 2 bioassays (Process stations 1 and 2).

Chlorophyll a: At each Processed and Condensed station, a shallow CTD was deployed for collection of chlorophyll *a*. Shallow CTDs were deployed at 3 out of the 4 days of occupation of a Process station and one out of 2 days at a Condensed station. Bottles were fired at nominal depths of 5, 10, 20, 30, 40, 50, 60, 80, 100 and 120 m and at a floating depth determined to be the chlorophyll maxima (from examination of fluorescence data on the downcast). Fluorescence data from the CTD will be examined back at Cambridge and calibrated against the chlorophyll samples collected. PAR data from the shallow CTD cast will also be examined to determine euphotic depths.

In addition, size fractionated chlorophyll *a*, from standard depths of 20 and 100 m as well as from the chlorophyll maxima were measured at all CTD stations mentioned above. Chlorophyll samples were also taken from the ships non-toxic seawater supply when the ship was underway and will be used to calibrate the Oceanlogger fluorescence.

All chlorophyll samples were filtered and then frozen at –20 ºC and stored until it was convenient to extract and analyse then on the ship.

The PML remote sensing group provided cruise support sending MODIS weekly composites of chlorophyll a and sea surface temperature. The images were updated every 3 days.

Photosynthetic physiology

Two Chelsea FRRF's were used during the cruise. The UKORS FRRF was deployed on a frame at each CTD station mentioned above. The BAS FRRF was connected to the ships underway seawater supply during transects. Two types of blanks were performed on both instruments at sea using bucket blanks, with DI water and filtered seawater, and were performed at all gain settings for both the light and dark chambers. An instrument response function was carried out on the UKORS FRRF using a chl a standard of 10 $\mu g.ml^{-1}$ in 90% acetone.
Additonal: At various time points in the bioassay, water was collected from the incubation bottles by Bibby and samples taken for chlorophyll a, POC and Lugols.

At Condensed stations 3 and 4, water samples were taken from the 100 µm bongo net. The water was added to filtered seawater containing f/2 and cultures were placed in the incubator on the aft deck. When the Polar Front was crossed on the return to the Falklands, the cultures were removed to the cold room. The cultures will be returned to the CCAP in Oban for the potential isolation of new phytoplankton species into culture.

Results:

Full data analysis will be performed back at BAS, Cambridge as many of the data sets are subject to a variety of correction factors, e.g. the chlorophyll standard needs to be calibrated itself on a spectrophotometer. Additionally, the data can only be fully interpreted with the contemporaneous physical oceanographic measurements from the CTD and Oceanlogger. However, from Figure 1 we can see that a fairly intense phytoplankton blooms is located in the region of the southern Scotia Ridge at the beginning of November. This bloom may also be associated with the retreating ice edge in this area. Note the area of high chlorophyll along the western most transect line below the Polar Front, an area previously believed to be low productivity. Figure 1b shows how the bloom along the ridge has retreated during the course of the cruise. A full evaluation of all the data should be completed during summer 2007.

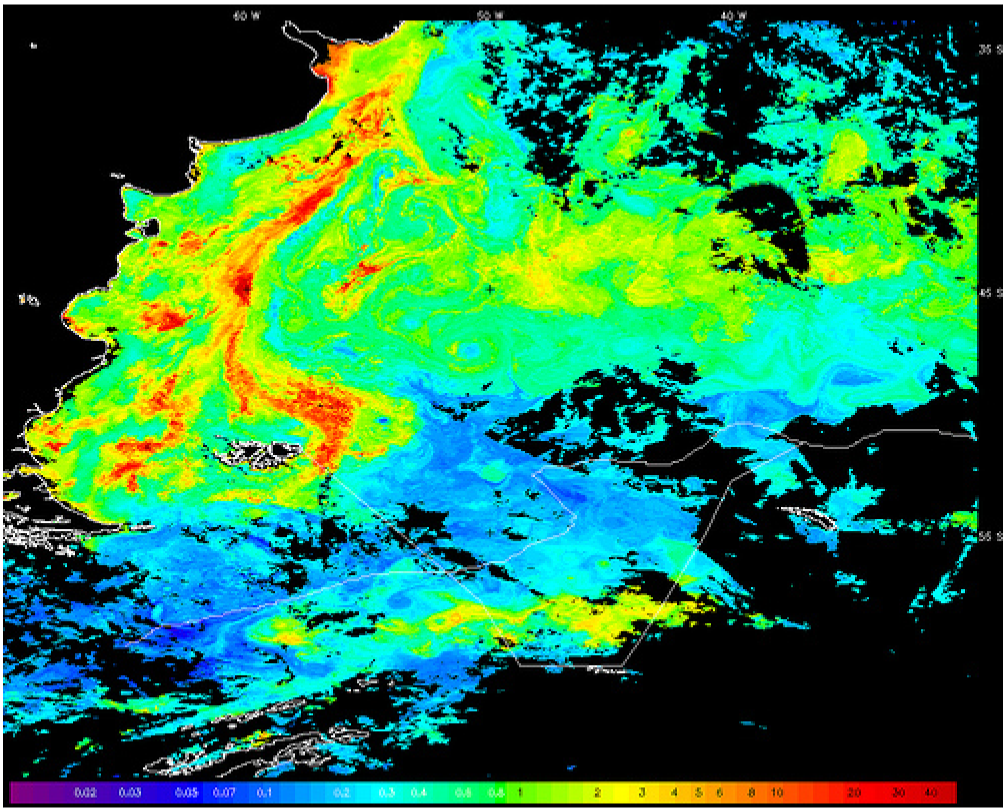

Figure 1a. MODIS 4km resolution chlorophyll a image, 7 day composite ending the 7th November 2006.

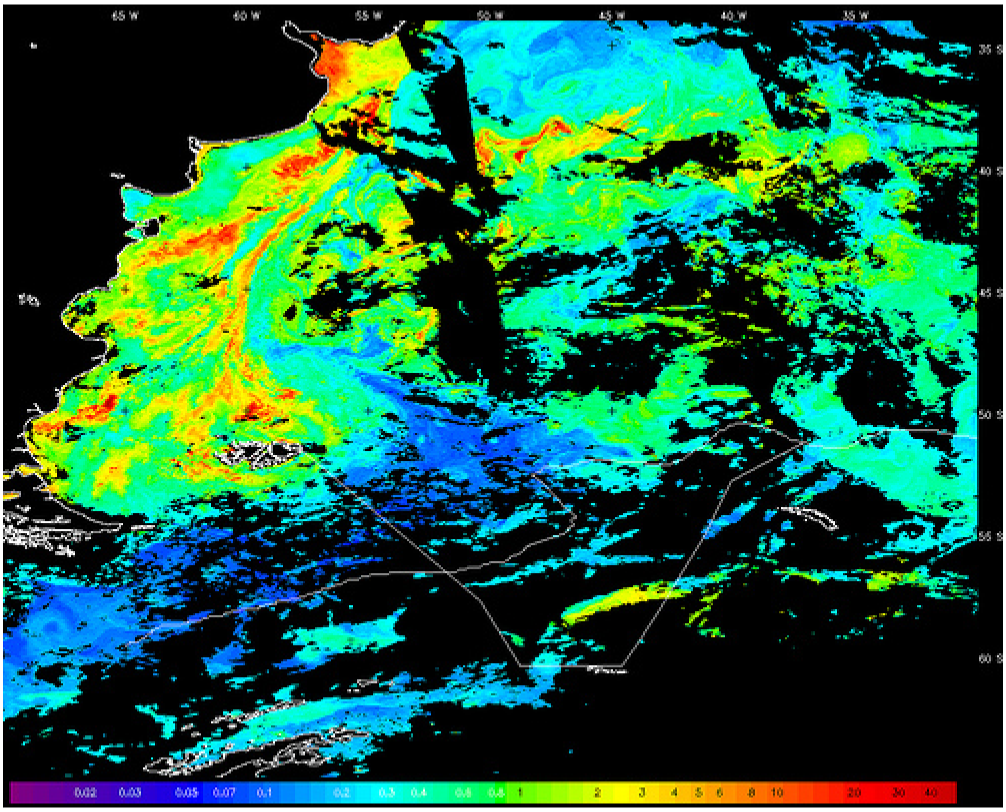

Figure 1b. MODIS 4km resolution chlorophyll a image, 7 day composite ending the 24th November 2006.

Problems

On of the major problems with the cruise was that we were unable to borrow the UKORS titanium CTD. Instead of one 24 bottle CTD, we had to deploy a 12 bottle CTD twice and collect "clean" water with GoFlo bottles. As noted by Whitehouse, the GoFlo bottle deployment required five people, the depths of water collection were nominal, there is no concurrent oceanographic measurements and the bottles didn't always close correctly.

At the beginning of the cruise the lab was cleaned out to remove soot or dust particles. However, after this the lab was repeatedly covered with dust/soot from the deckhead vents. It seems pointless to clean bottles etc thoroughly and follow clean techniques if the lab is so badly and regularly contaminated with dirt from the vents.

It was noted that one of the chemical waste drums from the rad lab containing seawater with 14C leaked whilst being moved to the CTD annex. The leak came from one side of the drum lid, which may have been faulty. Whilst the rad leak from this one drum was contained and did not present a danger to anyone, there may have been other incidences of leaky drums (this was never confirmed to me) which could present a real hazard to those moving the waste drums.

The BAS FRRF died near the very end of the cruise at condensed station 6. The problem most likely lies with the flashcard. Due to the death of the FRRF, an instrument response function test could not be performed on the instrument whilst at sea.

Internet access was often annoyingly slow. At times, it was difficult to download the satellite images that were sent to me which makes near real time cruise support a bit pointless!

To end this report on a positive note, I would like to say how useful the online event logs were for finding out both event numbers and underway oceanographic parameters e.g. PAR and fluorescence. Well done Nathan and Jeremy!

Study of phytoplankton response to naturally iron enriched regions of the Scotia Sea

December, 2006

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1.0 Overview

Iron is an essential component of the photosynthetic electron transfer chain and as such iron abundance and phytoplankton abundance are positively correlated. Iron concentrations in the Southern Ocean are generally low owing to the lack of continental derived Aeolian dust inputs. There are however, potential sources of iron into this system – including; seasonal melting sea ice, upwelling, and run-off / dust deposition from islands. The aim of this work, as part of JR-161, is to correlate natural iron abundance with phytoplankton abundance, speciation and productivity with respect to the rest of the Scotia Sea food chain.

2.0 Techniques

2.1 Phytoplankton physiology

Phytoplankton abundance, community structure and physiology are all outputs from the bench top FIRe system (Fluorescence Induction and Relaxation of Emission Spectrometer). This instrument is a development of the FRRF (Fast Repetition Rate Fluorometer) technique that is used widely in biological oceanography. This bench top instrument measures in real time and at high sensitivity a suit of parameters association with the community of phytoplankton. These include:

- **Fm** – Maximum fluorescence yield – Analogous to Chlorophyll Concentration - (Phytoplankton Abundance).

- **Fv/Fm** – The photosynthetic energy conversion efficiency. A measure of the 'health' of the phytoplankton community

- **Sigma-PSII** – A measure of the size of the light harvesting antenna association with the photosynthetic reaction centre Photosystem II (PSII)

2.1.1 Sampling

The FIRe instrument has been employed continuously on this cruise – measuring surface underway samples both on station and during transects from the uncontaminated sea-water. This has provided information spatial dynamics of phytoplankton physiology during transects and the temporal (diel) dynamics of phytoplankton physiology at stations.

In addition FIRe measurements have been made on discrete (500 ml) samples collected from the niskin rosette during the shallow biological casts. These discrete provided vertical profiles of the abundance and physiology of the phytoplankton community at both condensed and process stations. The physiology of the different size fractions (3, 5, 10 and 20 μm poly-carbonate membrane filters) of the sample collected from the chlorophyll maximum were also performed. This retuned information on the size-community structure of the phytoplankton community and the physiology associated with each size fraction.

2.2 On-deck Bioassay measurements

A series of on-deck bioassay incubation experiments were conducted at each process station, under controlled temperature and light conditions. The aim of these experiments is to identify the factors limiting phytoplankton growth. Trace metal clean surface water collected using the Go-Flo system or more normally the Tow-Fish were obtained at the start of each process station (such that enough time was available to observe a response). Samples (2 l) were subjected to the conditions summarised tables below, these also highlight the suit of measurements taken in order to characterise the response of the phytoplankton community to the artificially controlled conditions. These experiments will be import demonstrations of conclusions drawn from the sampling of the natural phytoplankton community and nutrient avaibility in the Scotia Sea.

Table 1 Conditions of Bioassay Incubation experiments

Condition	**60% of Surface PAR**	**60% of Surface PAR + 4 nM $FeCl_3$**	**30% of Surface PAR**	**30% of Surface PAR + 4 nM $FeCl_3$**
Bottle Numbers	**1-5**	**6-10**	**11-15**	**16-20**

Table 2 Summary of Incubation Experiments

Station	Experiment	Duration	Notes
PS1 - Nominally low – productivity	**Incubation 1**	**14 days**	**Overlap with Signy relief**
PS1 Nominally low – productivity	**Incubation 2**	**12 Days**	**Overlap with Signy relief**
PS2- South of S. Georgia	**Incubation 3**	**10 Days**	
PS3 – North of S. Georgia – Nominally high productivity	**Incubation 4**	**8 Days**	**Short due to end of cruise**

Table 3 Sampling summary of incubation experiments

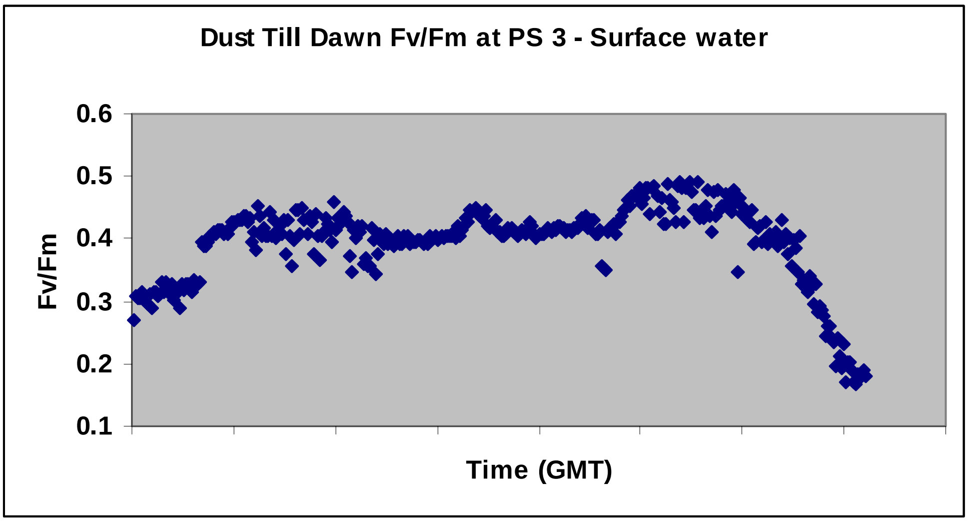
Time Point	Sampling
Start of experiment (T0)	**FIRe, Fe, Nutrients, P/E, Chlorophyll, Lugose, POC/PON, HPLC, Flow-Cytometry**
Daily	**FIRe**
Time Series, Two points determined by response as measured by daily FIRe	**FIRe, Nutrients, Chlorophyll**
End of Experiment (Tend)	**FIRe, Fe, Nutrients, P/E, Chlorophyll, Lugose, POC/PON, HPLC, Flow-Cytometry**

3.0 Preliminary Results

3.1 Underway measurements

Underway sampling using the FIRe technique delivers information of the spatial and temporal dynamics of phytoplankton abundance and physiology. An example of which is given in figure 1 which shows the dust till dawn Fv/Fm signal obtained from Process station 3. High Fv/Fm is measured at night indicative of a healthy and nutrient replete phytoplankton; this signal however can be seen to dramatically reduce during the day as a result of quenching by light. Such data obtained both on transects and at each station will be analysed with respect to nutrient concentrations, surface PAR, sea surface temperature, extracted chlorophyll, bathometry and higher food web structure.

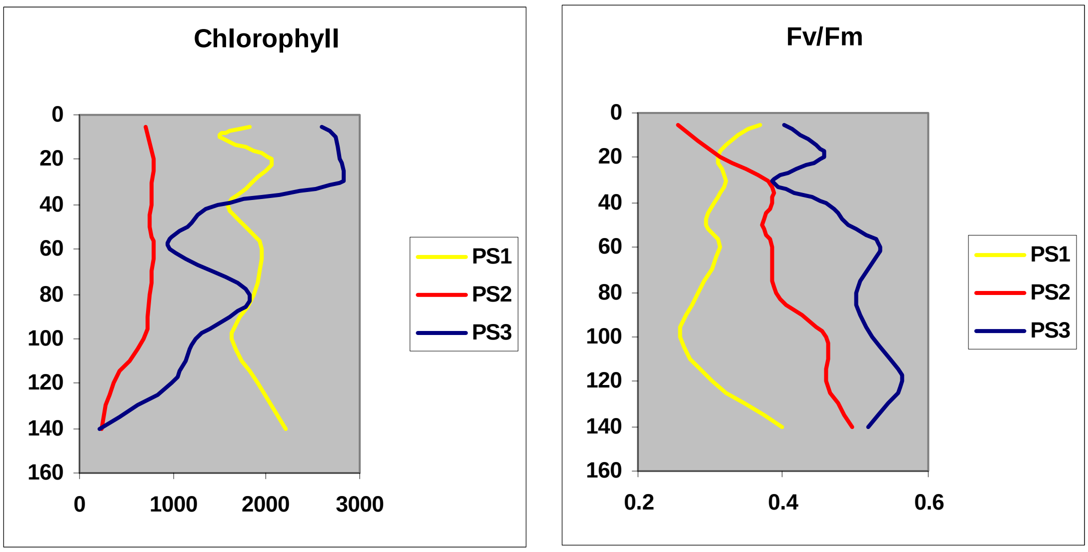
Figure 1



3.2 Discrete Sampling

Discrete samples were obtained throughout the euphotic zone on all shallow biological CTD's at both condensed stations and process stations. Examples of profiles showing chlorophyll abundance and Fv/Fm at each of the process stations is shown in Figure 2. Process station 3 can be seen to have high phytoplankton abundance in surface waters and elevated Fv/Fm throughout the water column, indicative of a more productive station. Such data from both condensed stations and process stations will be analysed with respect to surface PAR, nutrient avaibility, phytoplankton species composition, temperature, iron concentrations of higher food web structure.

Figure 2



4.0 Comments and further work

This work, as part, of JR161, has studied the response of phytoplankton to naturally iron enriched regions of the Scotia sea in early season. It is anticipated that the continuation of this work in 2007 and 2008 will provide an excellent opportunity to study this dynamic at later stages in the season and will reveal the extent to which the phytoplankton / nutrient relationship supports the rest of the Scotia Sea food web.

The localisation of the process stations and condensed stations on this and future cruises is critical in ensuring the sampling of both contrasting and representative regions. In future cruises it is highly recommend that these stations are selected with respect to real-time satellite chlorophyll data and data obtained during the cruise. This is essential to ensure the maximal potential scientific output of such cruises.

Also, the on-deck bioassay incubation experiments provide a valuable demonstration of the limiting nutrients in selected regions of the Scotia Sea and an insight in the response of the phytoplankton community to these inputs. However, owing to the low-temperatures responses can be slow (> 10 days). It would be beneficial if cruise logistics would ensure time for the completion of these experiments. During JR161 the cooling of the bioassay work was achieve by the pumping surface sea water – this is not ideal when the ship is moving through diverse bodies of water and it is recommended that a self contained water cooling system be used in future.

Lastly, the strong diel response of phytoplankton is clear from Figure 1. Sampling of phytoplankton should therefore be conducted at least twice daily (dark and light) and if possible at consistent times, avoiding the highly dynamic dawn and dusk transition.

Cruise report JR161

A study of the iron distribution in the Scotia Sea

December 2006

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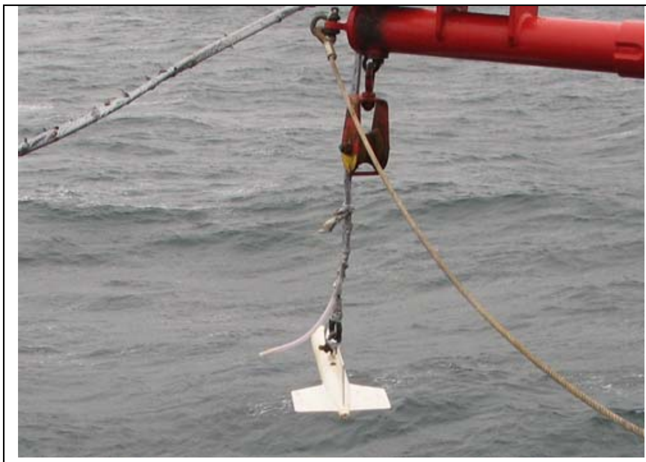
Introduction

Iron is an essential element for all living organisms and is of major importance for aquatic photosynthetic organism. Due to the insolubility of Fe(III) the concentration of iron in oxygenated seawater is extremely low (<0.5 nM in the open ocean). Iron is supplied to the surface ocean via atmospheric transport of dust and its deposition, as well as by upwelling, entrainment, or mixing of deeper waters relatively rich in nutrients and metals. Furthermore a runoff effect supplying iron from ice, sea icea and brine has been found to contribute significantly to the iron budget in higher latitudes.

Sample method

Underway: Samples were taken from a metal towfish that was towed at the stern on port side of the ship. Tubing went from the fish into the container where it was pumped with a peristaltic pump. See picture 1



Picture 1, torpedo towfish

Underway samples were filtered online through a 0.2 um Sartobran filter. All underway samples were acidified to a pH~1.8 with ultra pure HCl from Fisher.

Profiles: At each process station three profiles were collected and one at each condensed station. Samples were taken from 6 General Oceanic bottles at different depths. The bottles were attached to a plastic coated metal wire and the Go-Flo bottles were released with Teflon messengers.

All samples were acidified to a pH~1.8 with ultra pure HCl from Fisher.

Method

Dissolved iron was measured using the flow-injection chemiluminescence method by Obata (1993). Samples were buffered with ammonium acetate to a pH=4 and pre-concentrated on a resin column during analysis.

Results

14 Go-Flo profiles were taken and 136 underway samples with the towfish. The samples will undergo further analysis back at NOC.
Preliminary data from Process station 1 indicate that this station had higer dissolved Fe concentrations than one would expect for a typical HNLC region.
At process station 1 the dissolved iron concentration were quite high for the region. Ranging from dissolved Fe concentrations from 0.7 nM at surface to about 1 nM at 1000 m. See figure 1.

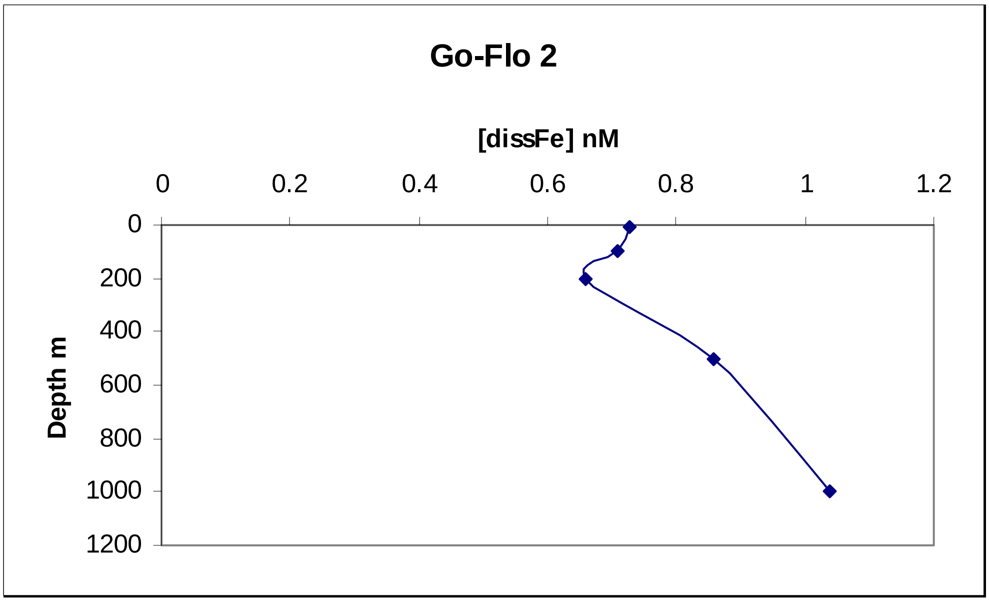


Figure 1. Process station 1, day 2.

At the ice edge condensed station, the dissolved iron concentrations increased both in surface and at depth, which could indicate a run off effect from the ice. See figure 2.

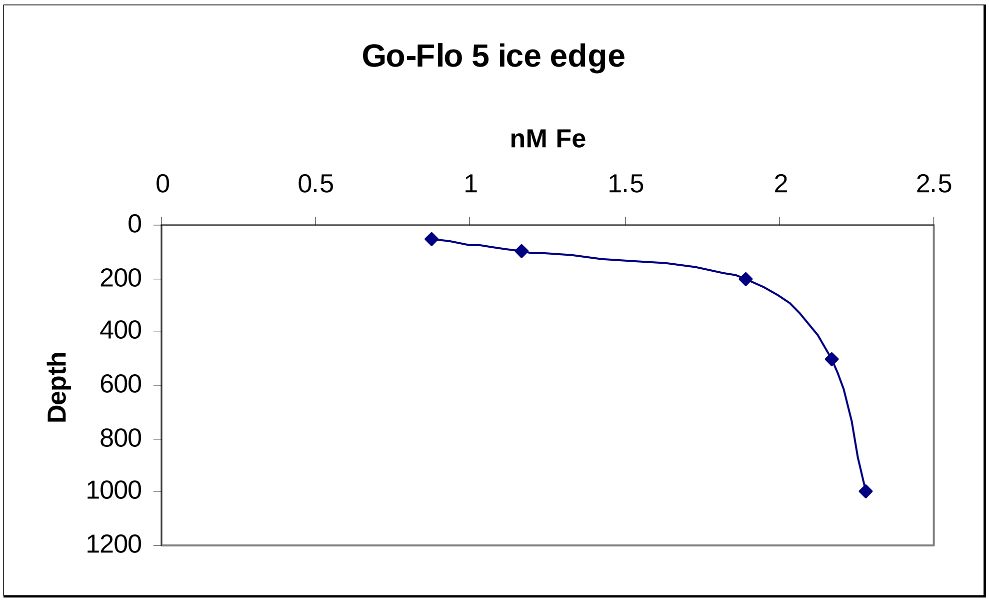


Figure 2. Condensed station 2, ice edge.

These are preliminary results and that the values might change after further check and calibration back at NOC.

Recommendations and future work

The initial results show that the first Process station was not as HNLC condition as planned. Therefore it would be advisable for future cruises that the cruise line would be take into account the latest satellite images.

For future cruises in this region a more cold resistant kind of tubing should be used as the tubing became very brittle in the water and snapped in half when pressure was put on it. Also, gaffa tape is better as use as tape as the grey tape I had was too brittle for the cold weather.

Access to the container should be avoided when the wire for the net comes in again as during the winch time a brush is washing the wire coming in spraying iron water all over the place and onto the container. See picture 2

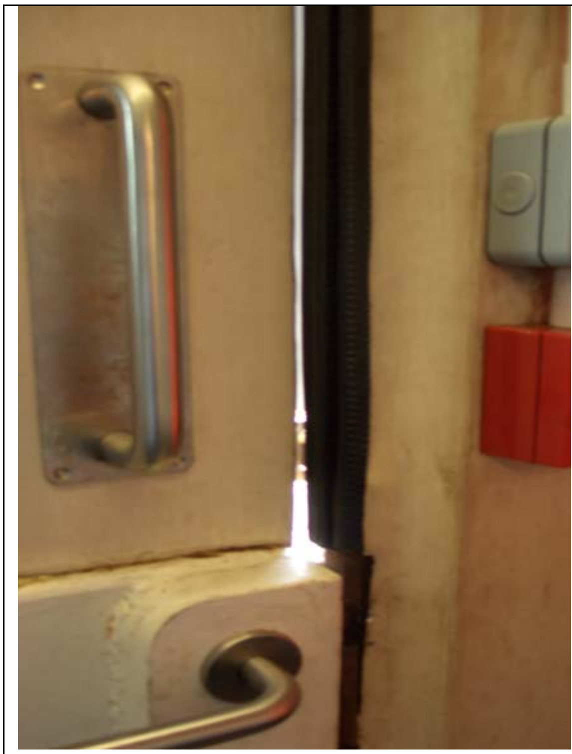
Picture 2, clean container covered in iron spray.

For future work, it would be a wish to bring at least one more person on the cruise to assist with the iron work and bioassay. This would improve the coverage of underway sampling and having an extra person would mean that a bigger suite of nutrient and light combinations for the bioassay experiments could be done.

Equipment

The clean container: The UKORS clean container was used as a lab.

The back and front door had both big visual gaps. Please see picture 3 and 4. The back door was sealed using silicon gel to avoid water, air and other contaminants to enter the clean space. The front door was left untouched.



Front door

Back door

The milli-Q system in the clean container had visual algal growth in the pipes and therefore it was decided to use the ships MQ system instead.

During the cruise on the 19.11.06 in the early morning it was noticed that one of the windows facing the afterdeck was cracked. There is no clue what has caused this accident.

The Go-Flos worked very well. Only comment for future cruises would to have a meter counter on the winch.

Acknowledgement
I would like to thank Dr. Dave Pond for the amazing help with the go-flos. Also, I would like to thank the captain, officers and crew for all their very professional help with the go-flos and not at least the towfish.

Copepod Condition Factors.

Rachael Shreeve

Depth stratified *Calanoides acutus* samples were taken across the survey area, to look at condition factors and depth distribution within the water column.

The aim for sampling *C. acutus* was to collect 10 stage CV's from each depth horizon sampled with the MOCNESS. These would be placed in pre-weighed tin capsules for carbon and nitrogen elemental analysis and stored at minus 80 oC for transport, and analysis, back in the UK.

MOCNESS hauls were taken at most stations both day and night. The daylight samples were all sorted for samples for CHN and preserved in ethanol, whilst the night time samples were preserved in Formalin. Many depth horizons produced very few, if any, CV *C. acutus*, consequently the samples collected reflect the main distribution of the population. Samples were also not in as good a condition as we are used to with the bongo net, and may cause problems with analysis.

Depths sampled with the MOCNESS were: - 1000 – 750m, 750 – 625 m, 625 – 500, 500 – 375, 375 – 250, 250 – 125 and 125 to the surface. Unfortunately the MOCNESS failed at CS4 so we resorted to using the Multinet. This net has only 5 cod ends so we then sampled the depth horizons: - 1000 – 700m, 700 – 500m, 500 – 400, 400 – 200, 200 – 125m, the top 125m were sampled with the bongo net. We had problems with this net system though, and on most deployments around half the nets failed to actually fire, even though the software indicated all was well. Therefore we are unsure about which depth horizons were sampled with the Multinet, however samples were taken to give some indication of the condition of *C. acutus* at the different sites.

Problems with MOCNESS and Mulitnet net systems.

Failure of the MOCNESS system half way through the cruise caused us to substitute this sampling with the Mulitnet. This system proved to be flakey, possibly linked to the net monitor system has caused problems with collecting samples. It is essential that before next cruise that we have a fully operating system to collect multiple samples on one deployment of plankton that is in good condition. Sea trails during summer 2007 will be essential to test this system out prior to the main cruise.

Krill for Clock genes project.

2 samples were taken for an initial look at the clock genes. One sample from near the South Orkneys and one to the north of South Georgia. Krill were taken at T0, and heads cut and placed inside a tube that was surround by Ethanol at minus 80 oC, to try and freeze the heads instantly.

Samples taken

Station (Event)	Depth horizon	Number/location of sample
PS1 (39)	375 - 250	10 C. acutus. Tray A A1 – A10
PS1 (39)	125 - 0	10 C. acutus. Tray A B1 – B10
CS1 (81)	1000 - 875	2 C. acutus Tray A C1 – C2
CS1 (81)	875 - 750	11 C. acutus Tray A C1 – D1
CS1 (81)	750 - 625	7 C. acutus Tray A D2 – D8
CS1 (81)	625 - 500	8 C. acutus Tray A D9 – E4
CS1 (81)	500 - 375	12 C. acutus Tray A E5 – F4
CS1 (81)	375 – 250	10 C. acutus Tray A F5 – G2
CS1 (81)	250 – 125	10 C. acutus Tray A G3 – G12
CS1 (81)	125 – 0 m	10 C. acutus Tray A H1 – H10
CS1 (82)	400 – 0m	10 C. acutus from Bongo for comparison with MOCNESS condition Tray B A 1 – A10
CS2 (104)	750 - 625	10 C. acutus Tray B B1 – B9 and C1
CS2 (104)	625 – 500	10 C. acutus Tray B C2 – C12
CS3 (132)	500 - 375	10 C. acutus Tray B D2 – D11
CS3 (132)	750 - 625	2 C. acutus Tray B E1 – E2
CS3 (132)	625 - 500	10 C.acutus Tray B E3 – E12
CS3 (132)	375 – 250	10 C. acutus Tray B F1 – F10
CS3 (132)	250 - 135	12 C. acutus Tray B F11 – G10
CS3 (132)	125 – 0	13 C. acutus Tray B G11 – H11
CS4 (153)	500 - 375	10 C.acutus Tray D A1 – A10
CS4 (153)	625 - 500	10 C. acutus Tray D B1 – B10
CS4 (153)	750 - 625	7 C. acutus Tray D C1 – C7
CS4 (153)	875 - 750	10 C. acutus Tray D D1 – D10
CS4 (153)	1000 – 875	2 C. acutus Tray D E1 – E2
CS4 (153)	375 - 250	10 C. acutus Tray D F1 – F10
CS4 (153)	250 - 125	10 C. acutus Tray D G1 – G10
CS4 (153)	125 – 0	10 C. acutus Tray D H1 – H10
PS3 (264)	Unclear (net 1)	15 C. acutus Tray F A1 – B3
PS3 (272)	Bongo 400 - 0	10 C.acutus Tray L A1 - A1

JR161 Krill Studies

Ryan Saunders, Sophie Fielding, Katrin Schmidt, Gabi Stowasser, Andrew Hirst

Introduction

Krill (*Euphausia superba*) were collected, analysed and preserved for ongoing BAS studies:

1. Population dynamics: assessment of the length-frequency and maturity status of the Scotia Sea population.
2. Trophic level analysis.
3. Genetic analysis: inter-regional differences throughout the Scotia Sea.
4. Clock gene analysis.
5. Swarm kinship: genetic analysis.
6. Ovarian analysis.

Methods

Samples were taken with an RMT25 net at the condensed and processed stations and during acoustic target fishing events. Length-frequency measurements and sex/maturity status were taken from fresh krill for population dynamical studies. Total length was measured from the front of the eye to the tip of the telson, rounded down to the nearest millimetre. Maturity status was based on the Makarov and Denys scale for juveniles, sub-adults and males. Adult females were classified according to the Cuzin-Roudy and Amsler scale. Samples were preserved for all other krill studies for subsequent laboratory analyses in the UK. Onboard krill sampling protocols are detailed in Table RAS1.

Table RAS1. Onboard sample preservation protocol for krill.

N	Where	Sample preparation	Notes	Responsible
>200	Each swarm	Live	Faecal pellet analysis	KS
10	Each net or swarm	Frozen at -80^{o}C	T_0 samples for Trophic analysis	GS
100	1 per station	95% ethanol	Genetic analysis	AH
200	1 per station	10% formaldehyde	Ovarian analysis	RAS
200	Each catch	Onboard analysis or frozen at -20^{o}C	Length-frequency/maturity	RAS
10	Where possible	Dissection to 95% ethanol	Clock gene analysis	RS
10*200	10 swarms in 1 area	95% ethanol	Kinship genetics	SF

Data coverage

A summery of the krill catches analysed/ preserved is shown in Table RAS2, together with station details. Few krill were caught at stations PS1, CS4, CS5 and CS6; therefore, no animals were analysed or preserved for the krill studies. The requisite numbers of krill were preserved for trophic and genetic analysis at each station, and between 100 and 200 krill per station were retained for ovarian analysis. Onboard length-frequency and maturity measurements were obtained from 100-200 individuals from each net haul. Some, but not all, of these samples were frozen at $-20\,^{\circ}C$. Dissections for clock gene analyses were collected at PS2 and PS3, and between 100-200 animals were collected from 5 discrete krill swarms for kinship genetics at PS3.

Table RAS2. Record of krill catches analysed/preserved for krill studies. Target hauls are denoted (*), and stations where krill were analysed/ preserved are denoted (+).

Date	Time	Station	Event	Net	Depth (m)	Pop. dynamics	Trophic analysis	Genetic analysis	Clock genes	Kinship analysis	Ovarian analysis
No krill caught at PS1											
01/11/2006	03:21	CS1	73	1	980-700	+	+	-	-	-	-
02/11/2006	01:43	CS1	84	1	400-200	+	+	+	-	-	+
02/11/2006	14:19	CS1	92	2	200-20	+	+	-	-	-	-
04/11/2006	20:37	AFI	95	2	100-10	+	+	+	-	-	+
06/11/2006	03:59	CS2	107	1*	45-30	+	+	+	-	-	+
09/11/2006	02:37	CS3	135	2*	35-24	+	+	+	-	-	+
No krill caught at CS4											
No krill caught at CS5											
18/11/2006	22:15	PS2	186	1*	26-24	+	+	+	+	-	+
18/11/2006	22:22	PS2	186	2*	26-25	+	+		-	-	-
23/11/2006	01:04	PS3	228	1*	25-10	+	+	+	-	+	+
23/11/2006	02:36	PS3	229	1*	30-25	+	+	-	-	+	-
25/11/2006	03:50	PS3	253	1	400-200	+	+	-	-	+	-
25/11/2006	04:32	PS3	253	2	200-20	+	+	+	-	+	+
27/11/2006	02:39	PS3	270	1*	30-15	+	+	+	+	+	+

Preliminary results

Relative length-frequency distributions from each net haul where onboard krill measurements were obtained are shown in Figure RAS1. In general, distinct differences in length-frequency distribution and population structure were observed in each net haul. Small, juvenile individuals (15-30 mm) were caught predominantly at sites closest to the ice-edge (CS1 and CS2), whilst krill with a larger body size (30-55 mm) and more advanced state of maturity were evident further north in the open Scotia Sea-South Georgia region. Maturity stage analysis found that almost no adult krill in the survey region were bearing spermatophores, indicating that reproduction had not started at the time of sampling (November).

Recommendations

Comparisons of length-frequency distributions obtained with RMT25 and RMT8 net: possibility of under sampling small krill with RMT25 due to larger mesh size.

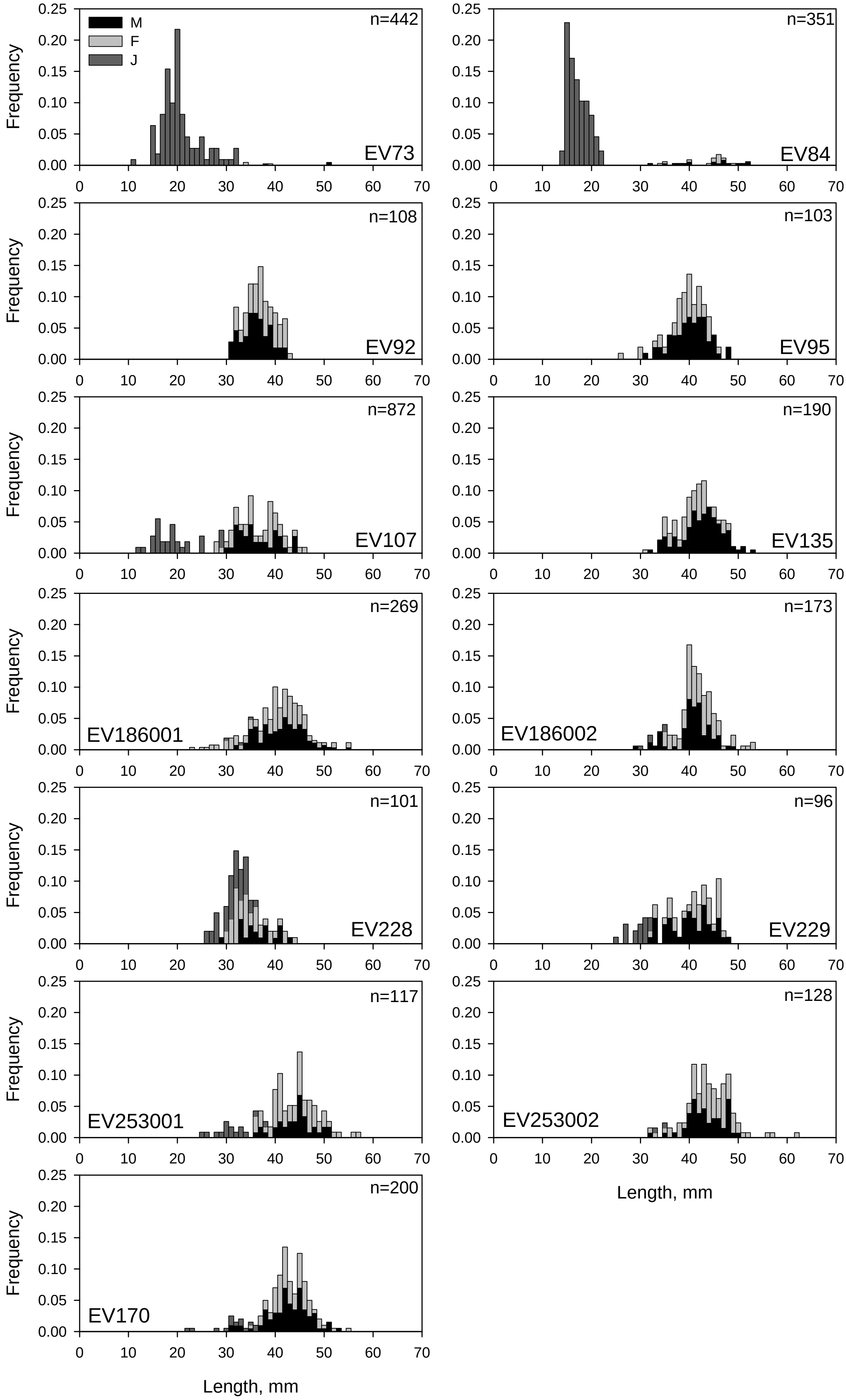


Figure RAS1. Relative length-frequency distribution of krill.

Mesozooplankton Sampling

(Peter Ward, Andrew Hirst and Rachael Shreeve)

This part of the zooplankton sampling programme was centered around two main objectives which were:

1) To describe the vertical distribution of plankton from the surface to 1000 m at each of the stations using the Longhurst-Hardy Plankton recorder (LHPR)

2) To sample *Oithona similis* (Copepoda:Cyclopoida) at each station and establish its abundance, population composition (stage structure), fecundity and population mortality in relation to temperature and food. Further, to isolate species stages and undertake grazing experiments using natural seawater obtained from the chlorophyll maximum.

A subsidiary objective was to use passage time to and from Stanley at the beginning and end of the cruise to tow the Continuous Plankton Recorder (CPR) and thus partially satisfy the requirements of the CPR LTMS project for the 2006/07 season.

LHPR Studies (Peter Ward)

It was planned that at each of the stations a day and a night LHPR profile (0-1000 m) would be taken. In the event this proved impossible as the normally reliable system proved extremely temperamental and malfunctioned on a number of occasions. A particularly annoying fault of continuously winding on at some point in its deployment cycle and latterly as soon as the net was lifted from the deck, was traced to fault in the wire. This was re-terminated only for the fault to reoccur and finally be traced to some frayed wiring on the winch slip ring. This fault occasioned the loss of some 4 hauls. Whilst remedying the slip ring problem there still remained a potentially serious problem with 6 of the 13 insofar as there was a mismatch between the number of commands and feedbacks, initiated and received by the deck command unit, and the number of wind-ons (complete revolutions of the gauze supply spool) and hence patches of plankton found on the gauzes. There is still some debate about the root cause of this problem. The number of spool revolutions was always less than the number of commands and feedbacks received. It is therefore seems possible that during its sampling period the magnet in the end cap of the supply spool may have disconnected from the reed-switch causing the next firing command from the deck unit to only move the spool back to its previous position. The disagreements were sometimes relatively trivial but ranged from 5 or so patches out, to in excess of 40. Why this should occur is unknown. It is possible that given the age of the magnets and reed-switches they are weakening and are no longer fit for purpose. Alternatively the method of deployment may be the root cause of the problem. On previous cruises the unit was deployed at around 3.5 knots. Because of the fishing depth required (1000 m) this meant that a ratio of around 3:1 (wire out: net depth) was anticipated. It transpired however that over the years successive re-terminations have reduced the length of the biological wire to something less than 3000 m. It was therefore not possible to achieve the desired depth at 3.5 kts. We accordingly reduced the ships speed on deployment to 2.0 kts and veered from the winch at 40 m/min which reduced the wire out to depth ratio to around 2:1. It may be that as a result of this new regime the unit is not experiencing a steady flow through the net which is causing the supply spool to 'wobble' as described above. This also suggests that the fault and mismatch is principally occurring on the descent and not on the ascent which is fished at a normal 3.5 kts and hauling rate of 30 m/min. If time allows we plan to check this by undertaking a test deployment to a lesser depth veering and hauling at a constant ships speed of 3.5 kts to see if this remedies the fault.

In the event a total of 17 deployments was made, 4 of which were not cut due to instrument malfunction (see above) and 7 indicated a mismatch between gauzes cut and that indicated by the deck command unit.

With a new net monitor being planned for use on future cruises it is important to ensure that it incorporates a better (more precise) way of disabling the LHPR motor during fishing, rather than further reliance on the reed-switch. It also needs to take into account the requirements to be able to increase the time period that gauzes fish (presently 99 seconds max) as well as incorporating a flow diverter in the cod-end allowing the net to be vented until it is appropriate to switch. A specification needs to be drawn up before work progresses much further on this project.

Oithona similis: mortality rates and role in the Antarctic ecosystem

Peter Ward and Andrew Hirst

Introduction:

Oithona is a ubiquitous genera of cyclopoid copepod which plays an important role as a grazer of microplankton and as a prey item for many fish larvae and other higher predators. *Oithona similis* has been shown to perform coprorhexy, and as such is implicated as a potentially important player in modifying vertical flux of faecal material. *Oithona similis* dominate mesozooplankton numbers in Antarctic waters and is an important contributor to zooplankton biomass. Mortality plays a critical role in determining the population dynamics of copepods, and can be as important as growth in determining spatio-temporal patterns of abundance and productivity. Although our knowledge on this species growth and fecundity rates has been progressed in recent years (e.g. Ward & Hirst, in press), without a better understanding of mortality and its controls we will be unable to predict population dynamics of this important species. Although there are some measurements of copepod mortality rates in waters of $<5^{o}$C (Hirst & Kiørboe 2002), these are largely based on rates in cold seasons in temperate regions, as such they may be expected not to necessarily represent Polar waters. There are very few measurements on copepod mortality in the Antarctic Ocean. The objectives of this work were to collect quantitative samples that would allow first assessments of mortality (using a vertical life-table approach) for *Oithona similis* in this region. Our work would also complement previous studies on fecundity and grazing. Our methods are described in detail below.

Methods:

Abundance

At each of the Process (P1 to P3) and Condensed stations (C1 to C6) the 50µm bongo net was hauled vertically from 400 metres, collected samples were preserved in 4% formaldehyde. Details on all net hauls are provided in the Bongo Appendix at the end of this Cruise Report. In addition, collections were made using 10L Niskin bottles on the CTD, with 2 bottles being fired at each of the depths 400m, 300m, 200m, 100m, 50m, and surface. These events are detailed in the CTD Appendix in the Cruise Report (Events and dates were: E27 28/11/06; E86 02/11/06; E109 06/11/06; E161 17/11/06; E195 19/11/06; E245 24/11/06; E286 29/11/06). Each samples was carefully filtered through 50µm mesh and preserved in formaldehyde. Upon return to the laboratory these samples will be used to obtain quantitative estimates of abundance of all stages (egg to adult). We will using stage-specific development times and the abundance estimates in order to determine fecundity and stage-specific mortality rates (using a vertical life-table approach).

Grazing

At each of the stations grazing experiments were also undertaken. Bongo net samples were rapidly sorted and 4 aliquots, each containing 30 *O. similis* (a mixture of CV and CVI females) were isolated in filtered seawater and left in the cool room (1^{o}C) for 24 hours to acclimate. Following this they were filtered and backwashed into 250 ml Duran bottles containing seawater obtained from the chlorophyll maximum not more than one to two hours before the experiment was set up. Three initial 250 ml seawater samples were fixed in 2% lugols iodine, and a further 3 control samples were placed in Duran bottles. These, along with the bottles containing *O. similis* were placed on grazing wheel (approx 1 rev per 90 sec) and incubated for 24 hrs. The experiments were concluded by placing all of the 3 control samples into lugols iodine, as well as three of the bottles containing animals. The remaining bottle containing animals was filtered and the contents inspected under a microscope to establish likely mortality rates during the course of the experiment. The bottles (9 per station) will await counting in the UK.

Biomass

At PS1 and PS2 3 aliquots of 200-250 animals were placed into pre-weighed dried tin capsules. These will be used to determine mean carbon content once in UK.

References:

Ward P, Hirst AG (in press) *Oithona similis* in a high latitude ecosystem: abundance, distribution and temperature limitation of fecundity rates in a sac spawning copepod. Marine Biology

Hirst AG, Kiørboe T (2002) Mortality of marine planktonic copepods: global rates and patterns. Marine Ecology Progress Series <u>230</u>: 195-209

CPR tows (Peter Ward and Rachael Shreeve)

As part of the LTMS CPR project, 3 tows were planned to take place during cruise JR161. An initial tow was made on departure Stanley and continued up to the first Process Station, a distance of some 380 miles. The second and third tows are planned for the journey back to the Falklands commencing on departure of the final station.

RMT25 fishing during JR161

Ryan Saunders, Sophie Fielding, Katrin Schmidt, Gabi Stowasser, Andrew Hirst, Martin Collins, Peter Enderlein

Introduction

The mesopelagic fish and macro-zooplankton are an important part of the foodweb that are not adequately sampled by smaller nets. During the cruise the RMT25 was used to characterise the fish and macro-zooplankton community at each station, to ground truth acoustics with target hauls and to catch krill in surface waters for a range of studies.

Gear

The RMT25 was rigged with 2 nets, with the release mechanism and downwire net-monitor with flow, temperature, salinity and PAR sensors. In general the RMT 25 performed well. There were two problems with the release mechanism, the first being a failure of the feedback mechanism. The second being when the connection between the shaft and the gear mechanism had worked loose. The RMT nets suffered considerable wear and tear and are now at the end of their working lives.

Catch sorting and processing

Depth stratified hauls (1000-700; 700-400; 400-200 & 200-surface) were conducted day and night at each of the stations (30 hauls) (see Table X1), with each net open for 35-45 minutes. In addition 20 hauls were undertaken at stations either targeting krill or fish marks identified on the EK60 echosounder or to catch krill in surface waters. In addition 3 hauls were made to catch fish larvae (AFI) over the South Orkneys continental shelf.

For the stratified hauls the total catch was sorted and quantified. Numbers caught and total weight (when > 1 g) was obtained for each species. For some groups specific identification was not possible. Samples were collected from key species for stable isotope analysis and the remainder of the catch, with the exception of the large jellies, was preserved in formalin or ethanol (pteropods and some amphipods only). All data were recorded in an MS Access relational databse.

Fish were separated from the rest of the catch and were measured and sexed (using external sexual characters when possible). At stations P1 & C1 stomachs and tissue were sampled and otoliths collected from the most abundant species. At subsequent stations fish were measured, sexed and frozen whole. Bathylagus were all frozen whole from all stations.

Preliminary results

Details of species caught are given in Tables X2-X6. Over 3000 fish, belonging to 33 species were caught during the cruise (Table X2) with catches dominated by the myctophids (lantern fish) and bathylagids (deep-sea smelts) with the most abundant species being *Krefftichthys anderssoni*, *Electrona antarctica, Electrona carlsbergi, Protomyctophum bolini, Gymnoscopelus braueri* and *Bathylagus* sp. The bathlagids were not always identified to the species level, but most were *Bathylagus antarcticus*.

Length frequency distributions of Electrona antarctica, Electrona carlsbergi and Krefftichthys anderssoni are illustrated in Figure X1.

Few fish were caught during daylight hauls in the top 400 m, indicating that the fish are able to avoid the net during daylight. Daylight target hauls on clear fish marks caught either few or no fish.

Whilst all fish and euphausids were identified to the species level, it was not possible to identify other faunal groups to the species level. A photographic guide is being developed to make identification easier and provide consistency between cruises and catch sorters.

Recommendations for future cruises

1. It is essential to carry a full set of spares for the RMT 25 release mechanism and net monitors. Fortunately we were able to remove parts from the RMT8 release to keep the RMT25 system working. With the exception of one haul the net monitor worked reliably with the RMT25, but given the problems that were encountered with other gears, a new net monitoring system is essential.

2. The current set of nets is extremely worn out, with lots of rips that have been hurriedly repaired. We have one spare net, which needs slight adjustment to fit to the bars and a second net is on order. The old nets will be OK as emergency spares.

3. The RMT25 is clearly unable to catch fish in the surface waters during daylight, so to get any idea of fish abundance night time hauls must be used. This may present problems during summer cruises, when darkness is limited and there is pressure from other gears for darkness slots.

Table X2 Fish

Species	Weight	Number	Family
Channichthyidae (larvae)		1	Channichthyidae
Champsocephalus gunnari (larvae)		5	Channichthyidae
Chaenocephalus aceratus (larvae)		2	Channichthyidae
Electrona antarctica	3587	614	Myctophidae
Electrona carlsbergi	2263	368	Myctophidae
Electrona sp.	1	2	Myctophidae
Electrona subaspera	18	1	Myctophidae
Gymnoscopelus bolini	12	1	Myctophidae
Gymnoscopelus braueri	2637	460	Myctophidae
Gymnoscopelus fraseri	131	13	Myctophidae
Gymnoscopelus nicholsi	772.5	36	Myctophidae
Gymnoscopelus opisthopterus	237	18	Myctophidae
Gymnoscopelus piabilis	155	9	Myctophidae
Gymnoscopelus sp.	2.5	2	Myctophidae
Krefftichthys anderssoni	1013	705	Myctophidae
Lampanyctus achirus	797	53	Myctophidae
Lampanyctus sp.	2	1	Myctophidae
Protomyctophum andreyeshevi	3	2	Myctophidae
Protomyctophum bolini	403	266	Myctophidae
Protomyctophum gemmatum	7	3	Myctophidae
Protomyctophum luciferum	1	1	Myctophidae
Protomyctophum parallelum	22	26	Myctophidae
Protomyctophum tenisoni	93	91	Myctophidae
Bathylagus antarcticus	210	54	Bathylagidae
Bathylagus gracilis	10	1	Bathylagidae
Bathylagus sp.	3884	345	Bathylagidae
Benthalbella elongata	43	2	Other fish
Benthalbella macropinna	122	4	Other fish
Borostomias antarcticus	447	20	Stomiidae
Cyclothone sp.	64	175	Gonostomatidae
Cynomacrurus piriei	323	13	Macrouridae
Fish larvae indet.	1	2	Other fish
Icichthys australis	481	1	Other fish
Nansenia antarctica	44	7	Other fish
Notolepis coatsi	53	4	Paralepididae
Notolepis sp.	2	4	Paralepididae
Paradiplospinus gracilis	724	10	Gemyplidae
Paralepididae	14	36	Paralepididae
Poromitra crassiceps	252	19	Melamphidae
Sio nordenskjoldii	25	2	Melamphidae
Stomias gracilis	173	9	Stomiidae

Table X3 Amphipods

Species	Number
Amphipod indet.	33
Cyllopus sp.	79
Cyphocaris anonyx	1
Cyphocaris faueri	1
Cyphocaris richardi	483
Danaella mimonectes	1
Eurythenes obesus	1
Eurythenes sp.	12
Eusirius antarcticus	4
Eusirius perdentatus	2
Hyperia crassa	3
Hyperidae indet.	6
Lanceola sayana	4
Lanceolidae indet.	2
Orchomene sp.	1
Orchomene sp. "L"	4
Orchomene sp. "S"	1
Parandania boecki	292
Parandania gigantea	3
Pegohyperia princeps	9
Phronima sp.	3
Primno macropa	142
Scina cf crassicornis	1
Scina cf incerta	1
Scina sp.	3
Stenopleura atlantica	22
Themisto gaudichaudii	2222
Vibilia antarctica	1

Table X4 Mollusca

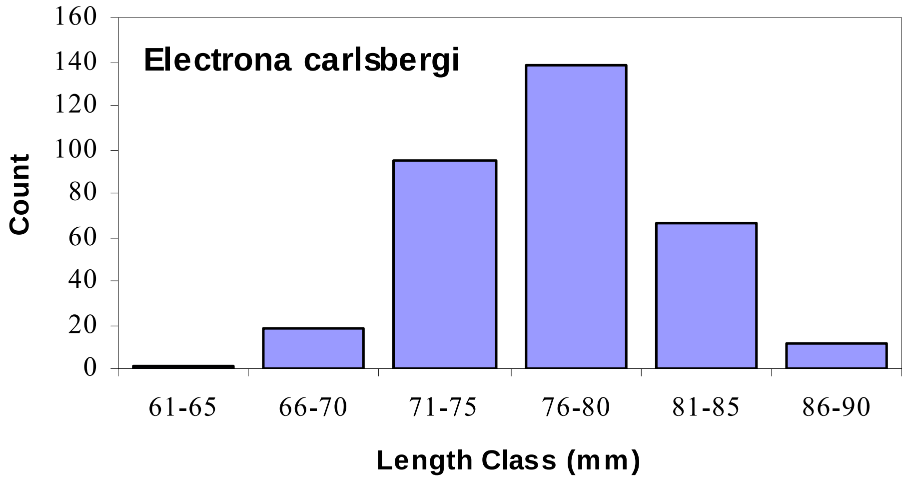
Species	Mass (g)	Number
Bathyteuthis abyssicola	36	6
Cranchiidae indet.	83	33
Gonatus antarcticus	1	1
Histioteuthis eltaninae	34	1
Mastigoteuthis psychrophila	126	3
Moroteuthis knipovichi	69	2
Psychroteuthis glacialis	7	2
Slosarczykovia circumantarctica	104	24
Squid indet.	5	3
Clio sp.		16
Clione sp.		3
Pteropoda indet.		23
Spongiobranchia sp.		233

Table X5 Decapods, mysids, euphausids & ostracods

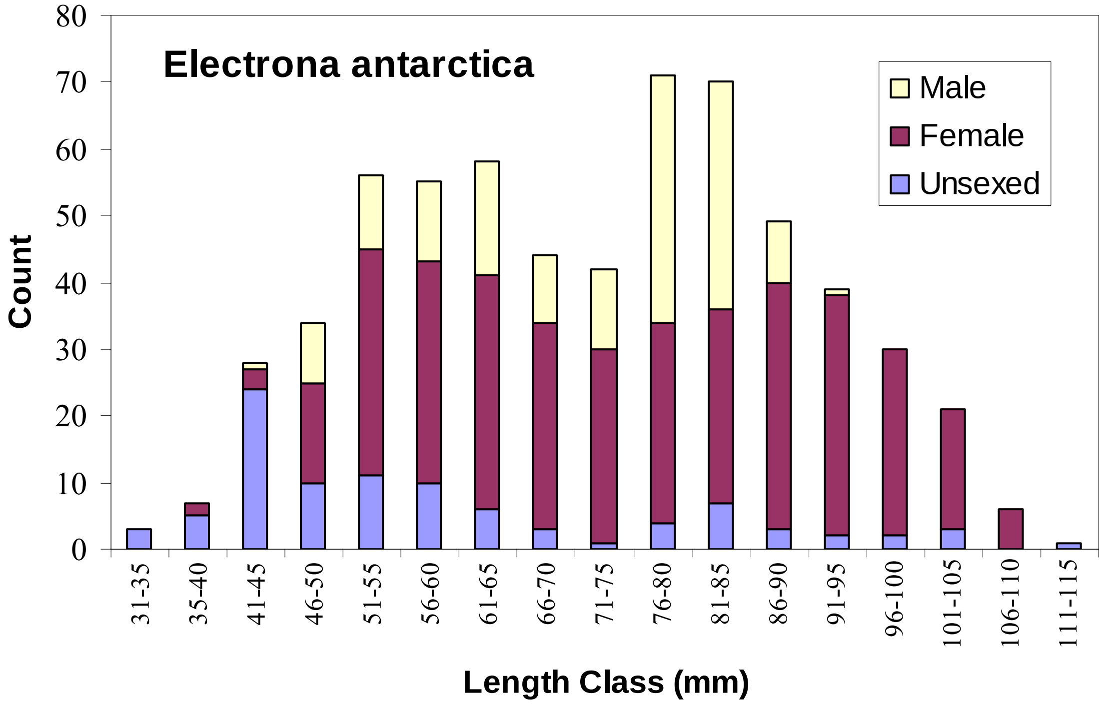
Species	Mass	Number
Acanthephyra sp.	526	80
Decapod larvae Type 1	5	36
Gennadus sp.	684	738
Munida gregaria	2	1
Sergestes sp.	35	12
Sergestid sp.	15.5	21
Sergia sp.	187.5	108
Euphausia frigida	143	2013
Euphausia superba	200729	
Euphausia triacantha	820	3591
Euphausia vallentini	10.5	165
Thysanoessa sp.	321.5	3414.4
Thysanopoda acutifrons	3.5	6
Gnathophausia sp.	82	104
Mysid sp “A”	1	3
Gigantocypris sp.	287	238

Table X6 Gelatinous zooplankton

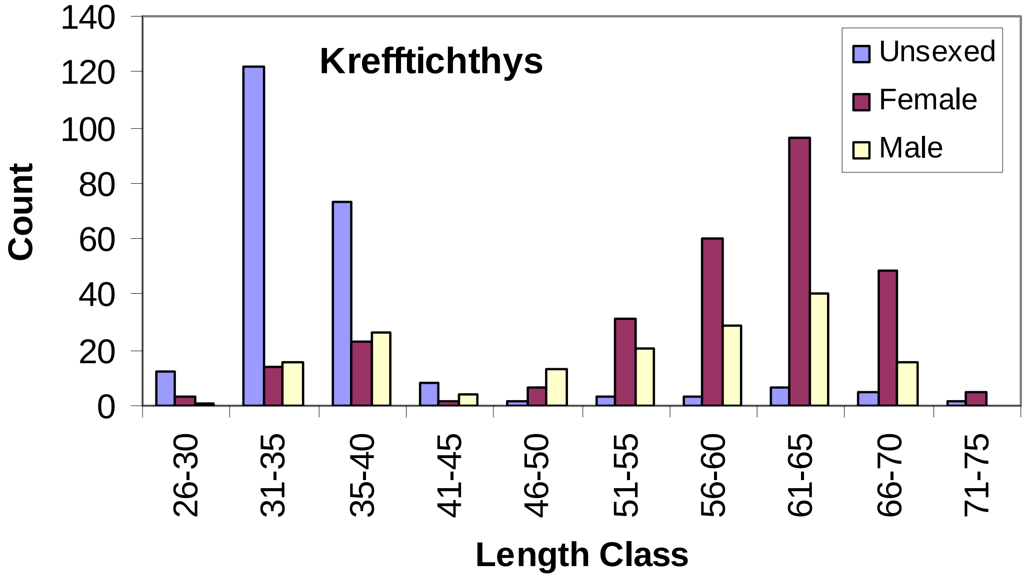
Species/group	Weight	Number	Group
Chaetognaths indet.	639	1417	Chaetognaths
Atolla wyvillei	7856	353	Cnidaria
Calycopsis borgrevichi	725.5	384	Cnidaria
Diphyes sp. 1	835	1379	Cnidaria
Diphyes sp. 2	122	379	Cnidaria
Hydromedusae (clear)	1	1	Cnidaria
Hydromedusae (red)	182	35	Cnidaria
Hydromedusae indet.	27	43	Cnidaria
Nipple medusae	435.5	279	Cnidaria
Periphylla periphylla	53932.5	213	Cnidaria
Scyphomedusae (large transparent)	726	1	Cnidaria
Sibogita sp.	243	211	Cnidaria
Siphonophore indet.	141	7	Cnidaria
Stygiomedusa gigantea	48157	9	Cnidaria
Beroe sp.	1033	6	Ctenophores
Ctenophora indet.	78	12	Ctenophores
Flatworms indet.	10	11	Flatworms
Tomopteris sp.	57	128	Polychaetes
Vanadis sp.	3	3	Polychaetes
Salpa thompsoni	2077	1300	Salps



Electrona carlsbergi
Count
160
140
120
100
80
60
40
20
0
61-65
66-70
71-75
76-80
81-85
86-90
Length Class (mm)



Electrona antarctica
Male
Female
Unsexed
Count
80
70
60
50
40
30
20
10
0
31-35
35-40
41-45
46-50
51-55
56-60
61-65
66-70
71-75
76-80
81-85
86-90
91-95
96-100
101-105
106-110
111-115
Length Class (mm)



Krefftichthys
Unsexed
Female
Male
Count
140
120
100
80
60
40
20
0
26-30
31-35
35-40
41-45
46-50
51-55
56-60
61-65
66-70
71-75
Length Class

Table X1 Details of RMT25 stations during JR161

Event	Net	Station	Type	D or N	Open Date	Open Time	Open Lat	Open Long	Open Wire	Open Depth	Close Date	Close Time	Close Lat	Close Long	Close Wire	Close Depth	Duration	Comments
41	1	P1	Target	Day	28-Oct-06	21:30	-57.6762	-50.3939	332	201.73	28-Oct-06	21:56	-57.6567	-50.394	254	107.5	25.5	
41	2	P1	Target	Day	28-Oct-06	22:05	-57.6493	-50.3941	170	88.06	28-Oct-06	22:34	-57.6254	-50.3971	48	26.27	28.5	
42	1	P1	Stratified	Night	29-Oct-06	0:24	-57.632	-50.4466	1895	999.29	29-Oct-06	1:12	-57.6021	-50.4678	1535	685	47.6	
42	2	P1	Stratified	Night	29-Oct-06	1:12	-57.6017	-50.4681	1520	679.07	29-Oct-06	1:58	-57.572	-50.4876	816	386	45.6	Cod-end lost no catch
43	1	P1	Stratified	Night	29-Oct-06	3:51	-57.5134	-50.5064	751	391.11	29-Oct-06	4:25	-57.488	-50.5085	436	192.2	33.5	
43	2	P1	Stratified	Night	29-Oct-06	4:26	-57.4867	-50.5087	415	178.24	29-Oct-06	4:59	-57.4615	-50.5133	35	21.51	32.6	
55	1	P1	Target	Day	29-Oct-06	22:29	-57.7502	-50.465	85	58.44	29-Oct-06	22:49	-57.7547	-50.4905	154	71.48	20.6	
55	2	P1	Target	Day	29-Oct-06	22:52	-57.7552	-50.4933	126	78.05	29-Oct-06	23:13	-57.7598	-50.518	48	27.25	20.5	
56	1	P1	Stratified	Night	30-Oct-06	0:13	-57.7753	-50.5763	1175	699	30-Oct-06	1:01	-57.7904	-50.6292	855	412.5	48.7	Repeat of 42/2
56	2	P1	Target	Night	30-Oct-06	1:02	-57.7906	-50.6301	844	410.83	30-Oct-06	1:36	-57.7964	-50.6683	311	162	33.8	
58	1	P1	Stratified	Day	30-Oct-06	9:43	-57.7763	-50.3472	750	398.57	30-Oct-06	10:16	-57.7628	-50.3818	442	200.1	33	
58	2	P1	Stratified	Day	30-Oct-06	10:17	-57.7624	-50.3831	441	199.23	30-Oct-06	10:49	-57.7501	-50.4159	49	29.31	32.6	
59	1	P1	Stratified	Day	30-Oct-06	12:11	-57.7078	-50.4564	1668	996.54	30-Oct-06	12:51	-57.6868	-50.4661	1322	703.4	39.5	
59	2	P1	Stratified	Day	30-Oct-06	12:52	-57.686	-50.4664	1302	699.47	30-Oct-06	13:33	-57.6634	-50.4796	835	401.8	40.6	
71	1	C1	Target	Day	31-Oct-06	21:37	-57.4615	-50.5133	35	21.51	31-Oct-06	21:57	-60.6819	-48.6985	86	34.7	20.5	
71	2	C1	Target	Day	31-Oct-06	21:58	-60.6812	-48.6987	86	39.36	31-Oct-06							
73	1	C1	Stratified	Night	01-Nov-06	3:21	-60.5001	-48.7553	1917	979.97	01-Nov-06	4:02	-60.5068	-48.7535	1634	700	40.9	
73	2	C1	Stratified	Night	01-Nov-06	4:04	-60.4669	-48.7677	1551	702.02	01-Nov-06	4:40	-60.4389	-48.7841	936	403.5	36.1	
84	1	C1	Stratified	Night	02-Nov-06	1:43	-60.5544	-48.927	639	402.69	02-Nov-06	2:19	-60.5385	-48.9724	419	200.1	35.8	
84	2	C1	Stratified	Night	02-Nov-06	2:19	-60.5385	-48.9724	419	200.06	02-Nov-06	2:55	-60.5234	-49.0216	33	19.6	35.8	
85	1	C1	Target	Night	02-Nov-06	3:47	-60.5234	-49.0216	33	19.6	02-Nov-06	4:07	-60.5075	-49.1053	68	27.74	20.1	
85	2	C1	Target	Night	02-Nov-06	4:07	-60.5074	-49.1058	68	29.5	02-Nov-06	4:27	-60.5016	-49.1338	42	16.56	19.4	

91	1	C1	Stratified	Day	02-Nov-06	10:48	-60.6275	-48.8185	1970	994.63	02-Nov-06	11:38	-60.6111	-48.8983	1682	701.1	50.4	
91	2	C1	Stratified	Day	02-Nov-06	11:39	-60.6109	-48.8992	1673	699.91	02-Nov-06	12:33	-60.5914	-48.9888	990	402.2	54.6	
92	1	C1	Stratified	Day	02-Nov-06	13:45	-60.574	-49.1069	627	404.94	02-Nov-06	14:19	-60.572	-49.1609	452	203.4	33.4	
92	2	C1	Stratified	Day	02-Nov-06	14:19	-60.5719	-49.1616	446	200.99	02-Nov-06	14:57	-60.5662	-49.2204	33	12.78	37.5	
95	1	AFI	AFI	Day	04-Nov-06	20:06	-60.7052	-43.95	312	202.9	04-Nov-06	20:37	-60.6946	-43.9984	238	98.45	30.4	
95	2	AFI	AFI	Day	04-Nov-06	20:37	-60.6944	-43.9991	238	102.37	04-Nov-06	21:07	-60.6798	-44.0491	36	9.89	30.2	
96	1	AFI	AFI	Day	04-Nov-06	22:25	-60.7188	-43.9416	282	194.86	04-Nov-06	22:50	-60.6987	-43.9672	210	97.47	24.7	
96	2	AFI	AFI	Day	04-Nov-06	22:50	-60.6983	-43.9678	210	100.95	04-Nov-06	23:15	-60.6787	-43.9987	27	5.77	25.4	
98	1	AFI	AFI	Night	05-Nov-06	1:35	-60.7324	-43.9979	257	182.65	05-Nov-06	2:00	-60.715	-44.0265	213	102.4	25.2	
98	2	AFI	AFI	Night	05-Nov-06	2:01	-60.7147	-44.0271	213	107.47	05-Nov-06	2:26	-60.699	-44.0599	24	11.65	25.1	
106	1	C2	Stratified	Night	06-Nov-06	1:49	-60.4923	-44.687	673	402.78	06-Nov-06	2:24	-60.4818	-44.7476	432	201.9	34.8	
106	2	C2	Stratified	Night	06-Nov-06	2:24	-60.4816	-44.7485	432	202.12	06-Nov-06	3:00	-60.4668	-44.8074	31	11.65	35.5	
107	1	C2	Target	Night	06-Nov-06	3:59	-60.4767	-44.7447	54	45.34	06-Nov-06	4:19	-60.4691	-44.7769	70	32.05	20.3	
107	2	C2	Target	Night	06-Nov-06	4:20	-60.469	-44.7773	67	31.61	06-Nov-06	4:34	-60.464	-44.8023	20	4.3	14.5	
114	1	C2	Stratified	Day	06-Nov-06	11:39	-60.4335	-44.5092	1803	918.57	06-Nov-06	12:14	-60.4261	-44.5638	1499	695.3	35.2	
114	2	C2	Stratified	Day	06-Nov-06	12:14	-60.4261	-44.5641	1496	695.94	06-Nov-06	12:57	-60.4201	-44.6286	732	398.6	43.3	
115	1	C2	Stratified	Day	06-Nov-06	14:57	-60.4791	-44.4862	675	401.71	06-Nov-06	15:35	-60.4581	-44.5374	466	198.3	37.9	
115	2	C2	Stratified	Day	06-Nov-06	15:36	-60.4575	-44.5388	452	198.49	06-Nov-06	16:11	-60.4346	-44.579	27	9.69	35	
117	1	C2	Target	Day	06-Nov-06	21:54	-60.4258	-44.6723	135	95.51	06-Nov-06	22:10	-60.4118	-44.6725	109	49.41	16.7	
117	2	C2	Target	Day	06-Nov-06	22:14	-60.4088	-44.6743	68	44.02	06-Nov-06	22:25	-60.4017	-44.6853	40	11.31	10.6	
118	1	C2	Stratified	Night	07-Nov-06	0:52	-60.4315	-44.3711	1585	851.68	07-Nov-06	1:23	-60.4186	-44.4147	1518	702.9	31.1	
118	2	C2	Stratified	Night	07-Nov-06	1:23	-60.4186	-44.4147	1518	702.85	07-Nov-06							net 2 closed?
123	1	C3	Target	Day	07-Nov-06	21:48	-59.6788	-43.9305	65	47.65	07-Nov-06	21:56	-59.6744	-43.9401	95	28.62	7.7	Net 1 did not close
123	2	C3	Target	Day	07-Nov-06	21:57	-59.6736	-43.9418	95	32.5	07-Nov-06	22:00	-59.699	-43.9739	-28	0.83	2.6	Did not open
134	1	C3	Stratified	Night	08-Nov-06	23:38	-59.6304	-44.1404	2260	988.5	09-Nov-06	0:18	-59.6103	-44.1882	1679	700.6	40	
134	2	C3	Stratified	Night	09-Nov-06	0:19	-59.6094	-44.19	1675	697.01	09-Nov-06	0:56	-59.5909	-44.2349	1013	400	36.3	
135	1	C3	Target	Night	09-Nov-06	2:37	-59.6079	-44.1919	60	47.16	09-Nov-06	2:57	-59.5961	-44.2116	82	34.51	20.2	

135	2	C3	Target	Night	09-Nov-06	2:58	-59.5957	-44.2123	80	36.66	09-Nov-06	3:18	-59.5836	-44.2327	68	23.42	20.4	
136	1	C3	Stratified	Night	09-Nov-06	4:07	-59.5509	-44.2875	685	399.74	09-Nov-06	4:38	-59.5304	-44.3196	452	200.7	31.2	
136	2	C3	Stratified	Night	09-Nov-06	4:38	-59.5303	-44.3198	447	199.67	09-Nov-06	5:04	-59.5127	-44.3461	151	68.93	25.6	Closed early by mistake
142	1	C3	Stratified	Day	09-Nov-06	10:54	-59.6118	-44.0918	2226	993.5	09-Nov-06	11:33	-59.5814	-44.1279	1939	700.4	38.8	
142	2	C3	Stratified	Day	09-Nov-06	11:33	-59.5813	-44.1282	1937	700.74	09-Nov-06	12:23	-59.5529	-44.1962	1119	399.6	49.7	
143	1	C3	Stratified	Day	09-Nov-06	13:48	-59.5158	-44.3235	789	400.14	09-Nov-06	14:24	-59.5018	-44.3825	574	197.2	36.2	
143	2	C3	Stratified	Day	09-Nov-06	14:24	-59.5016	-44.3836	574	202.61	09-Nov-06	15:00	-59.4937	-44.4469	36	18.37	36.1	
157	1	C5	Stratified	Night	17-Nov-06	0:24	-57.3829	-42.6392	2319	995.56	17-Nov-06	1:11	-57.3379	-42.6498	1884	700.8	47.05	1000-700
157	2	C5	Stratified	Night	17-Nov-06	1:12	-57.3371	-42.6503	1873	702.7	17-Nov-06	1:53	-57.3009	-42.6724	1017	399.9	41.133	700-400
159	1	C5	Stratified	Night	17-Nov-06	4:02	-57.2846	-42.7888	746	398.52	17-Nov-06	4:37	-57.3048	-42.8452	541	201.5	35.1	
159	2	C5	Stratified	Night	17-Nov-06	4:38	-57.3051	-42.846	540	203.05	17-Nov-06	5:14	-57.3213	-42.9124	36	14.4	35.9	
160	1	C5	Target	Dawn	17-Nov-06	5:49	-57.3306	-42.9852	90	59.91	17-Nov-06	6:07	-57.3395	-43.0179	108	39.95	18.217	
160	2	C5	Target	Dawn	17-Nov-06	6:07	-57.3396	-43.0184	108	41.17	17-Nov-06	6:26	-57.3448	-43.0536	57	20.97	18.217	
185	1	P2	Target	Day	18-Nov-06	20:35	-55.1522	-41.0051	41	26.37	18-Nov-06	20:46	-55.1565	-41.0205	44	17.54	11.567	
185	2	P2	Target	Day	18-Nov-06	20:52	-55.1582	-41.0281	210	123.46	18-Nov-06	21:13	-55.1637	-41.054	210	101.6	20.733	
186	1	P2	Target	Dusk	18-Nov-06	22:15	-55.1596	-41.0321	33	26.27	18-Nov-06	22:22	-55.161	-41.0405	58	23.82	6.4833	Krill target
186	2	P2	Target	Dusk	18-Nov-06	22:22	-55.1611	-41.0409	58	26.32	18-Nov-06	22:38	-55.1653	-41.0603	58	25.24	15.467	Krill target
199	1	P2	Stratified	Night	19-Nov-06	23:19	-55.2073	-41.3185	1938	1000	20-Nov-06	0:04	-55.2089	-41.3755	1680	702.6	44.533	1000-700 Night
199	2	P2	Stratified	Night	20-Nov-06	0:04	-55.2089	-41.3756	1679	702.31	20-Nov-06	0:53	-55.2098	-41.4429	980	400.5	49.817	700-400
200	1	P2	Target	Night	20-Nov-06	1:53	-55.211	-41.5125	59	41.13	20-Nov-06	2:14	-55.2117	-41.5405	65	27.25	21.017	Krill surface haul
200	2	P2	Target	Night	20-Nov-06	2:14	-55.2117	-41.5413	65	35.09	20-Nov-06	2:35	-55.2126	-41.5684	31	14.15	20.35	Krill surface haul
201	1	P2	Target	Night	20-Nov-06	3:36	-55.2136	-41.553	260	179.37	20-Nov-06	3:46	-55.2127	-41.5381	308	149.9	9.6833	Myctophid target
201	2	P2	Target	Night	20-Nov-06	3:52	-55.212	-41.5283	177	101.59	20-Nov-06	4:02	-55.211	-41.5125	163	76.48	10.317	Myctophid target
214	1	P2	Stratified	Night	21-Nov-06	3:17	-55.26	-41.1606	628	399.74	21-Nov-06	3:52	-55.2895	-41.1793	481	200.9	35.25	400-200
214	2	P2	Stratified	Night	21-Nov-06	3:53	-55.2126	-41.5368	475	204.37	21-Nov-06	4:28	-55.3209	-41.1984	45	15.09	34.95	200-10
215	1	P2	Target	Dawn	21-Nov-06	6:09	-55.2436	-40.9302	153	100.22	21-Nov-06	6:25	-55.2543	-40.943	97	43.82	15.917	
215	2	P2	Target	Dawn	21-Nov-06	6:25	-55.2546	-40.9434	97	48.24	21-Nov-06	6:43	-55.2664	-40.9576	28	10.04	17.883	

217	1	P2	Stratified	Day	21-Nov-06	12:31	-55.197	-41.2866	2208	999.48	21-Nov-06	13:19	-55.2353	-41.3146	1761	700.3	47.583	1000-700 Day
217	2	P2	Stratified	Day	21-Nov-06	13:19	-55.2361	-41.3151	1749	696.38	21-Nov-06	14:05	-55.2721	-41.343	969	399.1	45.25	700-400 Day
218	1	P2	Stratified	Day	21-Nov-06	15:17	-55.3246	-41.3857	600	400.33	21-Nov-06	15:53	-55.3516	-41.4103	476	202.5	35.767	400-200 Day
218	2	P2	Stratified	Day	21-Nov-06	15:53	-55.352	-41.4107	476	205.36	21-Nov-06	16:31	-55.3828	-41.4392	33	11.16	37.133	200-10 Day
219	1	P2	Target	Day	21-Nov-06	17:36	-55.3316	-41.3683	458	301.96	21-Nov-06	17:51	-55.345	-41.3723	435	203	15.083	Fish Targets in Daylight
219	2	P2	Target	Day	21-Nov-06	17:52	-55.3459	-41.3726	432	203.88	21-Nov-06	18:03	-55.3568	-41.3762	343	145.5	11.383	Fish Targets Daylight
228	1	P3	Target	Night	23-Nov-06	1:04	-52.8585	-40.0954	37	26.86	23-Nov-06	1:22	-52.8464	-40.0856	29	9.69	18.5	
228	2	P3	Target	Night	23-Nov-06	1:23	-52.846	-40.0851	29	18.81	23-Nov-06	1:23	-52.8459	-40.0849	29	17.98	0.2167	
229	1	P3	Target	Night	23-Nov-06	2:36	-52.8735	-40.1042	39	30.14	23-Nov-06	2:41	-52.8703	-40.1017	53	26.71	4.5667	
229	2	P3	Target	Night	23-Nov-06	2:43	-52.8691	-40.1009	53	35.73	23-Nov-06	2:59	-52.8691	-40.1009	53	35.73	16.767	
230	1	P3	Target	Night	23-Nov-06	4:18	-52.8693	-40.0906	49	37.3	23-Nov-06	4:30	-52.8605	-40.0862	49	26.32	12.317	not sorted
230	2	P3	Target	Night	23-Nov-06	4:30	-52.8603	-40.0861	49	27.64	23-Nov-06	4:32	-52.8589	-40.0854	29	15.38	1.9167	not sorted
253	1	P3	Stratified	Night	25-Nov-06	3:50	-53.0431	-40.5435	743	397.59	25-Nov-06	4:31	-53.0642	-40.6007	415	200.7	41.133	
253	2	P3	Stratified	Night	25-Nov-06	4:32	-53.0676	-40.6099	380	153.82	25-Nov-06	5:08	-53.0833	-40.6564	37	13.66	36.183	
265	1	P3	Stratified	Night	26-Nov-06	4:35	-52.9243	-40.3771	296	201.09	26-Nov-06	5:10	-52.9449	-40.3444	40	19.99	35.5	200-0
265	2	P3	Stratified	Night	26-Nov-06	5:17	-52.9492	-40.3389	109	73.44	26-Nov-06	5:32	-52.9599	-40.3259	129	61.77	15.75	target layer 60-80
267	1	P3	Stratified	Day	26-Nov-06	15:15	-52.8492	-40.019	1913	997.82	26-Nov-06	16:08	-52.8963	-40.0361	1711	700.3	53.317	1000-700
267	2	P3	Stratified	Day	26-Nov-06	16:08	-52.8966	-40.0363	1705	700.15	26-Nov-06	16:58	-52.9395	-40.0582	1046	400.5	49.167	700-400
270	1	P3	Target	Night	27-Nov-06	2:43	-52.9786	-40.1071	29	28.13	27-Nov-06	2:48	-52.9822	-40.1112	25	15.04	5.1167	krill mark 10 - 20 m
270	2	P3	Target	Night	27-Nov-06	2:49	-52.9828	-40.1118	25	21.46	27-Nov-06	3:00	-52.9908	-40.1201	38	21.46	10.85	
273	1	C6	Stratified	Night	27-Nov-06	23:43	-49.9972	-38.0176	2027	992.23	28-Nov-06	0:27	-50.0271	-38.0584	1734	697	43.933	Stratified 1000-700 45 mins
273	2	C6	Stratified	Night	28-Nov-06	0:28	-50.0277	-38.0591	1734	699.81	28-Nov-06	1:15	-50.0643	-38.0993	1000	400.6	47.45	700-400
275	1	C6	Stratified	Night	28-Nov-06	3:21	-50.1229	-38.1407	683	399.65	28-Nov-06	4:01	-50.1579	-38.1625	465	199	40.067	400-200
275	2	C6	Stratified	Night	28-Nov-06	4:01	-50.1583	-38.1629	465	201.24	28-Nov-06	4:41	-50.1893	-38.1865	34	17.2	40.183	200-15
282	1	C6	Stratified	Day	28-Nov-06	16:43	-50.022	-38.0964	707	400.19	28-Nov-06	17:22	-50.0201	-38.1392	473	200.1	38.933	400-200
282	2	C6	Stratified	Day	28-Nov-06	17:22	-50.0201	-38.1397	466	199.52	28-Nov-06	18:02	-50.0149	-38.181	38	16.17	40.2	200-15
283	1	C6	Stratified	Day	28-Nov-06	19:58	-49.9731	-38.0157	1815	997.62	28-Nov-06	20:44	-49.9513	-38.0555	1726	701.3	46.383	1000-700

283	2	C6	Stratified	Day	28-Nov-06	20:44	-49.9511	-38.0559		701.48	28-Nov-06	21:30	-49.9279	-38.099	1054	398.6	45.167	700-400
294	1	C6	Target	Day	30-Nov-06	14:40	-50.0001	-38.2304	379	205.55	30-Nov-06	15:02	-49.99	-38.2511	483	202.1	21.95	
294	2	C6	Target	Day	30-Nov-06	15:02	-49.9899	-38.2515	483	204.37	30-Nov-06	15:25	-49.9839	-38.2764	379	170	22.933	

Acoustics Report

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Introduction

JR161 is the first of three Discovery 2010 cruises running two transects (Stanley to Signy and Signy to South Georgia) across the Scotia Sea. Within these transects there are a series of Process (three) and Condensed (six) stations. During JR161 the three Process stations were undertaken, but the number of Condensed stations was reduced to five as a result of time restrictions (due to a longer than expected Signy relief). Dedicated acoustic transects were run at each of the stations, although the EK60 echosounder was actually run continuously throughout the cruise with relatively few problems (notably a considerable number were ironed out in the preceding cruise JR159), although periods of Doppler log, ADCP bottom tracking mode and swath bathymetry reduced data quality on occasions.

Aim

Collection of acoustic data to accompany all transects, acoustic surveys, and net tows during the Scotia Sea survey.
Backup and post process the acoustic data

Methods/System specification

Software versions

Simrad ER60 v. 2.0
Sonardata Echolog 60 v 4.05
Sonardata Echoview v 4.0.75.6342 Live viewing and processing

HASP Dongle BAS3 licensed for base, bathymetry, analysis export, live viewing, school detection and virtual echogram was used to run the echolog and echoview in live viewing mode. It was intended to use the analogue BAS1 HASP, however it appears that the dongle is slightly damaged and the connection is intermittent. Therefore processing of the acoustic data was undertaken using the BAS1 dongle (screwed tightly into a parallel port to get it to work!). It should be noted that the use of this dongle will become increasingly restricted where new computers do not have a parallel port.

The echosounder pc AP10 and the EK60 workstation 2 are integrated into the ship's LAN. ER60 .raw data files were logged to a Sun workstation jrua, using a Samba connection, which is backed up at regular intervals. Echolog was run on workstation 2 and wrote compressed files also directly to the Sun workstation via a Samba connection. On JR159 the network was changed and the Samba software updated. This caused several communication (with the transducers) and logging problems that were eventually solved by IT support. It should be noted though that the newest version of Samba is not compatible with the EK60 and any future changes in software should be done with caution and understanding that an older version may have to be reverted back to for EK60 use.

Echolog compression settings

Final compression settings used in Echolog for all frequencies:

1) Power data only (angle data is still available from the raw files)
2) From 0 - 500 m (38 kHz), 0 – 400 (120 kHz) and 0 – 300 (200 kHz)data only (data from deeper is available from the raw files)
3) Average samples where both Sv below -100 and TS below 20
4) Maximum number of samples to average: 50
5) DO NOT use average samples below echosounder detected bottom unless sure of bottom detection

Note – echolog was originally setup to average samples where Sv was below -80 dB. This was pointed out on the 26/11/2006 and changed to the above setting of -100 dB. However, given certain warning messages received (logging error warnings), it was decided to not trust the echolog compressed files and instead echozip was used to create ek60 files in post-processing. The settings are given below:

1) Power data only
2) From 0 – 1000 m (38 kHz), 0 – 400 (120 kHz) and 0 – 300 (200 kHz) data only
3) Average samples where both Sv below -100 dB and TS below 20
4) Maximum number of samples to average: 50
5) DO NOT use average samples below echosounder detected bottom unless sure of bottom detection

Echozip run in windows only allows you to compress one file at a time. However, it can be run on entire folders if run through the command prompt – an example of which is below.

C:> Echozip_60 –Z c:\jr61\acoustics\P1_T1

where P1_T1 is the name of a folder. This writes EK60 files from all the raw data files

File locations

Folders were created to roughly follow transects and stations such that data is contained in folders:

Stanley to P1
P1
P1 to Signy
Signy to P2
P2
P3
C6

Most files are also prefixed with the station/transect name, this needs some clearing up as prefixes were not always changed if no one was watching the echosounder.

All echozip compressed files and ev files were saved onto the L drive in folders by day.

EK60 (ER60) settings

The EK60 was calibrated immediately prior to JR161 on cruise JR159. Details regarding this calibration can be found in the cruise report for JR159. The following table lists the settings of the EK60 that were obtained during the calibration in Stromness Bay.

Variable	38 kHz	120 kHz	200 kHz
Ping interval (per sec)	2	2	2
Salinity (PSU)	34	34	34
Temperature (°C)	1	1	1
Sound velocity (m/s)	1453	1453	1453
Mode	Active	Active	Active
Transducer type	ES38	ES120-7	ES200-7
Transceiver Serial no.	009072033fa5	00907203422d	009072033f91
Transducer depth (m)	0	0	0
Absorption coef. (dB/km)	10.07	26.27	39.8
Pulse length (ms)	1.024	1.024	1.024
Max Power (W)	2000	500	300
2-way beam angle (dB)	-20.70	-20.70	-19.60
Sv transducer gain (dB)	24.07	21.38	22.03
Sa correction (dB)	-0.63	-0.39	-0.31
Angle sensitivity along	22	21	23
Angle sensitivity athwart	22	21	23
3 dB Beam along	-0.02	-0.12	0.17
3 dB Beam athwart	0	-0.07	-0.24
Along offset	6.96	7.48	6.44
Athwart offset	6.88	7.48	6.43

The EK60 was run through the SSU for most of the cruise, barring a brief period of swath bathymetry where it was run on internal ping mode to maintain a consistency in ping rate. A new SSU.ini file was created which grouped the EA600, EK60 and ADCP in to the same group, and then each instrument was set as follows:

EA600 external trigger Tx pulse
EK60 external trigger* Calculated (Set to 2.5 seconds in ER60 software)
ADCP external trigger Tx pulse (this setting only works if the bottom tracking mode is off)

*note this is not technically true – this set up will work even if the EK60 is in internal trigger mode – why? I do not know.

A 2.5 second ping rate was decided as it gave the ADCP time to ping its full water column depth. This ping rate was maintained for the whole of the cruise. False bottom echoes were accepted, although an investigation into which is more acceptable – changing the ping rate or accepting false bottoms should be undertaken? This setup works fine as long as ADCP bottom track data is not required. When bottom tracking mode is on the EK60 suffers seriously from interference. A major recommendation from this cruise is to obtain a few days on JCR's trials cruise during the summer along with an ADCP expert and IT support to interface the two instruments together correctly with minimum data loss for both physicists and biologists.

Data processing in echoview

Post-processing was undertaken in Echoview. Two template EV files were set up, one for use with the net data, the other for use with the acoustic transects – although both had a similar format and the main difference was the depth of data used. The EV file contained the following virtual variables for the 38 kHz, all other frequencies use the same variables apart from the DO resamples* that are just at 38 kHz.

38 raw – resampled raw data to prevent fractions occurring later
38surf&botbmp – Surface and bottom line mask
38goodbmp – removes bad data
38s&b&gbmp – Combines the surface and bottom mask with the good mask
38-e – raw data masked by the above bitmap
DO resample* - resample into 1 mean column per ping
DOresample2* - resample back on to raw grid
DObmp – choose data range that removes dropout
38-e no DO – 38-e with no dropout
noise 38-e – noise level for 38 kHz
38-n – 38-e without noise
38-100m – data resampled onto 100 m grid

EV files were created for each net event and for each acoustic transect. The following procedure was used to create these files:

Using the jr161net or jr161trans template add new files according to the time of the net or transect

View cruise track, making sure that cruise tracks are believable and there isn't too much bad data

Review surface noise and integration stop line

Mark bad data: Start and end, false bottom, interference, drop-out, missed pings. Use automatic detection for various properties (uses the schools detection module from echoview.

EA600 interference detect:

Threshold:	-60 dB
Min school length (m):	5
Min school height (m):	2
Min candidate length (m):	2
Min candidate height (m):	0.1
Max vertical linking (m):	2
Max horizontal linking (m):	0.2

ADCP interference detect:

Threshold:	-65 dB
Min school length (m):	5
Min school height (m):	10
Min candidate length (m):	2
Min candidate height (m):	0.1
Max vertical linking (m):	2
Max horizontal linking (m):	0.2

Review both 120 and 38 kHz for interference not detected using the automatic detection.

Acoustic transects

Acoustic transects were run at each process or condensed station. The shape of the transect had been discussed in detail in Cambridge, although the direction in which it would be run on board was to be dependant on weather and current conditions. Unfortunately ocean current information was not available in real time and so the decision of survey direction was based on wind conditions and the presence of icebergs. In the future some current information would be useful to make sure that the same water mass was not being repeatedly sampled, especially at site P3 where it was obvious that there was a strong west-east current (as observed by the third officer trying to keep the ship on station). Acoustic transects were run over three legs labelled Station number_T1, T2 and T3. The first transect was always called T1 independent of where it was started and whether it was a long or short leg (see below) and the long leg was always run upwind unless stated. The optimum was to run three transects at 10 knots, two of 25 km and one of 50 km. Actual transects achieved and any comments are given in acoustic table.

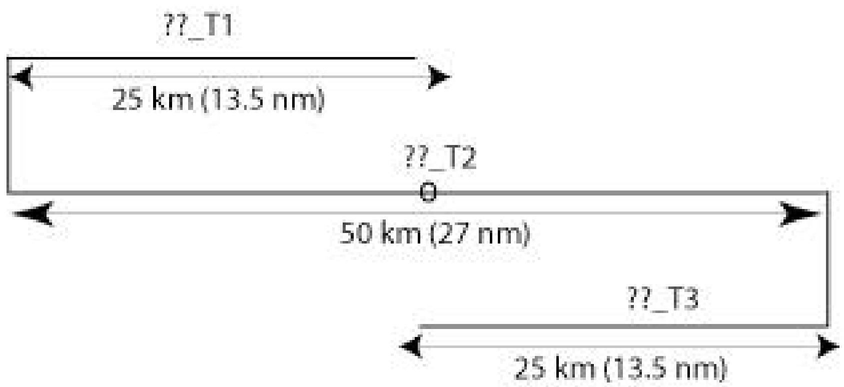

Figure 1 Theoretical acoustic transect and associated distances

Underway temperature was plotted during the acoustic transect to examine physical variability around the station site (Figure acoustics 2) and a high degree of change was observed over the relatively short transect lengths. It is highly recommended that for the subsequent cruises the UOR is brought to better elucidate the physical environment around the station.

Predator observations were undertaken during the acoustic transects. This should yield some interesting results and it is important that the predator observer and the acoustician on any future trip interact early on in the cruise.

Target fishing

A degree of RMT25 target fishing was allowed for at each station and was primarily for krill for live incubation experiments. The short period allowed for target fishing and the scarcity in targets at some of the stations resulted in two strategies for target fishing. The first, traditional, strategy was to head downwind searching for targets. Once found, the ship sails on for ½ to 1 mile more (depending on target depth) and then turns ready to shoot the net. This strategy worked well when there were targets and it was found useful to leave the RMT25 fully cocked whilst searching to enable a prompt deployment. Only at P3 where significant currents were around did the targets move in a different direction from the wind. The large catches of krill during this cruise were all collected using this strategy. The second strategy was to do a night-time surface trawl whether there were targets or not. This strategy worked once at the ice edge, other than that it was normal to bring up empty nets. This was/is a very frustrating task, to maximise opportunity for krill catching it is important that this surface net is undertaken in darkness with time allocated for its undertaking.

Note: there are not enough hours within the current programme to undertake a proper search for targets at each station – especially the low productivity stations where targets were few and far between. It would be very useful if the acoustic transects had time at the beginning of each station so that the probability of encountering targets in the station area can be examined. In addition it was noted several times that there was a high degree of variability around the chosen station sites. A UOR tow combined with the acoustic survey would be an excellent method for determining the small scale variability in the area.

Twenty two target hauls were undertaken in total (Table 2). The targets included myctophid marks, krill swarms and salp layers (Figure acoustics 3).

Problems encountered.

Interference from the EA600 and ADCP was extremely obvious on the transect out from Stanley to P1. This was due completely to the SSU not being set up correctly. The ADCP was being run in internal mode and the EA600 had not been switched from internal trigger to being controlled by the SSU. Once this was undertaken the acoustic data was exceeding clean all the way to Signy. The main reason, when normally some interference is commented upon, was that the ships Doppler logger was out of commission. The Doppler logger was fixed during the relief of Signy, unfortunately, and since that point there was intermittent interference on the 120 kHz due solely to this instrument. It is highly recommended that there is some dialogue between the scientists and the ships side to examine whether these instruments can be interfaced together.

Key to the success of running biological acoustics with physical current collection is the setting up of the instruments so that neither suffers from interference. This has not been done satisfactorily on board JCR yet. It is highly recommended that a period during the trials cruise is used to set up the instruments correctly so that maximum data coverage can occur during cruises. Trying to do it during a science cruise DOES NOT WORK as people are concerned that they are not getting their data. A method for collecting acoustic data without interference when collecting a combination of ADCP in bottom pinging mode and EK60 data has not been created yet and should be.

Recommendations summary

1) Investigate value of BAS1 Echoview dongle – should we replace parallel port dongle for USB dongle?
2) Real-time current information would be useful when deciding what direction to run the acoustic transect in.
3) The UOR should be brought on subsequent cruises. It is obvious from the underway TSG that the survey sites are regions of high variability. The vertical structure of this should be investigated.
4) The method of searching for targets downwind and then fishing on them upwind worked very well (typically also because of the responsiveness of all the crew and officers onboard – thank you). It is recommended that this method is used in the future.
5) The acoustic transects should occur at the beginning of the stations rather than at the end so that the viability of target fishing can be evaluated rather than wasting valuable fishing time doing non-target target fishing or not targeting the right location within the survey area.
6) THE ADCP AND EK60 NEED INTERFACING PROPERLY. THIS REQUIRES DEDICATED TIME ON BOARD THE JCR WITH AN ADCP EXPERT, MYSELF AND IT SUPPORT. Until this happens biological and physical data will be compromised.
7) A night time slot should be allocated to undertake a shallow RMT tow for live krill experiment catches.
8) The Doppler logger of the ship causes interference with the EK60 120 kHz data quality. An investigation into whether the Doppler logger is still required or whether it could be interfaced with the SSU would be desirable. This will be raised by Pete Enderlein in the STEG.

Figure 2 – SST During the Condensed Stations

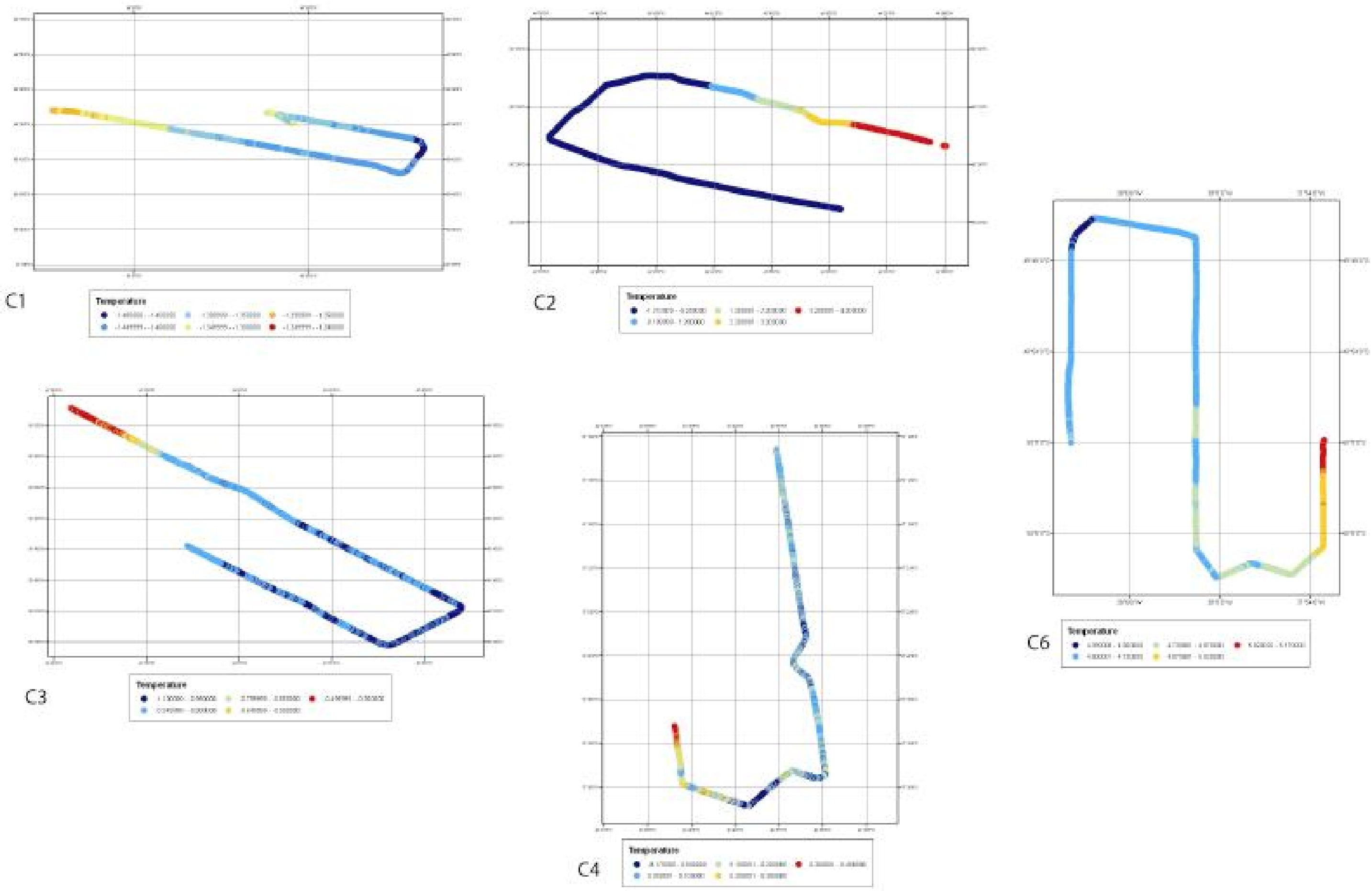

Figure acoustics 2 - Sea surface temperature during the condensed stations acoustic transects

Figure 2b – SST along acoustic transects

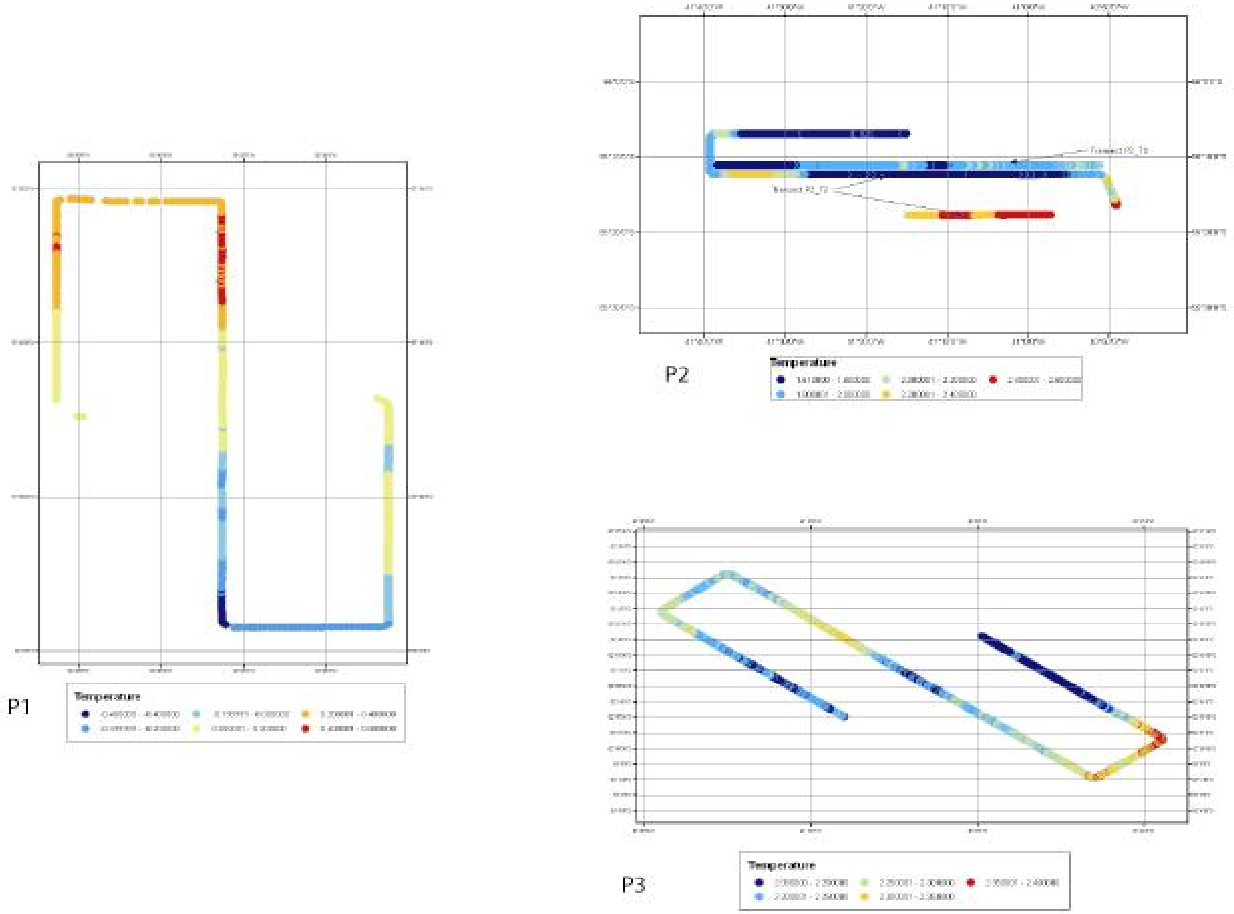

Figure acoustics2b - Sea surface temperature along the acoustic transects at the process stations - note all scales are different

Acoustic Table 1 – Acoustic transect start and end times

Date	Transect	Time start	Time end	Speed	Bearing	Comment
30/10/2006	P1_T1	15:06	16:26	10	180	
30/10/2006	P1_T2	17:03	19:47	10	0	
30/10/2006	P1_T3	20:22	21:44	10	180	
02/11/2006	C1_T1	15:51	18:34	10	110	Downwind due to time constraints
02/11/2006	C1_T2	19:22	20:41	10	290	Terminated early due to ice
06/11/2006	C2_T1	17:16	18:35	6	296	Terminated early due to ice
06/11/2006	C2_T2	19:24	20:45	6	116	Terminated early due to ice
09/11/2006	C3_T1	16:03	18:45	10	135	
09/11/2006	C3_T2	19:21	20:42	10	325	
16/11/2006	C4_T1	16:21	18:41	10	175	Terminated early due to ice
16/11/2006	C4_T2	19:25	19:50	10	355	Terminated early to go to fishing point
19/11/2006	P2_T1	14:48	16:08	10	90	
19/11/2006	P2_T2	16:44	19:30	10	270	
19/11/2006	P2_T3	20:02	21:24	10	90	
21/11/2006	P3_T1	07:35	10:17	5	270	Abandoned due to bad weather
26/11/2006	P3_T2	07:30	08:51	10	315	
26/11/2006	P3_T3	09:29	12:11	10	135	
26/11/2006	P3_T4	12:48	14:09	10	315	
29/11/2006	C6_T1	09:40	10:21	10	180	
29/11/2006	C6_T2	11:24	13:58	8	0	Terminated early due to ice
29/11/2006	C6_T3	14:40	16:00	10	180	

Acoustic Table 2. Target RMT25 hauls

Date	Station	Event number	Depth open (m)	Depth closed (m)	Net number	Target description
28/10/2006	P1	41	200	100	1	Myctophid layer 100 – 200 m
			110	25	2	Myctophid marks 0 – 100 m
29/10/2006	P1	55	60	70	1	No targets
			80	20	2	No targets
31/10/2006	C1	71	20	35	1	No targets
			40	10	2	No targets
02/11/2006	C1	85	20	30	1	No targets
			30	15	2	No targets
06/11/2006	C2	107	45	30	1	Fishing on krill mark at 40 m– not there during tow
			30	4	2	No targets
06/11/2006	C2	117	95	50	1	Fishing on krill mark at 80 m – not there during tow
			44	10	2	No targets
07/11/2006	C3	123	50	30	1	Fishing on krill mark at 40 m – juvenile krill caught but net didn't close properly
			30	10	2	
09/11/2006	C3	135	47	35	1	No targets
			35	24	2	No targets
17/11/2006	C4	160	60	40p	1	Fished krill mark 24 m – caught adult krill
			40	20	2	No target
18/11/2006	P2	185	25	17	1	Fishing on krill mark at 20 m – not there during tow
			125	100	2	Diffuse weak layer – caught salps
18/11/2006	P2	186	25	24	1	Krill mark fished – 104 kg
			25	25	2	Krill mark fished – 52 kg
20/11/2006	P2	200	40	25	1	No target
			35	14	2	No target
20/11/2006	P2	201	180	150	1	Fish target 225-125 – caught *E. carlsbergi*
			100	75	2	Fish target 90-40 – caught *E. carlsbergi*
21/11/2006	P2	215	100	45	1	No target
			50	10	2	No target
21/11/2006	P2	219	300	200	1	Myctophid targets
			200	145	2	Myctophid targets
22/11/2006	P2	222	130	0	1	Krill target – but not discrete as net didn't close
23/11/2006	P3	228	25	10	1	Krill target
			20-	15	2	No target
23/11/2006	P3	229	30	25	1	Krill target
			35	35	2	No target
23/11/2006	P3	230	37	25	1	No target
			27	15	2	Notarget
26/11/2006	P3	265	74	61	2	Target 120 kHz layer (not shown in 38 kHz)
27/11/2006	P3	270	30	15	1	Small krill mark
			20	20	2	Empty water sample discarded
30/11/2006	C6	294	200	200	1	Myctophid layer but nothing caught
			200	170	2	Myctophid layer but nothing caught

JR161 Predator Observations

Ewan Wakefield

Introduction

As a compliment to other scientific work being carried out during JR161 systematic visual observations of air-breathing predators were made throughout the cruise. Quantitative ship-based surveys of seabirds and marine mammals generally employ a combination of distance sampling and strip-transect surveying (Tasker et al. 1984, Webb & Durinck 1992, Buckland et al. 2001, Camphuysen et al. 2004). Distance sampling relies on obtaining an accurate measure of the distance of the animal from the transect line at the time of detection. This method is usually used to survey marine mammals and birds not in flight while strip transects are used for flying birds. In order to avoid biases caused by the movement of birds through the survey area strip transects are usually subdivided into a series of consecutive boxes. Individuals are recorded at one instant in each box (the 'snapshot' method Webb & Durinck 1992). Although this technique is invaluable for obtaining relative or absolute animal density estimates (van Franeker 1994) it may be more useful for studies of spatial scales of interaction to record all animals encountered within the transect.

An assumption of both the snapshot and of distance sampling methods is that animals are detected before they react to the presence of the survey platform. For most air breathing marine predators however this assumption is poor. Many species of flying seabird for example are attracted to and follow ships. This tendency is especially prevalent in the *Procellariiformes* (Hyrenbach 2001), the dominant group in the Southern Ocean. Further complications occur with diving species, such as penguins and marine mammals, which may move towards or away from the survey vessel whilst submerged. For cetaceans at least this difficulty has recently been surmounted by the use of double platform surveys (Buckland et al. 2004). These rely on a second observer team, which tracks animals' movements in response to the approach of the survey ship. The rate of avoidance or attraction can then be modelled and used to correct the primary observers' results. Similar methods have recently been employed to investigate the avoidance of approaching ships by flying birds (e.g. Borberg et al. 2005). A number of more subjective strategies have also been suggested for identifying which flying birds are following the survey ship, so that these individuals are not over recorded (e.g. Spear et al. 2004).

Despite these complications, abundance estimates of some species of flying seabirds based on at-sea data accord with estimates from colony censuses (Clarke et al. 2003). Furthermore, for the purposes of studies of the distribution of marine predators versus prey or for investigating the effects of environmental correlates, relative rather than absolute abundance may be used (e.g. Ryan & Cooper 1989, Ainley et al. 1993, van Franeker et al. 2002, Woehler et al. 2003, Chapman et al. 2004, Littaye et al. 2004). The assumption implicit in studies taking this approach is that each species reacts in a consistent manner to approaching survey vessels. To my knowledge no one has yet tested this assumption but it seems like a reasonable one.

As well as animal movements and distance a whole host of other covariates may affect the detection rate of air breathing marine predators. These include visibility, sea state, number of observers, ship activity (e.g. fishing vs. steaming) and ship speed. It is essential to record these covariates during surveys so that unwanted variance can be partitioned from variance due to the variables of interest (Buckland et al. 2004). In addition, it is increasingly being recognised that considerable insights can be gained by recording the behaviour of higher predators at sea, for example to identify foraging areas (Veit 1999, Camphuysen & Garthe 2004).

Aims

The aims of the work were to establish the relative abundance and diversity of air breathing predators, both at process and condensed stations and along the ship's track between stations. Amongst other things, this data will be used to characterise the higher predator assemblage at and between stations; investigate spatial cross correlations between higher predators and acoustically detected prey aggregations; <anyone else want to add anything else here?>.

Methods

Underway observations

One observer (Ewan Wakefield) collected data during the cruise, with the assistance of a data recorder (Nick Young or Mike Dunn) during all acoustic transects at process and condensed stations and whenever else possible. There were insufficient observers to use dual platform methods, so while the ship was under way the standard seabirds at sea methodology was used to record seabirds and pinnipeds (Webb & Durinck 1992, Camphuysen et al. 2004). Priority was given to recording species not thought show a marked attraction to or avoidance of ships (pinnipeds and penguins), followed by flying birds and finally (due to the difficulty of detecting them whilst recording other species) cetraceans. Data were collected from one or other of the bridge-wings (eye height 17 m above sea level), the side being chosen and changed if necessary to minimise sun glare and exposure to the prevailing wind. If conditions allowed, a transect 300 m wide (measured from the side of the ship) was surveyed. This was reduced to 200 or 100 m if visibility deteriorated sufficiently; if the sea state became too high to reliably detect animals at its limit or if animal density was too high to record all animals in the transect. Flying birds were recorded when they entered a box with square sides the same length as the transect width, measured from the bridge-wing (figure pred1a). Birds present in the box at times corresponding to 300 m intervals were recorded as present in snapshot. Birds sitting on the water, flightless birds and pinnipeds were recorded in one of five distance bands (A, 0-50 m; B, 50-100 m; C, 100-200 m; D, 200-300 m; E, >300 m) running parallel to the ships track, measured from the side of the ship (figure pred1b). Distances relative to the horizon were checked whenever possible using a simple rangefinder (Heinemann 1981). The range and bearing to cetaceans occurring in a 90° arc running port or starboard from the bow of the ship to the horizon (depending on which bridge-wing was being used) were also recorded. Bearings were measured clockwise form the ship's head using a modified builder's level and ranges were estimated using the rangefinder. Where possible cetaceans sighted on the opposite side of the ship were also recorded but this area was not systematically scanned.

All animals were detected using the naked eye and if necessary identified with the aid of a pair of 10 x 42 Leica Ultravid binoculars. Where there was any ambiguity in identification (for example with prions *Pachyptila* spp.) animals were recorded to genus, or to a lower taxonomic level. Specific and common names follow Shirihai {, 2002 #345}. All data were entered directly into an Access database running on an Itronix Go Book III rugged laptop. The laptop was secured to the bridge-wing combing with a pair of G clamps. The database allowed rapid entry of observations, either using the touch screen or shortcut keys, which were tailored throughout the cruise to reflect the most commonly sighted species. Data entry was standardised and data were automatically checked for common errors by the database. Each observation was automatically time-stamped to the nearest second (UTC), allowing cross reference to data from the ship's telemetry and Ocean Logger systems (for a full explanation of database fields and codes see appendix pred1).

All behaviour indicative of attempted or successful foraging was recorded using a combination of movement, searching and foraging codes adapted in part from Harper et al. (1985) and Camphuysen and Garthe (2004). It was also attempted to identify prey items, although this was rarely possible. Where nothing was recorded it can be assumed that the animal was not actively foraging as the ship passed. Weather conditions (Beaufort wind speed and direction, swell size and direction, sea state, cloud cover and precipitation) were recorded at the start of each observing session and every time they changed. Similarly, the visibility and the amount of sun glare (arc obscured relative to the ship's head) were recorded. Where relevant, sea ice extent was recorded in tenths (World Meteorological Organization 1970).

Stationary observations

During periods when the ship was stationary (at process, condensed and CTD stations) hourly counts of air breathing predators were made from the monkey island (eye height 20 m above sea level). Because it was impossible to obtain instantaneous counts in a 360° arc, counts were made in 180° arcs on either side of the vessel from the port and starboard extremities of the monkey island (from where there is an unobscured view from the bow to the stern). All animals within a radius of 300 m were recorded in band A. It had been intended to record animals in further distance bands. However, it proved impracticable to obtain instantaneous counts beyond 300 m. Hence, only large aggregations of animals or scarce species such cetaceans beyond this distance were recorded and labelled as being in band B (figure pred1d). In the latter case the range and bearing to the animals relative to the ships head were also recorded. Before the counts the surveyor spent between 10 minutes and half an hour familiarising himself with the distribution of animals within the vicinity of the ship. Port and starboard counts were then made in close succession and every attempt was made to avoid double counting of animals. For each species of flying bird the percentage of animals in flight at the time of the counts was noted. Following the counts, the behaviour of the majority of individuals of each species was recorded using the suite of codes described for underway observations. Movement categorisation was based on observing three animals of each species if possible for five seconds each (appendix pred1).

In addition to the methods outlined above notes were made of any other observations of interest made whilst not surveying (such as foraging behaviour, unusual species or unusually high numbers of animals).

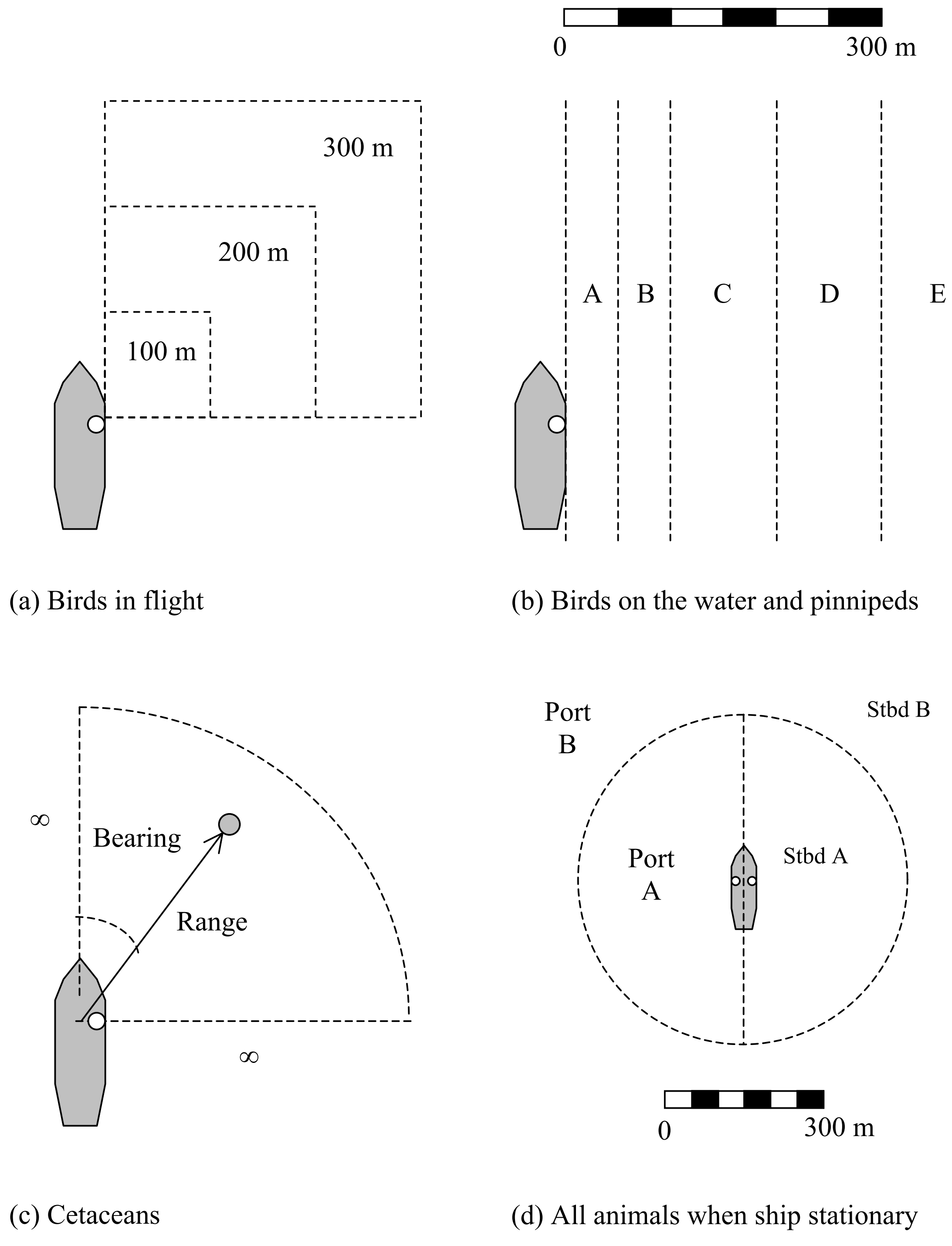

Figure pred1.

Recording areas for air breathing predators observed whilst under way (a, b, c) and stationary (d). White dots indicate surveyor's position on the bridge-wings (a, b, c) and monkey island (d). Underway surveying was carried out from the port or starboard bridge-wing depending upon sun glare and wind direction.

Data coverage

Data was recorded whenever possible throughout the cruise. Underway observations were made whilst on passage between sampling stations, with priority being given to periods when the ship was approaching or leaving stations. However, these periods often occurred during darkness. A total of 146 hours of underway observations were made (table pred1). Underway observations were made during all acoustic transects at process and condensed stations and at other times when the ship was under way, with the exception of periods when the ship was engaged in RMT fishing. Whilst the ship was stationary at sampling stations hourly counts were made form the monkey island. A total of 80 hourly counts were made at 12 stations (table pred2).

Table pred1. Summary of periods during which underway air breathing predator observations were made during JR161.

Transect	Stage of cruise	From	To	Hours on-effort
A	Stanley to PS1	24/10/06 19:26	26/10/06 22:12	16.3
B	PS1	27/10/06 19:40	30/10/06 21:44	13.2
C	PS1 to CS1	31/10/06 11:24	31/10/06 20:33	6.5
D	CS1	01/11/06 13:55	02/11/06 20:42	9.6
E	CS1 to Signy to CS2	03/11/06 09:56	04/11/06 19:24	12.7
F	CS2	05/11/06 19:35	06/11/06 20:46	7.3
G	CS2 to CS3	07/11/06 13:24	07/11/06 20:52	3.3
H	CS3	08/11/06 16:19	09/11/06 20:44	7.8
I	Signy to CTD D	15/11/06 11:17	15/11/06 20:50	7.2
J	CS4	16/11/06 16:23	17/11/06 21:19	8.7
K	PS2	18/11/06 15:35	21/11/06 10:17	12.0
L	PS2 to PS3	22/11/06 07:47	22/11/06 21:25	7.5
M	PS3 (abandoned due to poor weather)	23/11/06 15:08	23/11/06 16:39	1.5
N	PS3	26/11/06 07:35	26/11/06 14:10	5.1
O	PS3 TO CS6	27/11/06 08:35	27/11/06 22:00	8.7
P	CS6	28/11/06 13:35	30/11/06 21:25	12.5
Q	CS6 TO Stanley	01/12/06 11:16	01/12/06 21:15	6.0

Table pred2. Summary of periods during which stationary air breathing predator observations were made during JR161.

Station	Database code	From	To	Number of scans
PS1	A	27/10/06	29/10/06	24
CS1	B	01/11/06	01/11/06	4
CS2	C	05/11/06	05/11/06	5
CTD A	D	07/11/06	07/11/06	2
CTD B	E	07/11/06	07/11/06	3
CS3	F	08/11/06	08/11/06	4
CS4	G	16/11/06	17/11/06	4
PS2	H	18/11/06	20/11/06	11
CTD I	I	22/11/06	22/11/06	1
CTDJ	J	22/11/06	22/11/06	1
PS3	K	23/11/06	25/11/06	18
CS6	L	28/11/06	29/11/06	3

Preliminary Results

Whilst there was insufficient time to analyses data during the cruise approximate relative abundances of animals recorded whilst underway (table pred3) and at sampling stations (table pred4) are summarised below. These data have not been corrected for the effects of weather, distance, etc. on the detectability of animals and should only serve to illustrate very coarse scale patterns. A total of 39,403 air-breathing predators from at least 61 species were recorded whilst the ship was underway. The most frequently recorded species were cape petrels *Daption capense* and prions *Pachyptila sp.,* both of which are persistent ship followers. A total of 4075 animals from at least 23 species were recorded while the ship was on station, again the most frequently recorded species being cape petrels and prions.

Table pred3. Standardised sighting rate of air-breathing predators recorded whilst the ship was underway (animals/hour). Total indicates total number of animals seen.

			Transect							
Common Name	**Species**	**Total**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Penguin sp.		50	0.1	0.3	0.6	1.0	0.1	1.0	1.2	1.2
King Penguin	*Aptenodytes patagonicus*	33								
Emperor Penguin	*Aptenodytes forsteri*	1					0.1			
Gentoo Penguin	*Pygoscelis papua*	2					0.1			
Adelie Penguin	*Pygoscelis adeliae*	85					6.7			
Chinstrap Penguin	*Pygoscelis antarctica*	1488	0.4	0.6	4.3		6.8	34.1	6.4	139.1
Crested penguin sp.	*Eudyptes sp.*	2								
Wandering albatross sp.	*Diomedea sp.*	17	1.0							
Wandering Albatross	*Diomedea exulans*	92	0.7	0.3	0.6	0.1				
Southern Royal Albatross	*Diomedea epomophora*	89	2.9							
Northern Royal Albatross	*Diomedea sanfordi*	5	0.2							
Black-browed Albatross	*Thalassarche melanophrys*	1450	69.3	3.0	0.6	2.3				1.8
Grey-headed Albatross	*Thalassarche chrysostoma*	146	2.0	2.0						1.5
Light-mantled Sooty Albatross	*Phoebetria palpebrata*	88	1.0	0.7						0.8
Giant Petrel sp.	*Macronectes sp.*	242	3.9	6.4	2.2	0.3		0.4	0.9	1.5
Southern Giant Petrel	*Macronectes giganteus*	394	3.3	9.0	2.3	3.2	1.7	2.1	0.3	0.6
Northern Giant Petrel	*Macronectes halli*	393	0.7	1.1	1.1	0.2			0.3	1.7
Southern Fulmar	*Fulmarus glacialoides*	1059	8.8	4.7	45.1	36.4	7.6	7.1	5.8	4.0
Antarctic Petrel	*Thalassoica antarctica*	260			0.3	12.2	8.1	4.7	1.2	
Cape Petrel	*Daption capense*	17407	256.3	119.2	306.0	217.4	37.6	369.9	188.2	131.9
Snow Petrel sp.	*Pagodroma sp.*	679				0.1	33.0	30.7		
Gadfly petrel sp.	*Pterodroma sp.*	1		0.1						
White-headed Petrel	*Pterodroma lessonii*	3	0.1							
Atlantic Petrel	*Pterodroma incerta*	71	4.4							
Soft-plumaged Petrel	*Pterodroma mollis*	102								
Blue Petrel	*Halobaena caerulea*	1899	20.2	28.7	7.1	0.1	0.3		16.1	26.7
Prion sp.	*Pachyptila sp.*	11039	12.8	28.7	10.9	5.0	0.2		6.4	9.0
Antarctic Prion	*Pachyptila desolata*	5	0.2	0.1						
Slender-billed Prion	*Pachyptila belcheri*	12	0.5							0.3
Fairy Prion	*Pachyptila turtur*	6	0.2	0.1						0.1
White-chinned Petrel	*Procellaria aequinoctialis*	403	1.7	4.8		0.4				0.5
Sooty Shearwater	*Puffinus griseus*	65	3.8							
Storm petrel sp.		2	0.1	0.1						
Wilson's Storm-petrel	*Oceanites oceanicus*	542	1.6	0.4	0.5	0.4	0.1	0.3	0.9	2.7
Grey-backed Storm-petrel	*Oceanites nereis*	1								
Black-bellied Storm-petrel	*Fregetta tropica*	395	0.3	0.3	1.4	0.7		0.5	4.2	3.6
Diving-petrel sp.	*Pelecanoides sp.*	50	0.1	0.1		0.2				
Blue-eyed shag sp.	*Phalacrocorax sp.*	7	0.4							
Tern sp.	*Sterna sp.*	5	0.2						0.3	0.1
Pale-faced Sheathbill	*Chionis alba*	6				0.4	0.1	0.1		
Brown skua sp	*Catharacta sp.*	4						0.1		
Subantarctic Skua	*Catharacta antarctica lonnbergi*	20			0.2	0.2		1.1		
Dolphin Gull	*Larus scoresbii*	1	0.1							

Kelp Gull	*Larus dominicanus*	8	0.1	0.1			0.3			
Arctic Tern	*Sterna paradisaea*	6		0.1		0.2		0.4		
Antarctic Tern	*Sterna vittata*	14				0.1	0.6	0.3		0.1
South American Tern	*Sterna hirundinacea*	2	0.1							

		Transect								
Common Name	**Species**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**Q**
Penguin sp.		0.8							0.2	
King Penguin	*Aptenodytes patagonicus*			1.0	1.1			0.9	0.2	0.3
Emperor Penguin	*Aptenodytes forsteri*									
Gentoo Penguin	*Pygoscelis papua*			0.1						
Adelie Penguin	*Pygoscelis adeliae*									
Chinstrap Penguin	*Pygoscelis antarctica*	0.7								
Crested penguin sp.	*Eudyptes sp.*								0.2	
Wandering albatross sp.	*Diomedea sp.*							0.1		
Wandering Albatross	*Diomedea exulans*		0.1	0.1	0.4	5.3	4.9	2.5	0.9	0.2
Southern Royal Albatross	*Diomedea epomophora*					1.3	2.4		2.0	0.3
Northern Royal Albatross	*Diomedea sanfordi*								0.1	
Black-browed Albatross	*Thalassarche melanophrys*	0.3	0.9	3.0	1.6	4.0	21.0	2.1	3.6	1.2
Grey-headed Albatross	*Thalassarche chrysostoma*			0.8	0.1		4.3	2.0	1.8	0.3
Light-mantled Sooty Albatross	*Phoebetria palpebrata*	0.1	0.9	3.0	0.5		0.2	0.3	0.2	0.2
Giant Petrel sp.	*Macronectes sp.*	0.4	3.0	0.4	0.1	1.3	1.8		1.0	
Southern Giant Petrel	*Macronectes giganteus*	1.9	10.9	0.5	0.5	0.7	0.6	0.2	0.6	
Northern Giant Petrel	*Macronectes halli*		7.4	3.4	1.6	10.0	20.8	5.1	5.0	
Southern Fulmar	*Fulmarus glacialoides*	1.4					0.4			
Antarctic Petrel	*Thalassoica antarctica*									
Cape Petrel	*Daption capense*	36.3	27.8	69.1	13.1	46.7	84.7	90.8	2.5	
Snow Petrel sp.	*Pagodroma sp.*			1.9	0.8		1.2			
Gadfly petrel sp.	*Pterodroma sp.*									
White-headed Petrel	*Pterodroma lessonii*								0.2	
Atlantic Petrel	*Pterodroma incerta*									
Soft-plumaged Petrel	*Pterodroma mollis*								5.9	4.7
Blue Petrel	*Halobaena caerulea*	5.3	56.9	19.0	2.1		4.1	9.0	0.2	
Prion sp.	*Pachyptila sp.*	11.0	66.9	114.6	173.7	75.3	211.6	646.2	6.0	1.7
Antarctic Prion	*Pachyptila desolata*									
Slender-billed Prion	*Pachyptila belcheri*	0.3								
Fairy Prion	*Pachyptila turtur*									
White-chinned Petrel	*Procellaria aequinoctialis*	0.3	2.9	1.4	7.2	12.7	13.9	5.1	4.0	3.7
Sooty Shearwater	*Puffinus griseus*								0.2	0.2
Storm petrel sp.										
Wilson's Storm-petrel	*Oceanites oceanicus*	1.7	6.6	2.0	3.7		6.7	29.1	5.4	0.3
Grey-backed Storm-petrel	*Oceanites nereis*								0.1	
Black-bellied Storm-petrel	*Fregetta tropica*	4.0	2.0	2.3	4.7	2.7	5.5	13.4	5.0	0.5
Diving-petrel sp.	*Pelecanoides sp.*		0.2	1.0	1.3	0.7	2.5	0.5	0.2	0.2
Blue-eyed shag sp.	*Phalacrocorax sp.*									
Tern sp.	*Sterna sp.*									
Pale-faced Sheathbill	*Chionis alba*									
Brown skua sp	*Catharacta sp.*		0.2						0.1	
Subantarctic Skua	*Catharacta antarctica lonnbergi*		0.1				0.2	0.5	0.2	
Dolphin Gull	*Larus scoresbii*									
Kelp Gull	*Larus dominicanus*								0.2	
Arctic Tern	*Sterna paradisaea*									
Antarctic Tern	*Sterna vittata*	0.3								
South American Tern	*Sterna hirundinacea*									
True seal sp.										
Leopard Seal	*Hydrurga leptonyx*									

Weddell Seal	*Leptonychotes weddellii*									
Crabeater Seal	*Lobodon carcinophaga*									
Fur seal sp.	*Arctocephalus sp.*	1.1	6.2	7.0	19.3	8.7	35.5	11.4	3.2	0.5
Small cetacean sp										
Long-finned Pilot Whale	*Globicephala melas*						1.6			
Beaked Whale sp.					0.1					
Southern Bottlenose Whale	*Hyperoodon planifrons*							0.1		
Large cetacean sp.			0.1	1.3			0.2		0.1	
Baleen whale sp.	*Balaenoptera sp.*		0.2							
Minke Whale sp.	*Balaenoptera sp.*									
Fin Whale	*Balaenoptera physalus*			1.8	0.5			0.2		

Table pred4. Standardised abundance of air-breathing predators recorded within 300 m of the ship whilst the ship was on station (animals/count). 'P' indicates the species was recorded beyond 300 m from the ship.

		Staion											
CommonName	**Species**	**PS1**	**CS1**	**CS2**	**CTD A**	**CTD B**	**CS3**	**CS4**	**PS2**	**CTD I**	**CTD J**	**PS3**	**CS6**
Penguin sp.				1.6		0.3							
Gentoo Penguin	*Pygoscelis papua*											0.1	
Chinstrap Penguin	*Pygoscelis antarctica*				2.5								
Wandering albatross sp.	*Diomedea sp.*											0.7	
Wandering Albatross	*Diomedea exulans*								0.4	P		1.3	2.3
Southern Royal Albatross	*Diomedea epomophora*											0.8	1.0
Black-browed Albatross	*Thalassarche melanophrys*	2.5	0.3			1.0	0.3	1.0	0.9	2.0		1.3	1.7
Grey-headed Albatross	*Thalassarche chrysostoma*	0.1							0.5			0.3	1.3
Light-mantled Sooty Albatross	*Phoebetria palpebrata*	0.0						0.5	0.5			0.1	0.3
Giant Petrel sp.	*Macronectes sp.*	5.3			0.5	P	0.5	2.3	0.5			0.7	
Southern Giant Petrel	*Macronectes giganteus*	0.9	0.5	1.0	0.5	0.7	0.5	2.0	0.1	3.0		0.1	1.0
Northern Giant Petrel	*Macronectes halli*	0.3				0.3	2.5	2.0	1.6	11.0	12.0	9.4	11.7
Southern Fulmar	*Fulmarus glacialoides*	0.3	2.8	1.6	1.0	6.3	1.0						
Antarctic Petrel	*Thalassoica antarctica*				0.5	0.7							
Cape Petrel	*Daption capense*	33.7	7.5	89.8	22.0	88.0	40.0		21.4	11.0	14.0	11.2	1.0
Snow Petrel sp.	*Pagodroma sp.*	0.0											
Soft-plumaged Petrel	*Pterodroma mollis*												0.7
Blue Petrel	*Halobaena caerulea*	2.1				9.0	2.5	5.3	16.9			1.2	
Prion sp	*Pachyptila sp.*	3.8				2.7	1.0	3.0	8.9	5.0	9.0	14.9	1.0
Broad-billed Prion	*Pachyptila vittata*					0.3							

Antarctic Prion	*Pachyptila desolata*	0.3	0.3										
White-chinned Petrel	*Procellaria aequinoctialis*	1.5					0.5	1.5	1.5	1.0	1.0	2.8	6.0
Wilson's Storm-petrel	*Oceanites oceanicus*	0.5			P	0.3	0.5	2.5	1.2		4.0	1.1	2.0
Black-bellied Storm-petrel	*Fregetta tropica*				P	0.3	0.3	0.3	0.5			0.7	1.7
Diving-petrel sp	*Pelecanoides sp.*								0.1			0.2	
Pale-faced Sheathbill	*Chionis alba*	0.5							0.1				
Subantarctic Skua	*Catharacta antarctica lonnbergi*				1.5		0.3						
Tern sp.	*Sterna sp.*	P											
Arctic Tern	*Sterna paradisaea*	0.0											
Fur seal sp.	*Arctocephalus sp.*								1.5		1.0	0.9	
Large cetacean sp.									P			P	
Fin Whale	*Balaenoptera physalus*	P							P			P	

Problems encountered and recommendations

1. The method of counting animals whilst on station was felt to be inadequate because it was only possible to systematically count animals close to the ship. These animals tended to be species that were attracted to the ship (although this tendency could be exploited as a sampling method). They usually congregated around the stern in the prop wash (while in station use of the ship's DP system to hold the vessel head to wind meant there was always some prop wash) or midway along the beam, where the ship's macerators discharged food waste. Counting animals from the stern and bow might have been preferable to counting from the sides as this would give some indication of which animals were attracted to the ship and which were simply passing by. Alternatively, animals in as area further from the ship could be counted using binoculars but this method would only be effective in low sea states and good visibility.

2. It was possible at most but not all times for an observer to collect and enter data simultaneously. This was due mainly to the use of the rugged laptop, which was invaluable and performed very well throughout the cruise (although see below). However, at times when the animal density was high a data recorder was necessary in order for the observer not to miss a significant number of animals. Furthermore, because there was only one observer data could not be collected continuously whilst underway. This meant that important features such as fronts were often crossed while no predator data was being collected. An ideal situation would be to have two trained observers working shifts assisted by data recorders drawn from the scientific party or people in transit.

3. The movement codes were over complicated. Flight type could have been more succinctly described as direct, turning or circling.

4. The laptop's touch-screen backlight occasionally switched off unexpectedly making it nearly impossible to use the screen. This seemed to happen if the laptop was left outside in the cold on standby during breaks, etc. Hence, it was always taken inside when not in use. Having spoken to the manufacturers it seems that this is a fault and should be fixed before the laptop is used on another cruise.

5. During underway observations all birds in flight passing through the transect were recorded (with some marked as in snapshot). For some studies this level of detail may be unnecessary and it may be acceptable to record only birds seen in the snapshot counts. Taking this approach would mean more time could be devoted to recording birds' behaviour.

6. Working from the bridge wings was effective and is common practice among predator observers. However, it did at times cause some disruption to the bridge officers. Given that cetacean or air-breathing predator surveys are often undertaken from the *RRS James Clark Ross* it might be worth considering fitting a permanent or removable shelter on the monkey island for observers. Such shelters have apparently been fitted to the *Polar Stern* and other research ships operating in the Southern Ocean.

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References

Ainley DG, Ribic CA, Spear LB (1993) Species-Habitat Relationships among Antarctic Seabirds - a Function of Physical or Biological Factors. Condor 95:806-816

Borberg JM, Ballance LT, Pitman RL, Ainley DG (2005) A test for bias attributable to seabird avoidance of ships during surveys conducted in the tropical Pacific. Marine Ornithology 33:173–179

Buckland ST, Anderson DR, Burnham KP, Laake JL, Borchers DL, Thomas L (2001) Introduction to distance sampling, Vol. Oxford University Press, Oxford

Buckland ST, Anderson DR, Burnham KP, Laake JL, Borchers DL, Thomas L (2004) Advanced distance sampling, Vol. Oxford University Press, Oxford

Camphuysen CJ, Fox T, Leopold MF, Petersen IK (2004) Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the UK [COWRIE BAM-02–2002], The Crown Estate, London

Camphuysen CJ, Garthe S (2004) Recording foraging seabirds at sea: standarised recording and coding of foraging behaviour and multi-species foraging associations. Atlantic Seabirds 6:1-32

Chapman EW, Ribic CA, Fraser WR (2004) The distribution of seabirds and pinnipeds in Marguerite Bay and their relationship to physical features during austral winter 2001. Deep-Sea Research Part Ii-Topical Studies in Oceanography 51:2261-2278

Clarke ED, Spear LB, McCracken ML, Marques FFC, Borchers DL, Buckland ST, Ainley DG (2003) Validating the use of generalized additive models and at-sea surveys to estimate size and temporal trends of seabird populations. Journal of Applied Ecology 40:278-292

Harper PC, Croxall JP, Cooper J (1985) A guide to foraging methods used by marine birds in Antarctic and Subantarctic seas. Compiled on behalf of the BIOMASS Working Party on Bird Ecology, Vol 24

Heinemann D (1981) A range finder for pelagic bird censusing. Journal of Wildlife Management 45:489–493

Hyrenbach KD (2001) Albatross response to survey vessels: implications for studies of the distribution, abundance, and prey consumption of seabird populations. Marine Ecology-Progress Series 212:283-295

Littaye A, Gannier A, Laran S, Wilson JPF (2004) The relationship between summer aggregation of fin whales and satellite-derived environmental conditions in the northwestern Mediterranean Sea. Remote Sensing of Environment 90:44-52

Ryan PG, Cooper J (1989) The Distribution and Abundance of Aerial Seabirds in Relation to Antarctic Krill in the Prydz Bay Region, Antarctica, During Late Summer. Polar Biology 10:199-209

Shirihai H (2002) A complete guide to Antarctic Wildlife, Vol. Alula Press, Degerby, Finland

Spear LB, Ainley DG, Hardesty BD, Howell SNG, Webb SW (2004) Reducing biases affecting at-sea surveys of seabirds: use of multiple observer teams. Marine Ornithology 32:147-157

Tasker ML, Jones PH, Dixon T, Blake BF (1984) Counting Seabirds at Sea from Ships - a Review of Methods Employed and a Suggestion for a Standardized Approach. Auk 101:567-577

van Franeker JA (1994) A comparison of methods for counting seabirds at sea in the Southern Ocean. Journal of Field Ornithology 65:96–108

van Franeker JA, van den Brink NW, Bathmann UV, Pollard RT, de Barr HJW, Wolff WJ (2002) Responses of seabirds, in particular prions (Pachyptila sp.), to small-scale processes in the Antarctic Polar Front. Deep-Sea Research Part Ii-Topical Studies in Oceanography 49:3931-3950

Veit RR (1999) Behavioural responses by foraging petrels to swarms of Antarctic Krill Euphausia superba. Ardea 87:41-50

Webb A, Durinck J (1992) Counting birds from ships. In: Komdeur J, Bertelsen J, Cracknell G (eds) Manual for aeroplane and ship surveys of waterfowl and seabirds, Vol 19. IWRB Special Publication, p 24-37

Woehler EJ, Raymond B, Watts DJ (2003) Decadal-scale seabird assemblages in Prydz Bay, East Antarctica. Marine Ecology-Progress Series 251:299-310

World Meteorological Organization (1970) WMO sea-ice nomenclature. Terminology, codes and illustrated glossary, Vol 147. Secretariat of the World Meteorological Organization, Geneva

Appendix Pred1. Fields in predator observations database

Table	Field	Description
GeneralData	form_id	Cruise code & ddmmyy & "_" & transect
	site	Cruise code ("SG" throughout JR161)
	boat	Ship's name
	transect	Letter indicates leg (between or at stations), number indicates day of leg
	observer	"EW" Ewan Wakefield throughout cruise
	date	Date
	page	Not used
	start_time	Initial start time at beginning of the day
	finish_time	Final end time at the end of the day
	notes	Concise log of start and end times, activities, etc. during transect
CountData	form_id	Cruise code & ddmmyy & "_" & transect
	observation	Observation number
	PositionID	Cruise code & ddmmyyhhmmss (used to match records to positions, Ocean Logger data, etc.)
	time	Time of observation (UTC)
	species	Species or administrative code (see species codes)
	age	Age of animal or plumage stage (cy = calendar year for gulls, etc.; type = Gibson plumage index for *Exulans* spp.): A; Adult; I; Immature ; J; Juvenile ; 1; type I; 2; 2nd cy or type II; 3; 3rd cy or type III; 4; 4th cy or type IV; 5; 5th cy or type V; 6; 6th cy or type VI; 7; 7th cy or type VII; U; Undetermined
	pl	Plumage, morph or size: W; Winter (non-breeding); S; Summer (breeding); T; Transition; M; Male; F; Female; D; Dark; I; Intermediate; L; Light; E; Eclipse; 1;½ or less than adult size; 2; over ½ adult size; 3; about same size as adult; U; Undetermined
	numbers	Number of animals seen
	band	F; bird in flight within the box or A; on water 0-50 m; B; on water 50-100 m; C; on water 100-200 m; D; on water 200-300 m; E; on water >300 m.
	dir	Animal's direction of flight of swimming relative to the ship's head
	Movement	See movements codes
	Search	See searching codes
	Forage	Foraging or other behaviour code (see foraging and behaviour codes)
	Prey	See prey codes

radial	Not used
height	Not used
grad	Not used
T	1 = flying bird in snapshot 0 = flying bird not in snapshot
notes	Any additional notes
OffEastings	Not used
OffNorthings	Not used
Range	Estimated radial distance to cetaceans at time of first sighting (m)
Bearing	Estimated bearing to cetaceans at time of first sighting relative to ship's head
Ass	Not used
Lat	Latitude of ship when animal recorded
Long	Longitude of ship when animal recorded
Truncation	Transect width (1; 50 m; 2; 100 m; 3; 200 m; 4; 300 m; 5; 1 km; 6; 5 km; 7; Horizon)
speed	Ship's speed (knots)
snapshot_interval	Not used
wind_dir	True wind direction, estimated by observer
cloud_cover	Percentage cloud cover estimated by observer
precipitation_type	See precipitation types
wind_sp	True Beaufort wind speed estimated by observer
wave_hgt	Significant wave height estimated by observer
sea_ice	Sea ice concentration in 10ths estimated by observer
swell_direction	True dominant swell direction estimated by observer
vis	Visibility (km) estimated by observer. 20 km = beyond the visible horizon
sun_glare_from	Start of arc obscured by sun glare (deg), clockwise from ship's head
sun_glare_to	End of arc obscured by sun glare (deg), clockwise from ship's head
temperature	Subjective temperature category, estimated by observer
pressure	Not used
direction_scan	Location of obsever and direction of scan (PW; Port bridge wing; SW; Starboard bridge wing; PB; Port inside bridge; SB; Starboard inside bridge)
sea_state	Beaufort sea state estimated by observer

	Base_activity	Ship's activity (due to communication difficulties this may need check, i.e. instruments or equipment may have been deployed without the observer knowing). 0; no data; 1; non-fishing activity; 2; major fishing activity; 3; steaming between fishing stations; 4; Flaring; 5; steaming between other sampling stations; 6; Seismic Survey; 7; acoustic krill survey; 8; steaming; 9; RMT25; 10; MOCNESS; 11; LHPR.
SpeciesCodes	Code	Either: two uppercase letters for bird species (based on BTO codes); three lower case letters for lower taxonomic groupings of birds; three uppercase letters for marine mammals (species or lower grouping); four upper case letters for special codes ("STRT"; start of a surveying session, "STOP"; end of a surveying session, "NOTE"; timed note, "METO"; a metreological observation). Some species may not have had a code allocated, in which case they will simply have a number.
	CommonName	Common name following Shirihai (2002)
	FuncGroup	Not presently used
	Genus	Genus following Shirihai (2002)
	Species	Species following Shirihai (2002)
	SubSpecies	Sub-species following Shirihai (2002)
	Expected	1 = likely to be encountered, 2 = not likely to be encountered (the latter species will produce a warning message if entered into the database)
	Type	BTO; birds identified to species; UNB; birds not identified to species; MAM; marine mammals; NOT; special codes; VES; other vessels (not used on JR161)
	VoousNumber	Approximate taxonomic order
	Group	Group following Shirihai (2002)
	Order	Order following Shirihai (2002)
	Status	Order following Shirihai (2002)
	Family	Family following Shirihai (2002)
	BAS_code	Not presently used

Fields in stationary predator observations database

Table	Field	Description
GeneralData	form_id	Cruise code & ddmmyy & direction_scan & transect
	site	Cruise code ("SG" throughout JR161)
	boat	Ship's name
	transect	Actually refers to scans. Letter indicates station (lettered from A, including CTD stations), number indicates scan (numbered sequentially from 01)
	observer	"EW" Ewan Wakefield throughout cruise
	date	Date
	direction_scan	PM; port side of monkey island; SM; starboard side of monkey island
	page	Not used
	start_time	Time scan started
	finish_time	Time scan finished, nominally five minutes after start
	form_id	Cruise code & ddmmyy & "_" & transect
	observation	Observation number
	notes	general notes
	Truncation	Not used
	speed	Defaults to 0 knots
	snapshot_interval	Not used
	wind_dir	True wind direction, estimated by observer
	cloud_cover	Percentage cloud cover estimated by observer
	precipitation_type	See precipitation types
	wind_sp	True Beaufort wind speed estimated by observer
	wave_hgt	Significant wave height estimated by observer
	sea_ice	Sea ice concentration in 10ths estimated by observer
	swell_direction	True dominant swell direction estimated by observer
	vis	Visibility (km) estimated by observer. 20 km = beyond the visible horizon
	sun_glare_from	Start of arc obscured by sun glare (deg), clockwise from ship's head
	sun_glare_to	End of arc obscured by sun glare (deg), clockwise from ship's head
	temperature	Subjective temperature category, estimated by observer
	pressure	Not used
	direction_scan	Location of observer and direction of scan (PW; Port bridge wing; SW; Starboard bridge wing; PB; Port inside bridge; SB; Starboard inside bridge)
	sea_state	Beaufort sea state estimated by observer

	Base_activity	Ship's activity (due to communication difficulties this may need check, i.e. instruments or equipment may have been deployed without the observer knowing). 0; no data; 1; non-fishing activity; 2; major fishing activity; 3; steaming between fishing stations; 4; Flaring; 5; steaming between other sampling stations; 6; Seismic Survey; 7; acoustic krill survey; 8; steaming; 9; RMT25; 10; MOCNESS; 11; LHPR.
CountData	form_id	Cruise code & ddmmyy & direction_scan & transect
	observation	Automatically numbered
	PositionID	Cruise code & ddmmyyhhmmss (used to match records to positions, Ocean Logger data, etc.)
	time	Defaults to scan start time
	species	Species or administrative code (see species codes)
	age	Age of animal or plumage stage (cy = calendar year for gulls, etc.; type = Gibson plumage index for *Exulans* spp.): A; Adult; I; Immature ; J; Juvenile ; 1; type I; 2; 2nd cy or type II; 3; 3rd cy or type III; 4; 4th cy or type IV; 5; 5th cy or type V; 6; 6th cy or type VI; 7; 7th cy or type VII; U; Undetermined
	pl	Plumage, morph or size: W; Winter (non-breeding); S; Summer (breeding); T; Transition; M; Male; F; Female; D; Dark; I; Intermediate; L; Light; E; Eclipse; 1;½ or less than adult size; 2; over ½ adult size; 3; about same size as adult; U; Undetermined
	numbers	Total number of animals seen
	band	A; within 300 m of the ship's monkey island; B; beyond 300 m from the ship's monkey island
	dir	Animal's direction of flight of swimming relative to the ship's head (cetaceans only)
	Movement	See movements codes
	Search	See searching codes
	Forage	Foraging or other behaviour code (see foraging and behaviour codes)
	Prey	See prey codes
	radial	Not used
	height	Not used
	grad	Not used
	T	Not used
	notes	Any additional notes
	OffEastings	Not used
	OffNorthings	Not used
	Range	Estimated radial distance to cetaceans at time of first sighting (m)

	Bearing	Estimated bearing to cetaceans at time of first sighting relative to ship's head
	Ass	Not used
	Lat	Latitude of ship when animal recorded
	Long	Longitude of ship when animal recorded
	PropFlight	The percentage of birds in flight
SpeciesCodes		As underway database

Movement, searching, foraging, behaviour and prey codes used in underway and stationary observations databases. Partly based on Harper et al. (1985) and Camphuysen & Garthe (2004).

Type	Sub-type	Code	Description
Movement	Diving	DDD	Dived/diving direct
		DDT	Diving directionless
	Flight circling	FT1	Flight - turns < 90 deg
		FT2	Flight - turns 90-180 deg
		FT3	Flight - turns >180 deg
	Flight direct	FDD	Flight - direct
	Flight following	FFS	Flight following other vessel
		FFF	Flight following fishing vessel
	Miscellanaeous	BTH	Bathing
		CRT	Courtship display
		UNW	Unwell
		DED	Dead
		SLP	Apparently asleep
	Sea/air	CLA	Landed
		CTO	Took off
	Sitting on	SOW	Sitting on the water
		SOD	Sitting on driftwood
		SOI	Sitting on ice
		SOF	Sitting on water by fishing vessel
		SOV	Sitting on water by other vessel
		SOL	Sitting on land
		SOB	Sitting on buoy
	Swimming	SSD	Swim slow - direct
		SUR	At surface, not logging but not moving in any particular direction
	Swimming fast	SF1	Swim fast - turns < 90 deg
		SF2	Swim fast - turns 90-180 deg
		SF3	Swim fast - turns >180 deg
	Swimming slow	SS3	Swim slow - turns >180 deg (milling)
		SFD	Swim fast - direct
		SS2	Swim slow - turns 90-180 deg
		SS1	Swim slow - turns < 90 deg
	Unrecorded	U	Unrecorded
Searching	Carrying prey	C	Carrying prey
	Feeding	F	Seen feeding
	No	0	Apparently not searching for prey
	Unrecorded	U	Unrecorded/unclear
	Yes	1	Apparently searching for prey

Foraging	Diving	DDS	Surface dive (brief)
		DDD	Diving (type unspecified)
		DDP	Pursuit dive from surface (full)
	Flight feeding	FPT	Pattering
		FAP	Aerial pursuit
		FDP	Dipping
		FFF	Flight feeding
	General foraging	0	Apparently not foraging
		1	Apparently foraging
	Kleptoparasitism	KLP	Kleptoparasitism
	Marine mammals	FLU	Fluke-up dive
		POR	Porpoising
		JUM	Jumping
		BLO	Blowing
		ASS	Associating with ship
		SLA	Tail/flipper slipping
		BOW	Bow riding
		SPY	Spy hopping/bottling
		LOG	Logging
		HER	Herding/concentrating prey
		LOB	Lobtailing
		BRE	Breaching
	Plunging	PPP	Plunging
		PPU	Pursuit plunging (dive from flight)
		PDP	Deep plunging (several metres)
		PSH	Shallow plunging (submerges body length)
		PSR	Surface plunging (doesn't fully submerge)
	Scavenging	SCA	Scavenging
	Surface feeding	SSS	Surface feeding
		SFP	Foot paddling
		SHY	Hydroplaning
		SFL	Surface filtering
		SSZ	Surface seizing
		SPK	Surface pecking
	Unrecorded	U	Unrecorded/unclear
Prey	Cephalopod	SQD	Squid sp
		OCT	Octopus sp
	Crustacean	KRL	Krill sp
	Fish	FSH	Fish sp
	Jellyfish	JEL	Jellyfish sp
	Salp	SAL	Salp sp
	Unidentified prey	UNP	Unidentified prey
	Unrecorded	U	Unrecorded

Engineering Technical Section
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AME Cruise Report

FAO:
The BAS AME (electronics) marine scientific instrumentation support engineers

Cruise Report Instructions

Richard Bridgeman is the first point of contact for marine scientific instrumentation – any questions email (ribr@bas.ac.uk) or phone him (01223 221407); try Steve Bremner (sfbr, 01223 221416) when Richard not available.

Before you leave HQ for cruise support, see Richard for an up to date DVD image of the JCR directories from the M: drive, including the up to date database for locating incidentals and spares – see Richard if you are unfamiliar with this database. The master database will be kept with Richard so **please email/phone Richard with any changes** you think are necessary or keep a log to give to Richard on return; changes made to any copy stored on the ship will be ignored. An incidentals stock check will be attempted annually but if something is getting dangerously low then tell Richard **BEFORE** the end of the cruise.

A brief cruise report checklist is **REQUIRED** for **every cruise** for the instruments AME are responsible for supporting. **Include pertinent notes on fault history and diagnosis at the end of the report even if you have already discussed via email.**

Please log **all** problems or changes made to systems in use while the cruise is underway to your own **log book**.

At the end of the cruise, please fill in the simple checklist attached, briefly describing any problems or changes made to the instrumentation (including intermittent problems, repairs, expansion, changes to software, etc). Tick 'Used?' against all instruments which were used or logged. This is so we can follow up these issues and keep a good history of our instruments.

In order to help us with calibrations and repairs, please note the **serial numbers** of the instruments ACTUALLY USED (as listed on the checklist), and also serial numbers of any spares which you swapped or tested due to a fault or fault-finding. Enter any details on the checklist. We now have many spare sensors which are identical except for serial number.

Richard would like to avoid having to run around at the last minute arranging shipment of incidentals, equipment or repairs half way across the planet. If incidentals are getting low, email Richard to order some more; do not wait for them to run out.

Please leave **one copy of the cruise report on the ship in the electronics workshop** for the next support engineer **AND ALSO** either:

a) Preferably, **email an electronic copy** (or scan in) to Richard and Steve Bremner at BAS, or
b) Give an electronic copy to Richard and Steve when you return to Cambridge as soon as possible.

Cruise: Start date:23/10/06 Finish date:03/12/06
Name of AME engineer: Mark Preston
Name of principle scientist (PSO): Rachael Shreeve

Instrument	**Used ?**	**Comments**
XBT (aft UIC) (PC, I/F box, handgun)	♦	Spare gun eventually found
Scintillation counter (prep lab)	♦	
AutoSal (labs on upper deck) S/N 63360		
AutoSal (labs on upper deck) S/N 65763	♦	Problems suspected to with the peristaltic pump caused drift and stability problems. To verify that this was the case 68533 was made available.
AutoSal (labs on upper deck) S/N 68533	♦	Drift and stability issues followed the BAS pump. Larger diameter pipe for the pump to be supplied.
Portasal S/N 68164		
Magnetometer STCM1 (aft UIC)	♦	
AME workshop PC	♦	New PC and monitor installed.

GPS, MRU, Gyro

GPS Furuno GP32 (bridge – port side)	♦	
DGPS Ashtec ADU5 (bridge – port side)	♦	
DGPS, MRU Seatex Seapath (UIC – swath suite)	♦	
DGPS Ashtec Glonass GG24 (bridge – starboard	♦	

side)		
Gyro synchro to RS232 Navitron NT925HDI (UIC – aft)	♦	
TSS HRP (UIC repeater)	♦	

ACOUSTIC

Instrument	Used ?	Comments
ADCP (aft UIC)	♦	
PES (aft UIC)		
EM120 (for'd UIC)	♦	
TOPAS (for'd UIC)		
EPC plotter (used with TOPAS)		
EK60 (mid UIC)	♦	
HP deskjet 1 (used with EK)		
HP deskjet 2 (used with EK)		
SSU (for'd UIC)	♦	
SVP S/N3298 (cage when unused)		
SVP S/N3314 (cage when unused)		
10kHz IOS pinger		
Benthos 12kHz pinger S/N 1316 + bracket		
Benthos 12kHz pinger S/N 1317 + bracket		
MORS 10kHz transponder		
Sonardyne USBL (aft UIC)		

OCEANLOGGER

Instrument	Used ?	Comments
Main logging PC hardware and software	♦	
Barometer (back of logger rack) #V145002 (7/03)	♦	
Barometer #V145003 (7/03)	♦	
Barometer #Y2610005		
Barometer #W4620001		
Air humidity & temp (for'd mast) #15619015		
Air humidity & temp #15619025		
Air humidity & temp #28552023 (HT1, 7/03)	♦	
Air humidity & temp #18109036 (HT2, 7/03)	♦	
Thermosalinograph SBE45 (prep lab) #4524698-0016		
Thermosalinograph SBE45 # 4532920-0072		
Thermosalinograph SBE45 #4524698-0018 (7/04)	♦	
Fluorometer (prep lab)	♦	
TIR sensor (pyranometer) (for'd mast) #990684		
TIR sensor #32374 (TIR1, 7/03)	♦	
TIR sensor #990685		

TIR sensor #011403 (TIR2, 7/03)	◆	
PAR sensor (for'd mast) #990069		
PAR sensor #990070		
PAR sensor #30335 (PAR1, 7/03)	◆	
PAR sensor # 010224 (PAR2, 7/03)	◆	
Flow meter (prep room) #45/59462	◆	
Uncontaminated seawater temp (transducer space)	◆	

CTD (all kept in cage/ sci hold when not in use)

Instrument	Used ?	Comments
Deck unit 1 SBE11plus S/N 11P15759-0458	♦	Failed mid cast, alarmed briefly, before blowing both input and output fuses.
Deck unit 2 SBE11plus S/N 11P20391-0502	♦	
Underwater unit SBE9plus #09P15759-0480 Press #67241		
Underwater unit SBE9plus #09P20391-0541 Press #75429		
Underwater unit SBE9plus #09P30856-0707 Press #89973		
Underwater unit SBE9plus #09P35716-0771 Press #93686	♦	
Carousel & pylon SBE32 #3215759-0173		
Carousel & pylon SBE32 #0248		
CTD swivel linkage	♦	
CTD swivel S/N196115		
CTD swivel S/N196111	♦	

CTD contd – C & T & pumps – please state which primary and secondary

Temp sensor SBE3plus #03P2191	♦ **S**	
Temp sensor SBE3plus #03P2307		
Temp sensor SBE3plus #03P2366		
Temp sensor SBE3plus #03P2679		
Temp sensor SBE3plus #03P2705		
Temp sensor SBE3plus #03P2709		
Temp sensor SBE3plus #03P4235		
Temp sensor SBE3plus #03P4302	♦ **P**	
Cond sensor SBE4C #041912	♦ **S**	
Cond sensor SBE4C #041913		
Cond sensor SBE4C #042222		
Cond sensor SBE4C #042248		
Cond sensor SBE4C #042255		
Cond sensor SBE4C #042289		
Cond sensor SBE4C #042813		
Cond sensor SBE4C #042875	♦ **P**	
Pump SBE5T # 51807	♦ **P**	
Pump SBE5T		

# 51813		
Pump SBE5T # 52371		
Pump SBE5T # 52395		
Pump SBE5T # 52400		
Pump SBE5T # 53415	♦ **S**	

CTD contd

Instrument	**Used ?**	**Comments**
Fluorometer Aquatracka MkIII #088216		
Fluorometer Aquatracka MkIII #088249	♦	
Standards Thermometer SBE35 #3515759-0005	♦	
Standards Thermometer SBE35 # 3527735-0024		
Standards Thermometer SBE35 # 3535231-0047		
Altimeter PA200 #2130.26993	♦	
Altimeter PA200 #2130.27001		
Transmissometer C-Star #CST-396DR		
Transmissometer C-Star #CST-527DR		
Transmissometer C-Star CST 846DR		
Oxygen sensor SBE43 #0242		
Oxygen sensor SBE43 #0245		
Oxygen sensor SBE43 #0620		
Oxygen sensor SBE43 #0676	♦	
PAR sensor #7235		
PAR sensor #7252		
PAR sensor #7274	♦	

PAR sensor #7275		

Notes on any other part of CTD e.g. faulty cables, wire drum slip ring, bottles, swivel, frame, tubing etc.		

AME UNSUPPORTED INSTRUMENTS BUT LOGGED

Instrument	Used ?	Comments
EA600 (bridge and UIC remote)	♦	
Anemometer	♦	
Gyro	♦	
DopplerLog	♦	
EMLog	♦	
CLAM winch monitoring system	♦	

At the end of the cruise, please ensure that:

- the XBT is left in a suitable state (store in cage if not to be used for a while – do not leave on deck or in UIC as it will get kicked around). Remove all deck cables at end of cruise prior to refit.
- the salinity sample bottles have been washed out and left with deionised water in – please check this otherwise the bottles will build up crud and have to be replaced.
- the CTD is left in a suitable state (washed (including all peripherals), triton + deionised water washed through TC duct, empty syringes put on T duct inlets to keep dust out and stored appropriately). Be careful about freezing before next use – this will damage the C sensors (run through with used standard seawater to reduce the chance of freezing before the next use). Remove all the connector locking sleeves and wash with fresh water. Blank off all unconnected connectors. See the CTD wisdom file for more information. If the CTD is not going to be used for a few weeks, at the end of your cruise please clean all connectors and attach dummy plugs or fit the connectors back after cleaning if they are not corroded.
- the CTD winch slip rings are cleaned if the CTD has been used – this prevents failure through accumulated dirt.
- the SVP is left in a suitable state (washed and stowed). Do not leave this on deck without a cover for any length of time as it rusts. Stow inside at end of cruise.
- all manuals have been returned to the designated drawers and cupboards.
- you clean all the fans listed below every cruise or every month, whichever is the longer.

Please clean the intake fans on the following machines:

Instrument	Cleaned?
Oceanlogger	♦
EM120, TOPAS, NEPTUNE UPSs	♦
Seatex Seapath	♦
Topas tweendeck	♦

Additional notes and recommendations for change / future work

When working on slip rings it is very important that the cover is installed properly and that the cable that enters the cover is orientated and adjusted properly. At one point in the cruise the net monitor was behaving most erratically, this was eventually traced to the slip rings. The large multi-core wire that enters the cover was placed such that too much of the cable was inside the housing. This meant that over time several of the inner cores gradually rubbed on the rotating slip ring and eventually started to cause an intermittent short.

A ‘last look’ with a torch and mirror is a good idea before closing the cover after PPM or problems.

British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Information Communications Technology

ICT Report

JR161: Discovery 2010

Dates : 23/10/2006 – 03/12/2006

PSO: Rachael Shreeve

Jeremy Robst, jpro@bas.ac.uk v1.0 02/12/2006
Ben Tullis, btull@bas.ac.uk

1.0 Personal Computers

The Chief Officers PC and Surgery PC were replaced with new machines. A few viruses were found during the cruise on various machines, though they were all harmless and were removed.

2.0 Netware

SP5 applied to JRNA. Some XP clients struggle to find the tree occasionally, especially immediately after powering on. No other problems with Netware.

3.0 Unix

There were no problems with any of the unix machines. The second v240, JRUB was used as a user accessible machine since it is more powerful than the Sun Blades. This can continue – there is no real need to replace the Blades with anything more powerful at they moment, they can stay as workstations.

Since the old JRUA is now JRUB some licences are tied to JRUB's hosted and so the licence managers run on this machine rather than JRUA, however there is no great need to acquire new licences – both JRUA & JRUB should be normally running.

4.0 SCS Logging System / Data Logging

The SCS logging system performed reasonably well throughout the cruise, though it is starting to show its age in several areas.

The Ashtech GPS regularly (approx every 5 days) stops outputting heading information and requires power cycling. Many times after the Ashtech is power cycled the SCS begins corrupting the output ACO file and this requires the Data acquisition to be stopped and restarted, causing a break in data logging and also the retransmission of data to other instruments (e.g GPS to EK60 / XBT).

The Seapath/Seatex GPS appears to be at least as good as the Ashtech for heading, so it may not be necessary to keep restarting the Ashtech, though it would be useful to have the Ashtech data as well for backup purposes.

Data acquisition for all streams needs to be stopped and restarted whenever changes are made to an individual stream or new instruments are added – this is not ideal.

The True wind speed & direction output from the SCS is not working at the moment – although it appears to have been configured identically to previous years. Because investigating the different options requires restarting the SCS it has not been possible to do much investigation during the cruise.

However the SCS True wind calculation suffers when the ship is stationary due to wild fluctuations in the heading sensors (either gyro or GPS) so it may be better to use an external True wind calcuation.

A bug was fixed in the ADCP data_server.pl program which was causing the program to stop outputting GPS information after midnight until the program was restarted. The program can now be run continuously with restarts.

The ADCP VmDAS program needs care when setting up – it logs data to two paths, the primary path & the seconday backup path. Only the essential raw data is logged to the secondary path (from which the intermediate & processed data files can be regenerated). However since the scientists use the intermediate/processed files always have the U: (network) drive as the primary path and the C: drive as the secondary path.

The EA600 had intermittent problems throughout the cruise. It either lost contact with the GPT transceiver – requiring the transceiver to be power cyled (The GPT is in the Gravity Meter room immediately to the right inside the door and the power switch is located on the wall just above the GPT box).

Sometimes the EA600 would stop outputting depth data over the serial port, mostly this just requires the software to be shutdown & restarted, however sometimes the machine on the bridge needs to be power cycled, occasionally repeatedly. The RO (Mike Glostein) is discussing with Simrad.

Data Acquisition Events	
Date / Time	Event / Reason
21:57 23/10/2006	Acquisition Started
21:21 - 21:30 25/10/2006	Power outage in UIC/dataprep/Computer office. The UPSes kept the servers going, but some streams were disrupted.
21:54 25/10/2006	Acquisition restarted since the Ashtech was power cycled and the ACO file was corrupted.
17:31 03/11/2006	Acquisition restarted to fix corruption in the Ashtech ACO file
11:05 05/11/2006	Acquisition restarted to fix corruption in the Ashtech ACO file
03:55 – 04:30 16/11/2006	Power outage in UIC/dataprep/Computer room. Too long for UPS to keep servers up, so everything restarted. Most things back up by 05:30.
22:59 16/11/2006	Acquisition restarted to fix corruption in the Ashtech ACO file
19:03 21/11/2006	Acquisition restarted to fix corruption in the Ashtech ACO file

5.0 Network

No problems reported.

6.0 Other

An L: drive was created, mapped to /data/cruise/jcr/current/work on the Unix system. This proved a very useful place for the scientists to store documents / images / data etc relevant to the cruise. In this location is it easy to backup with the rest of the cruise data.

The L: drive is mapped through a batch file run from the VP login script in the same manner as the M: & P: drives.

The M: & P: drives were moved to a volume (mediavol) on the FAS270c NetApp Filers and served from JRUA via Samba. JRLB was rebuilt as a virtual machine on JRLVMS1 and continues to run the SlimServer software for the MP3 players in the UIC and Officer & Crew bars.

Recommendations

The SCS is suffering from age (it only just installed on a Windows 2000 machine), and is not a good fit for the way the data logged is used on board. A new data logging system should be investigated, possible for installation in Summer 2007.

The UPS situation in the Computer Office is very poor, both in the capacity and the lack of graceful shutdown ability. This needs to be investigated and proper UPS provisioning provided.

Data Management Report

Nathan Cunningham

BASNet

BASNet is a major improvement for the JCR. It facilitates the use and interaction of the data streams collect in ways that were previously impossible. It opens up the opportunity to undertake scientific projects remotely and allows the unique and valuable nature of the JCR data to be disseminated quickly into the scientific community. For example, the Met. Office are extremely interested in receiving near-real-time data from the ship to input directly into their GCMs and Ocean models. This will mean that the profile of BAS as a unique data provider is increased, and enhanced in many positive ways. Not only being involved in collaborating with external institutions, but getting acknowledge for doing so.

I can not emphasis enough on how this technology is influence the way we work and think about our data.

Near-real-time JCR Data

Project Brief

Main Points

- Maintain the requirement for anybody on the ship to get at the data easily.
- Facilitate the viewing, access, retrieval of data from the JCR and Cambridge
- Ensure that a non-specialist interface to the JCR data resource.
- Increase the scientific/data output of the JCR.
- Provide a vital link in the long-term management of LTMS data.

Scientific Instrumentation on the JCR

There is interest and consensus across BSD that access to the JCR data streams in near real-time will offer substantial benefits, efficiencies and productivity to the marine based science being undertaken by the division. In addition, with this further functionality it will help to secure the JCRs reputation as one of the best research ships to accomplish world class Antarctic marine science. This consideration is made with the recent developments on the US research ships, which have started to provide their data in near-real time.

The main impacts are threefold, firstly it will allow the scientist to have an overview of the environmental, oceanographic, discrete equipment and underway data. Secondly, allow the scientist to react to these conditions and suggest alterations to instrument parameters to ensure the best quality data is collected. Finally, dramatically reduce the turn around time of raw data to proceed data can be, especially if the specialist scientist is not on that particular cruise; for example, an oceanographer to process the ADCP data.

With the implementation of near real time data streaming from the JCR it is understood that it is limited by the narrow bandwidth currently available, but with a co-ordinated effort most aspects of the JCR instrumentation could be summarised and binned into data packets suitable for streaming back. The instruments that are currently logged to the central SCS system could be streamed back immediately as a low priority process over BASnet.

As a proof of concept, targeting instrumentation used by for physical oceanography would be a useful starting point. It is complex enough to cover all the aspects of near real time data streaming by initially targeting three instruments and the underway SCS data. These are the CTD, the ADCP and the XBT data and the following things need to be implemented:

1. Develop the reduced data sets that are suitable for streaming back.
    a. ADCP – already summaries its data into 2 minute bins.
    b. CTD – this will output another data stream a reduce level (1-2 seconds) from the default 1/25th of a second and provide an initially overview of the cast.
    c. XBT – produce small ASCII file suitable for streaming back.
2. Develop the interface for streaming back data
    a. Work closely with PSD project for streaming back Halley data and develop knowledge and information transfer working practice.
3. Scientist/data manager works on streamed data to check that it can be used to
    a. Provide a succinct overview,
    b. Enough detail to perform initial analysis and suggest alteration to the collection parameters
    c. Does improve the turn around time of the raw data and the overall scientific output.

It is important to emphasis that this project should work closely with Peter Kirsch and the Halley data-streaming project.

Implementation

The project was successfully implemented and the proof of concept worked. Data is now streamed back to the UK in near real time. I would like to extend my gratitude to Jeremy Robst, Peter Kirsch, Paul Breen and Dave Judge for all their efforts. This work will help bring about a step change on how BSD can use and interact with the JCR.

Using Google Earth to Visualise Underway Data

The uptake of Google Earth as a quick and easy data visualisation tools has been good and levels of interest are high. Working with a number of scientist onboard the JCR serval useful data discovery products were produced. For example Martin Collins king penguin data was plotted using Google Earth and overlays of sea surface temperature and chlorophyll (from Beki Korb) were combined to help identify where the last polar front process station should be located.

David Judge developed an impressive range of Google Earth tools to help visualise ship data. These tools will be invaluable to how BSD scientist can discover which data sets are of interest. I would like to thank Dave Judge, Peter Kirsch and Paul Breen for all their work, help and support in getting this project of to such an impressive start.

Polar View Project

Working with Andrew Flemming a number of Polar View products were available for use on the ship. The most impressive is the high quality sea ice images. These were used by the JCR Officers to help inform them of the conditions around Signy. The Polor View Project uses Google Earth as its deliver technology and again will help form the suite of scientific tools utilising BASNet.

Web Based Data Tools

The event logs and integration tools were updated and widely utilised by all on the ship.

Appendix 1: Cruise Summary Report

CRUISE SUMMARY REPORT	*FOR COLLATING CENTRE USE* **Centre: BODC Ref. No.:** Is data exchange restricted ☐ Yes ☐ In part ☐ No

SHIP enter the full name and international radio call sign of the ship from which the data were collected, and indicate the type of ship, for example, research ship; ship of opportunity, naval survey vessel; etc.

Name: RRS James Clark Ross **Call Sign: ZDLP**

Type of ship: Research Ship

CRUISE NO. / NAME **JR 161 Discovery 2010 Spring cruise**
CRUISE LEG NO. **20061023**

Enter the unique number, name or acronym assigned to the cruise (or cruise leg, if appropriate).

CRUISE PERIOD start (set sail) 24/ 10/ 2006 day/ month/ year to 03 /12 /2006 day/ month/ year end (return to port)

PORT OF DEPARTURE (enter name and country) **Stanley, Falkland Islands**

PORT OF RETURN (enter name and country) **Stanley, Falkland Islands**

RESPONSIBLE LABORATORY enter name and address of the laboratory responsible for coordinating the scientific planning of the cruise

Name: British Antarctic Survey

Address: High Cross, Madingley Road, Cambridge. CB3 0ET

Country: UK

CHIEF SCIENTIST(S) enter name and laboratory of the person(s) in charge of the scientific work (chief of mission) during the cruise.

Dr. Rachael S. Shreeve. British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET. UK.

OBJECTIVES AND BRIEF NARRATIVE OF CRUISE enter sufficient information about the purpose and nature of the cruise so as to provide the context in which the report data were collected.

Cruise JR 161 was conducted within the Scotia Sea. Three transects were run as follows:

1. From Stanley in the Falkland Islands to Signy, South Orkneys,
2. From Signy towards the Polar Front North of the Island of South Georgia,
3. From the Polar Front back to Stanley.

Nine Stations were sampled in total; we remained on 3 stations for 4 days each and 6 stations for 2 days each. At each station we took samples and measurements to characterise the Oceanography, nutrients, phytoplankton, zooplankton, fish and higher predators.

The sampling was undertaken as part of the DISCOVERY 2010 BAS programme, with its remit to investigate and describe the response of the Southern Ocean ecosystem to climate variability, climate change and commercial exploitation.

PROJECT (IF APPLICABLE) if the cruise is designated as part of a larger scale cooperative project (or expedition), then enter the name of the project, and of organisation responsible for co-ordinating the project.

Project name: DISCOVERY 2010.

Coordinating body: British Antarctic Survey, High Cross, Madingley Road, Cambridge, CB3 0ET.

PRINCIPAL INVESTIGATORS: Enter the name and address of the Principal Investigators responsible for the data collected on the cruise and who may be contacted for further information about the data. (The letter assigned below against each Principal Investigator is used on pages 2 and 3, under the column heading 'PI', to identify the data sets for which he/she is responsible)

A. Oceanography. Mike Meredith. BAS

B. Nutrients. Mick Whitehouse. BAS

C. Phytoplankton. Rebecca Korb. BAS

D. Zooplankton – copepods. Pete Ward. BAS

E. Krill. Geraint Tarling. BAS

F. Fish. Martin Collins. BAS

G. High predator observations. Ewan Wakefield. BAS

H. Sediment trap – biogeochemistry. David Pond. BAS

MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS

This section should be used for reporting moorings, bottom mounted gear and drifting systems (both surface and deep) deployed and/or recovered during the cruise. Separate entries should be made for each location (only deployment positions need be given for drifting systems). This section may also be used to report data collected at fixed locations which are returned to routinely in order to construct 'long time series'.

PI See top of page.	APPROXIMATE POSITION						DATA TYPE enter code(s) from list on last page.	DESCRIPTION Identify, as appropriate, the nature of the instrumentation the parameters (to be) measured, the number of instruments and their depths, whether deployed and/or recovered, dates of deployments and/or recovery, and any identifiers given to the site.
	LATITUDE			LONGITUDE				
	deg	min	N/S	deg	min	E/W		
H	52	43	387	48	08	798	B73	Sediment trap mooring Deployed 25/11/2006 at Process station 3, in productive waters to the NW of South Georgia. 1* Sediment trap at 2000m, 1* Acoutic recording package at 200m , 1 * CTD at 500m, 1 * ADCP at 2000m,

SUMMARY OF MEASUREMENTS AND SAMPLES TAKEN

Except for the data already described on page 2 under 'Moorings, Bottom Mounted Gear and Drifting Systems', this section should include a summary of all data collected on the cruise, whether they be measurements (e.g. temperature, salinity values) or samples (e.g. cores, net hauls).

Separate entries should be made for each distinct and coherent set of measurements or samples. Different modes of data collection (e.g. vertical profiles as opposed to underway measurements) should be clearly distinguished, as should measurements/sampling techniques that imply distinctly different accuracy's or spatial/temporal resolutions. Thus, for example, separate entries would be created for i) BT drops, ii) water bottle stations, iii) CTD casts, iv) towed CTD, v) towed undulating CTD profiler, vi) surface water intake measurements, etc.

Each data set entry should start on a new line – it's description may extend over several lines if necessary.

NO, UNITS: for each data set, enter the estimated amount of data collected expressed in terms of the number of 'stations'; miles' of track; 'days' of recording; 'cores' taken; net 'hauls'; balloon 'ascents'; or whatever unit is most appropriate to the data. The amount should be entered under 'NO' and the counting unit should be identified in plain text under 'UNITS'.

PI see page 2	NO see abov e	UNITS see above	DATA TYPE Enter code(s) from list on last page	DESCRIPTION Identify, as appropriate, the nature of the data and of the instrumentation/sampling gear and list the parameters measured. Include any supplementary information that may be appropriate, e. g. vertical or horizontal profiles, depth horizons, continuous recording or discrete samples, etc. For samples taken for later analysis on shore, an indication should be given of the type of analysis planned, i.e. the purpose for which the samples were taken.
A				CTD
A				XBT
B				CTD
B				Underway
C				CTD
C				Go flo
C				Underway ships non toxic pumped sea water supply
C				Tow fish
D				Bongo net – vertically hauled
D				LHPR - towed
D				MOCNESS/ Multinet- towed
E				RMT 25. Krill
F				RMT 25. Fish
G				Observations

TRACK CHART: You are strongly encouraged to submit, with the completed report, an annotated track chart illustrating the route followed and the points where measurements were taken.	**Insert a tick(✓) in this box if a track chart is supplied**	✓

GENERAL OCEAN AREA(S): Enter the names of the oceans and/or seas in which data were collected during the cruise – please use commonly recognised names (see, for example, International Hydrographic Bureau Special Publication No. 23, 'Limits of Oceans and Seas').

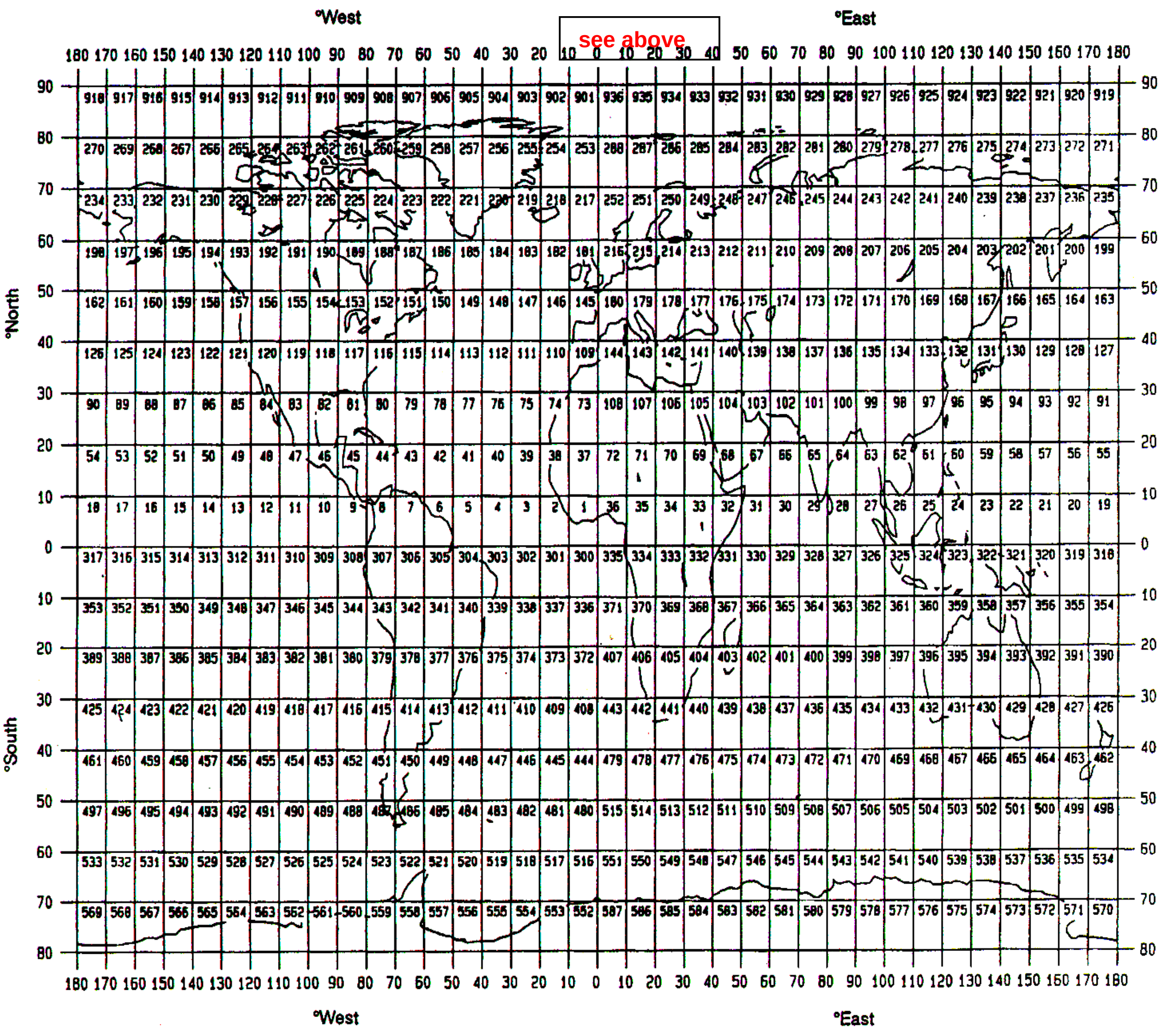
Scotia Sea. Altantic Sector of the Southern Ocean

SPECIFIC AREAS: If the cruise activities were concentrated in a specific area(s) of an ocean or sea, then enter a description of the area(s). Such descriptions may include references to local geographic areas, to sea floor features, or to geographic coordinates.

Please insert here the number of each square in which data were collected from the below given chart

520, 484, 483, 447

GEOGRAPHIC COVERAGE - INSERT 'X' IN EACH SQUARE IN WHICH DATA WERE COLLECTED



THANK YOU FOR YOUR COOPERATION

Please send your completed report without delay to the collating centre indicated on the cover page

PARAMETER CODES

METEOROLOGY

M01	Upper air observations
M02	Incident radiation
M05	Occasional standard measurements
M06	Routine standard measurements
M71	Atmospheric chemistry
M90	Other meteorological measurements

PHYSICAL OCEANOGRAPHY

H71	Surface measurements underway (T,S)
H13	Bathythermograph
H09	Water bottle stations
H10	CTD stations
H11	Subsurface measurements underway (T,S)
H72	Thermistor chain
H16	Transparency (eg transmissometer)
H17	Optics (eg underwater light levels)
H73	Geochemical tracers (eg freons)
D01	Current meters
D71	Current profiler (eg ADCP)
D03	Currents measured from ship drift
D04	GEK
D05	Surface drifters/drifting buoys
D06	Neutrally buoyant floats
D09	Sea level (incl. Bottom pressure & inverted echosounder)
D72	Instrumented wave measurements
D90	Other physical oceanographic measurements

CHEMICAL OCEANOGRAPHY

H21	Oxygen
H74	Carbon dioxide
H33	Other dissolved gases
H22	Phosphate
H23	Total - P
H24	Nitrate
H25	Nitrite
H75	Total - N
H76	Ammonia
H26	Silicate
H27	Alkalinity
H28	PH
H30	Trace elements
H31	Radioactivity
H32	Isotopes
H90	Other chemical oceanographic measurements

MARINE CONTAMINANTS/POLLUTION

P01	Suspended matter
P02	Trace metals
P03	Petroleum residues
P04	Chlorinated hydrocarbons
P05	Other dissolved substances
P12	Bottom deposits
P13	Contaminants in organisms
P90	Other contaminant measurements

MARINE BIOLOGY/FISHERIES

B01	Primary productivity
B02	Phytoplankton pigments (eg chlorophyll, fluorescence)
B71	Particulate organic matter (inc POC, PON)
B06	Dissolved organic matter (inc DOC)
B72	Biochemical measurements (eg lipids, amino acids)
B73	Sediment traps
B08	Phytoplankton
B09	Zooplankton
B03	Seston
B10	Neuston
B11	Nekton
B13	Eggs & larvae
B07	Pelagic bacteria/micro-organisms
B16	Benthic bacteria/micro-organisms
B17	Phytobenthos
B18	Zoobenthos
B25	Birds
B26	Mammals & reptiles
B14	Pelagic fish
B19	Demersal fish
B20	Molluscs
B21	Crustaceans
B28	Acoustic reflection on marine organisms
B37	Taggings
B64	Gear research
B65	Exploratory fishing
B90	Other biological/fisheries measurements

MARINE GEOLOGY/GEOPHYSICS

G01	Dredge
G02	Grab
G03	Core - rock
G04	Core - soft bottom
G08	Bottom photography
G71	In-situ seafloor measurement/sampling
G72	Geophysical measurements made at depth
G73	Single-beam echosounding
G74	Multi-beam echosounding
G24	Long/short range side scan sonar
G75	Single channel seismic reflection
G76	Multichannel seismic reflection
G26	Seismic refraction
G27	Gravity measurements
G28	Magnetic measurements
G90	Other geological/geophysical measurements

Appendix 2. Discovery 2010 Programme Statement

Global Science in the Antarctic Context: Programme Statement

DISCOVERY 2010

grating Southern Ocean Ecosystems

Summary

The biosphere is the most important component of the earth system for humanity. For earth systems analyses, we know little about the biosphere generally, and least of all about the biological systems of the ocean. There is an urgent need to quantify the role of ocean biological communities in the earth system. ***DISCOVERY 2010*** will undertake an integrated set of field studies, linked to targeted data syntheses and model development to analyse interactions in Southern Ocean ecosystems. The programme will significantly advance the development of global scale models of ocean ecosystems by 2010 and provide the UK required input on conservation science under the Antarctic Treaty.

Rationale

The most important challenge in earth systems science: to quantify the role of ocean ecosystems

For humans, the biosphere is the most important component of the earth system and changes in the biosphere will have the most serious and direct consequences for human communities in the next 20-100 years. Within the biosphere the ocean ecosystem is the least quantified component. We need a step-change in our capacity to predict the dynamics of ocean ecosystems. This requires focussed studies aimed at quantifying and modelling the dynamics of key ocean ecosystems. The large-scale Southern Ocean ecosystem plays a crucial role in earth systems processes, maintains unique biodiversity, is one of the key ocean ecosystems[1-2]. Previous studies have elucidated key biological processes and shown how physical and biological processes interact to generate large-scale variability in Southern Ocean ecosystems[3-12]. What is needed now is the development of integrated analyses and models of the interactions of biological, chemical and physical processes in ocean ecosystems. *DISCOVERY 2010* will develop and integrate previous analyses by undertaking directed data syntheses, field studies and model developments. The ecological analyses and models will be linked with analyses of regional and circumpolar environments to generate ocean scale ecosystem views. The analyses will provide the basis for the development of ecosystem models for more heterogeneous and complex systems in other oceans.

Change is already happening within the oceans and it is already directly affect humanity by modifying the operation of ecosystems on which human communities depend for food, goods and services[1,2,13-15]. These systems also play a crucial role in the global carbon cycle and maintaining biodiversity[1-2]. Current understanding of the operation of ocean ecosystems is extremely limited so there has been little development of a predictive modelling capacity. During the last decade years some useful biogeochemically-based models have been developed, yet these have little realistic biological structure and only encompass the smaller plankton[2]. There is now increasing evidence that such an approach is insufficient. Biological complexity and food-web structure determine key aspects of the way ecosystems function, affecting for example, the capacity to maintain key large predators, the diversity of species supported or the relative efficiency in recycling or exporting carbon[1-2]. Many of the interactions in ecosystems are highly non-linear so without a proper representation of biological systems, and the associated feedback processes, earth system projections will be misleading. The affect of such biological complexity in the food-web on the dynamics is illustrated by observations that rapid and unexpected "regime shifts" in ecosystem structure can occur, apparently in response to gradual changes in the physical environment or through direct human impacts[1].

Current analyses and models of ocean ecosystems cannot capture the effects of such complex behaviour generated through the interactive ecosystem. We therefore need to rapidly improve our capacity to analyse and model these systems, a fact further highlighted by realisations that ocean ecosystems cannot be just considered as passive components of the earth system, driven by physical processes. The latest coupled models have shown that the ocean biosphere generates feedbacks that influence the dynamics of the physical system[2]. Developing a capacity to predict the response of ocean ecosystems to environmental variability and change will be crucial in attempts to develop earth system projections of the future of human environments[1-2]. To develop realistic representations of marine ecosystems in earth system models therefore requires an ecosystem approach examining the physical-biological links that connect regional ecosystems with wider earth system.

Scientific Issues

Developing representations of oceanic biological systems in earth system models by *2010* is a practical aim, but to do this requires focused effort on ecosystem dynamics in globally important regions that also give a broader scale view of ecosystem operation[1-2]. Several characteristics of Southern Ocean ecosystems make them ideal for the development of ocean scale ecosystem integrations; a necessary prerequisite for global scale analyses. These characteristics include the fact that ecosystem studies in the Southern Ocean are well developed and there is a developing recognition that it is time for regional and large-scale integration[1,3-13] and that in many regions of the Southern Ocean the ecosystem is centred on a single key species[1,4,9,10,11,13], Antarctic krill (*Euphausia superba* Dana), which is also the target of a major fishery. However, during the last 5 to 10 years, there have been major advances in our understanding of the complexity of the system operation and the importance of alternative pathways[4,6,16]. The importance of these alternative links has yet to be accommodated into analyses and models, but will be important in understanding how ecosystem structure and function are related.

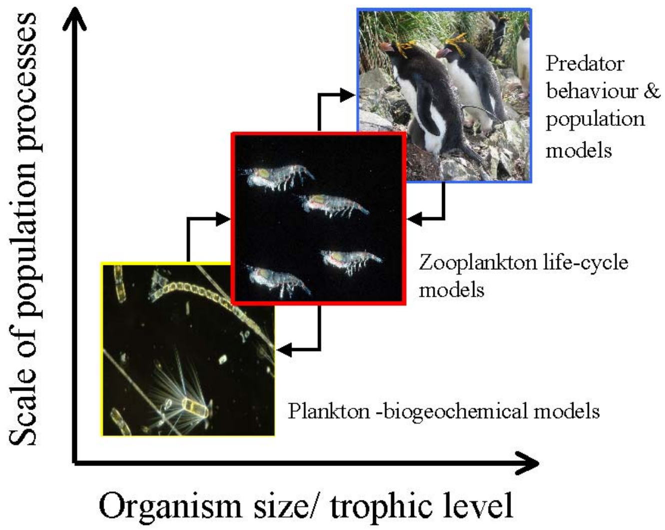


Figure 1. Realistic ecosystem modelling requires taking account of the scale of the biological processes involved which is generally a function of organism size. The schematic illustrates one possible approach linking models that resolve processes over 3 scales appropriate for the smaller plankton, the larger zooplankton and for the larger predators.

As is being seen elsewhere on the planet, harvesting of living resources has massively disturbed the Southern Ocean ecosystem; further change during the last few decades has also been related to changes in the environment[1,4,6,13,15]. Unique and extensive historical data on the Southern Ocean ecosystem generated by BAS scientists have enabled analyses of variability and change, generating major insights into the dynamics of large-scale systems[2,4,7,8,12]. Large-scale climate effects have already been shown to be crucial in determining some aspects of ecosystem dynamics in the Scotia Sea and more broadly across the Southern Ocean[2,6]. Ocean ecosystem studies at BAS have also shown how local processes in Southern Ocean are linked to large-scale scale physical and biological processes[3-8,12]. Major advances are now possible in understanding the circumpolar operation of the ecosystem. A particular strength in developing this science in the Southern Ocean is the wide geographical coverage of the international scientific community providing the potential to achieve ocean-scale analyses. In the Southern

Ocean an ecosystem approach to the development of sustainable management procedures is also being pioneered. BAS scientists have had a major role in developing the science underpinning the development of an ecosystem approach under the Antarctic Treaty system through the Convention for Conservation of Antarctic Marine Living Resources (CCAMLR). Maintaining a leading role in the development of CCAMLR science is a requirement of BAS by the UK government through the FCO. The challenge in further developing the ecosystem approach is to include more realistic representations of ocean ecosystems.

The challenge in developing a predictive capacity for ocean ecosystem dynamics is to generate coupled models that include sufficient complexity to represent the system dynamics while maintaining enough simplicity to be able to parameterise and analyse the models. Developing such realistic models is the focus of international research effort and the studies undertaken so far have shown that a range of models and approaches will be required that vary in resolution and complexity so that an assessment can be made of what is a sufficient and appropriate model for a given study[1]. This requires a hierarchical scale-based view of the ecosystem in which the analyses and models developed are appropriate for the scale of biological processes that are of interest[17] (Fig. 1).

Programme Structure

DISCOVERY 2010 will undertake directed field studies, data syntheses and model development to generate analyses and models of ocean ecosystems. Programme level objectives are:

- *To determine how ocean ecosystem structure and function is related to environmental variability*
- *To develop scale-based analyses and models of ocean ecosystems*
- *To assess the role of the Southern Ocean ecosystem in the global ocean system*

Although centred upon krill in some key regions such as the Scotia Sea and around the coast in the Antarctic Coastal Current, the entire ecosystem is known to involve many other pathways of energy and material flow, for example through copepods and mesopelagic fish. For initial simplicity, our approach in analysing and modelling the ecosystem is to undertake studies that develop the krill-centred view, examining the implications of including more complexity. Our major emphases will be on the role of zooplankton, links to their predators and the environmental connections. This will involve detailed analyses of the life-cycles of key species of plankton, fish, seals and seabirds examining how these are linked to their environment. To examine how the dynamics of these groups are affected by their interactions in an ecosystem, the food-web context for the krill centred interactions will be explored. This will require analyses of the spatial and temporal variability and operation of the food-web with a particular focus on seasonality.

Through targeted studies and collaborations we will develop coupled analyses of the role of zooplankton in lower trophic level systems, in particular we will collaborate to examine the biogeochemical implications of including detailed life-cycles of zooplankton in biogeochemical analyses. Together these studies will allow consideration of the operation of the whole system from end-to-end. To give a context to the more focussed studies we will generate more general descriptions of the whole system by describing the components, their interactions and where possible quantifying their contribution. Through other targeted collaborations we will also examine links between ecosystem structure and biodiversity with a particular focus on the large-scale diversity of zooplankton communities and the importance of diversity in microbial systems. For both the regional Scotia Sea and circumpolar analyses we will undertake targeted analyses and model development building out from the krill. The development of the ecosystem approach to fulfil our CCAMLR commitments will draw on the basic scientific analyses developed elsewhere in the programme, again centred around krill, by including further interactions in the food-web and a more realistic physical environmental basis for the ecosystem. The multidisciplinary science programme will be delivered through 4 integrated projects (Fig. 2).

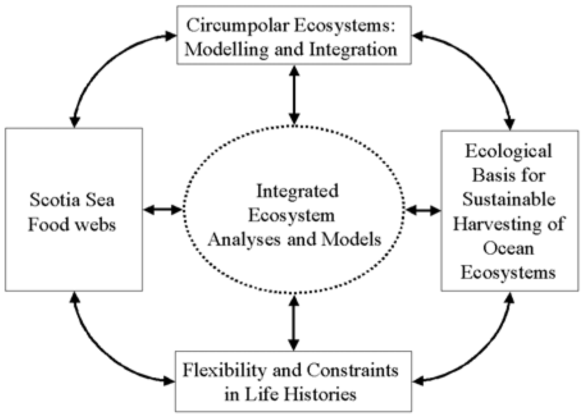


Figure 2. Modelling will be a central component of the programme and will link the activities in each project.

1. **Flexibility and Constraints in Life Histories (FLEXICON)** will examine how the life-histories of key species are linked to environmental processes.
2. **Scotia Sea Food-Webs (Food-Webs)** will examine the operation of Southern Ocean food-webs building out from the krill centred view.
3. **Ecological Basis for Sustainable Harvesting of Ocean Ecosystems (EBSHOE)** will develop ecosystem approaches to sustainable harvesting which will also provide input into CCAMLR for UK government.
4. **Circumpolar Ecosystems: Integration and Modelling (CEMI)** will examine the large-scale operation of ocean ecosystems by undertaking coupled physical-biological modelling and historical data syntheses building out from krill.

Integration will be an important aspect of the Programme linking the studies undertaken in the individual projects. There will be a modelling component in each Project that will be coordinated across the Programme and closely linked to the field effort. There will be targeted cruises focused on the life-cycles of krill and copepods, and the operation of the food-web centred on krill. Studies at sea will also be linked to year-round studies at Bird Island that allow analyses of how changes in the regional pelagic ecosystem affect higher predator dynamics. This will include recording changes in predator performance, satellite tracking and activity recording linked to environmental observation systems. Broader food-web based analyses will examine seasonal changes in abundance and diet composition. The analyses of temporal and spatial variability will draw on unique long-term datasets on predator foraging and breeding performance and krill abundance. With such a large-scale programme we cannot undertake all the required analyses in isolation so there will be coordinated collaborative studies targeting aspects where we require further input or expertise (Fig. 3). These collaborations include a range of ongoing externally funded projects and targeted proposals that are being developed under AFI and other international initiatives.

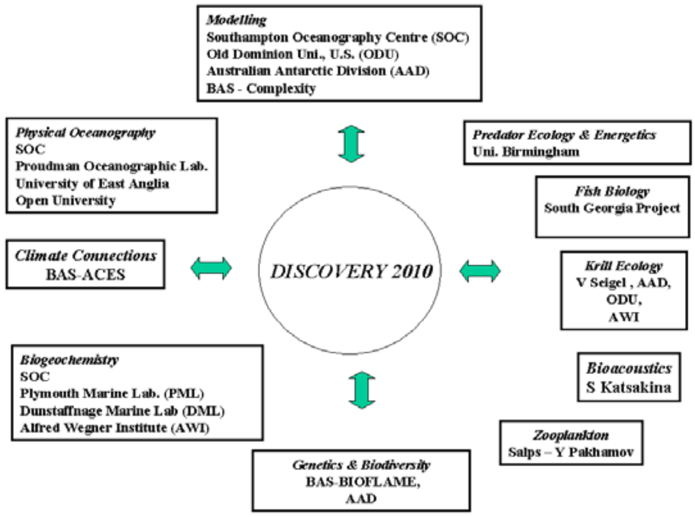


Figure 3. Major collaborations.

Leadership and Management

The PI will direct the integration of the science with a strong model focus in association with the Project Leaders. The PI and PL's will communicate the science to the widest possible audience including generation of primary science papers, input into international programmes, scientific meetings and to the public. To manage the programme the PI will form a steering committee with the Project Leaders, senior members of BSD and a modelling coordinator. The Project Leaders will have responsibility for delivery of the science through the projects.

Fit to NERC Strategy and the BAS Global Science in the Antarctic Context Programme

DISCOVERY 2010 will be a major contribution to the BAS and NERC strategies providing a leading role in Southern Ocean science on key aspects of ecosystem structure and function in relation to climate and the links to biogeochemical cycles and biodiversity. It will contribute to the development of analyses linking ocean ecosystems into earth system analyses and hence be a timely input to QUEST when it is able to include sufficient biology. The programme will act as a coordinating focus for national capability, be a major contribution to CCAMLR fulfilling BAS commitments to the FCO and UK government. The programme will help lead the development of circumpolar ocean science initiatives as part of the European Polar Board CIRCLE initiative, the International Integrated Circumpolar Climate and Ecosystem Dynamics (ICCED) initiative developing under IGBP IMBER/GLOBEC programmes and the Census of Marine Life (COML) and be a major UK input into the IPY. The circumpolar science initiative is being developed collaboratively with a range of groups with a strong commitment to developing a science programme: Prof Eileen Hofmann (US, ODU), Dr Steve Nicol (Australian Antarctic Division), Prof Uli Bathmann (Germany, AWI). Complementing this effort Dr Murphy is also the lead on the Southern Ocean component of the EUR-OCEANS network of excellence developing in the EU.

References

[1]GLOBEC: Marine Ecosystems and Global Change, *IGBP Science* No. 5., 2003.

[2]OCEANS/IMBER Integrating Marine Biogeochemistry and Ecosystem Research, Report, http://www.igbp.kva.se/obe/, 2003.

[3]Murphy, EJ, Clarke, A, Symon, C, Priddle, J, *Deep-Sea Res.,* 42:1045-1062, 1995.

[4]Murphy, EJ, Watkins, JL, Reid, K, Trathan, PN et al., , *Fish. Oeanog*., 7:381-390, 1998.

[5]Atkinson, A, Whitehouse, MJ, Priddle, J, Cripps, et al., *Mar. Ecol. Prog. Ser*., 216: 279-308, 2001.

[6]Reid, K and Croxall, JP, *Proc Roy Soc. Ser-B,* , 268: 377- 384, 2001.

[7]Trathan, PN and Murphy, EJ, *J. Geophys. Res*, 108, C4, art. no. 8075, 2002.

[8]Ward, P, Whitehouse, M, Meredith, M, Murphy, E, et al., *Deep-Sea Res*, 49:2183-2202, 2002.

[9]Fach, BA, Hofmann, EE, Murphy, EJ, *Mar. Ecol. Prog. Ser.,*231:187-203, 2002.

[10]Constable AJ, Nicol S, Strutton PG, *J. Geophys. Res*, 108 C4, art. no. 8079, 2003.

[11]Quetin LB, Ross RM, American Zoologist, 41:74-89, 2001.

[12]Meredith, MP, Watkins, JL, Murphy, EJ, et al., *J. Geophys. Res*, 108, C5, art. no. 3162, 2003.

[13]Loeb V, Siegel V, HolmHansen O, et al., Nature 387: 897-900,1997

[14]McGowan JA, Cayan DR, Dorman LM, *Science*, 281: 210-217,1998

[15]Smith RC, Ainley D, Baker K, Domack E, et al., Bioscience, 49 (5): 393-404, 1999

[16]Everson, I, Parkes, G, Kock, K_H, Boyd, IL, *J.App. Ecol.,* 36: 591-603, 1999.

[17]Murphy, EJ, Morris, DJ, Watkins, JL, Priddle, J, In: Saharage, D (ed), pp 120-130, 1988.

R.R.S. JAMES CLARK ROSS

BRITISH ANTARCTIC SURVEY

Uncontaminated Sea Water system Events During JR 161 Stanley to Stanley

Via Signy

Information Supplied By

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Appendix 3: Uncontaminated Sea Water system

UNCONTAMIATED SEA WATER SYSTEM EVENTS FOR OCTOBER 2006

DATE TIME LOCAL	TIME GMT	TIME ZONE	FILTER	PUMP	PROBE POSITION	EVENT	REMARKS	LOCATION CRUISE
23/11/2006 00:00	23/10/2006 00:00	GMT -3	-	-	Up	Water Off		Stanley
24/10/2006 17:32	24/11/2006 20:32	GMT -3	1	2	Mid	Water On	Sailed Stanley	JR 161
25/10/2006 08:10	25/11/2006 11:10	GMT -3	2	2	Mid	Filter Changeover and Clean		JR 161
26/10/2006 08:10	26/10/2006 11:10	GMT -3	1	2	Mid	Filter Changeover and Clean		JR 161
27/10/2006 08:10	27/10/2006 11:10	GMT -3	2	2	Mid	Filter Changeover and Clean		JR 161
28/10/2006 08:00	28/10/2006 11:00	GMT -3	1	2	Mid	Filter Changeover and Clean		JR 161
29/10/2006 08:04	29/10/2006 11:04	GMT -3	2	2	Mid	Filter Changeover and Clean		JR 161
30/10/2006 08:04	30/10/2006 11:04	GMT -3	1	2	Mid	Filter Changeover and Clean		JR 161
30/10/2006 08:06	30/10/2006 11:06	GMT -3	1	1	Mid	Pump Changeover		JR 161
31/10/2006 08:10	31/10/2006 11:10	GMT -3	2	1	Mid	Filter Changeover and Clean		JR 161

UNCONTAMINATED SEA WATER SYSTEM EVENTS FOR NOVEMBER 2006

DATE TIME LOCAL	TIME GMT	TIME ZONE	FILTER	PUMP	PROBE POSITION	EVENT	REMARKS	LOCATION CRUISE No
01/11/2006 08:10	01/11/2006 11:10	GMT -3	1	1	Mid	Filter Changeover and Clean		JR 161
02/11/2006 08:10	02/11/2006 11:10	GMT -3	2	1	Mid	Filter Changeover and Clean		JR 161
02/11/2006 08:10	03/11/2006 01:00	GMT -3	-	-	Up	Water Off	Water Off due to Ice	JR 161
03/11/2006 00:00	03/11/2006 00:00	GMT -3	-	-	Up	Water Off		JR 161
04/11/2006 15:20	04/11/2006 18:20	GMT -3	2	1	Mid	Water On		JR 161

05/11/2006 03:00	05/11/2006 06:00	GMT -3	-	-	Up	Water Off	Water Off due to Ice	JR 161
05/11/2006 08:10	05/11/2006 11:10	GMT -3	1	2	Mid	Water On		JR 161
05/11/2006 17:37	05/11/2006 20:37	GMT -3	-	-	Up	Water Off	Water Off due to Ice	JR 161
05/11/2006 19:20	05/11/2006 22:20	GMT -3	1	2	Mid	Water On		JR 161
06/11/2006 08:04	06/11/2006 11:04	GMT -3	2	2	Mid	Filter Changeover and Clean		JR 161
06/11/2006 08:06	06/11/2006 11:06	GMT -3	2	1	Mid	Pump Changeover		JR 161
06/11/2006 16:30	06/11/2006 19:30	GMT -3	-	-	Up	Water Off	Water Off due to Ice	JR 161
06/11/2006 19:04	06/11/2006 22:04	GMT -3	2	1	Mid	Water On		JR 161
06/11/2006 23:00	07/11/2006 02:00	GMT -3	-	-	Up	Water Off	Water Off due to Ice	JR 161
07/11/2006 07:38	07/11/2006 10:38	GMT -3	2	1	Mid	Water On		JR 161
08/11/2006 08:10	08/11/2006 11:10	GMT -3	1	1	Mid	Filter Changeover and Clean		JR 161
09/11/2006 08:10	09/11/2006 11:10	GMT -3	2	1	Mid	Filter Changeover and Clean		JR 161
09/11/2006 18:38	09/11/2006 21:38	GMT -3	2	1	Up	Probe Position Change	Probe up due to Ice	JR 161
09/11/2006 18:42	09/11/2006 21:42	GMT -3	2	1	Mid	Probe Position Change	Cleared Ice	JR 161
09/11/2006 22:00	10/11/2006 01:00	GMT -3	-	-	Up	Water Off	Water Off due to Ice	JR 161
10/11/2006 11:06	10/11/2006 14:06	GMT -3	2	1	Mid	Water On		JR 161
10/11/2006 17:15	10/11/2006 20:15	GMT -3	-	-	Up	Water Off	Water Off due to Ice	JR 161
10/11/2006 19:20	10/11/2006 22:20	GMT -3	2	1	Mid	Water On		JR 161
10/11/2006 20:00	10/11/2006 23:00	GMT -3	-	-	Up	Water Off	Water Off due to Ice	JR 161
11/11/2006 18:45	11/11/2006 21:45	GMT -3	2	1	Mid	Water On		JR 161

11/11/2006 00:00	11/11/2006 20:08	GMT -3	-	-	Up	Water Off	Water Off due to Ice	JR 161
12/11/2006 19:30	12/11/2006 22:30	GMT -3	2	1	Up	Water On		JR 161
12/11/2006 19:45	12/11/2006 22:45	GMT -3	-	-	Up	Water Off		JR 161
13/11/2006 11:12	13/11/2006 14:12	GMT -3	2	1	Mid	Water On		JR 161
13/11/2006 14:04	13/11/2006 17:04	GMT -3	-	-	Up	Water Off		JR 161/Signy
14/11/2006 00:00	14/11/2006 00:00	GMT -3	-	-	Up	Water Off All Day		JR 161/Signy
15/11/2006 08:00	15/11/2006 11:00	GMT -3	1	1	Mid	Water On		JR 161
16/11/2006 08:10	16/11/2006 11:10	GMT -3	2	1	Mid	Filter Changeover and Clean		JR 161
17/11/2006 08:10	17/11/2006 11:10	GMT -3	1	1	Mid	Filter Changeover and Clean		JR 161

UNCONTAMINATED SEA WATER SYSTEM EVENTS FOR NOVEMBER 2006

DATE TIME LOCAL	TIME GMT	TIME ZONE	FILTER	PUMP	PROBE POSITION	EVENT	REMARKS	LOCATION CRUISE No
18/11/2006 08:10	18/11/2006 11:10	GMT -3	2	1	Mid	Filter Changeover and Clean		JR 161
19/11/2006 08:10	19/11/2006 11:10	GMT -3	1	1	Mid	Filter Changeover and Clean		JR 161
20/11/2006 08:02	20/11/2006 11:02	GMT -3	1	2	Mid	Pump Changeover		JR 161
20/11/2006 08:10	20/11/2006 11:10	GMT -3	2	2	Mid	Filter Changeover and Clean		JR 161
21/11/2006 08:10	21/11/2006 11:10	GMT -3	2	1	Mid	Filter Changeover and Clean		JR 161
22/11/2006 08:10	22/11/2006 11:10	GMT -3	2	2	Mid	Filter Changeover and Clean		JR 161
23/11/2006 08:00	23/11/2006 11:00	GMT -3	1	2	Mid	Filter Changeover and Clean		JR 161
24/11/2006 08:10	24/11/2006 11:10	GMT -3	2	1	Mid	Filter Changeover and Clean		JR 161
25/11/2006 08:00	25/11/2006 11:00	GMT -3	1	2	Mid	Filter Changeover and Clean		JR 161
26/11/2006 08:10	26/11/2006 11:10	GMT -3	2	2	Mid	Filter Changeover and Clean		JR 161
27/11/2006 08:08	27/11/2006 11:08	GMT -3	2	1	Mid	Pump Changeover		JR 161
27/11/2006 08:10	27/11/2006 11:10	GMT -3	1	1	Mid	Filter Changeover and Clean		JR 161
28/11/2006 08:10	28/11/2006 11:10	GMT -3	2	1	Mid	Filter Changeover and Clean		JR 161
29/11/2006 08:10	29/11/2006 11:10	GMT -3	1	1	Mid	Filter Changeover and Clean		JR 161
30/11/2006 08:10	30/11/2006 11:10	GMT -3	2	1	Mid	Filter Changeover and Clean		JR 161

UNCONTAMINATED SEA WATER SYSTEM EVENTS FOR DECEMBER 2006

DATE TIME LOCAL	TIME GMT	TIME ZONE	FILTER	PUMP	PROBE POSITION	EVENT	REMARKS	LOCATION CRUISE No
01/12/2006 08:10	01/12/2006 11:10	GMT -3	1	1	Mid	Filter Changeover and Clean		JR 161
02/12/2006 08:10	02/12/2006 11:10	GMT -3	2	1	Mid	Filter Changeover and Clean		JR 161
02/11/2006 22:00	03/12/2006 01:00	GMT -3	-	-	Up	Water Off		Stanley FI
03/12/2006 08:00	03/12/2006 11:00	GMT -3	-	-	Up	Water Off	Alongside Stanley FI	Stanley FI

Appendix 4: JR161 Event Log

Time	Event	Code	Lat	Lon	Comment
29/11/2006 17:52	293	BONGO	-50.0438	-38.03731	Gantry Secure hove to till conditions improve
29/11/2006 17:44	293	BONGO	-50.04321	-38.03778	Bongo nets recovered
29/11/2006 17:28	293	BONGO	-50.04121	-38.03967	Bongo nets @ 400m and recovering
29/11/2006 17:17	293	BONGO	-50.0399	-38.04144	Bongo deployed
29/11/2006 17:12	293	BONGO	-50.03985	-38.04139	vessel stopped on D.P. for Bongo deployment
29/11/2006 16:00	292	ACOUSTIC	-50.00069	-38.16438	complete acoustic survey proceeding towards condensed station 6
29/11/2006 14:41	292	ACOUSTIC	-49.77718	-38.16189	Commence 3rd leg of acoustic transect
29/11/2006 13:59	292	ACOUSTIC	-49.77552	-38.02675	End of 2nd leg of acoustic transect
29/11/2006 11:24	292	ACOUSTIC	-50.11295	-38.02579	Commence 2nd leg of acoustic transect
29/11/2006 10:21	292	ACOUSTIC	-50.11033	-37.88615	Completed first transect. Repositioning for start of second transect.
29/11/2006 09:41	292	ACOUSTIC	-49.99966	-37.88543	Commenced first transect. Co 180 at 10kts
29/11/2006 08:50		ACOUSTIC	-50.0145	-37.99898	Midships gantry secured. Vessel out of DP and repositioning for start of Acoustic Survey
29/11/2006 08:38	291	BONGO	-50.01449	-37.99899	Bongo Nets on board.
29/11/2006 08:37	291	BONGO	-50.01443	-37.99901	Bongo Nets at the surface.
29/11/2006 08:19	291	BONGO	-50.01194	-37.99905	Bongo nets @ 400m and recovering
29/11/2006 08:09	291	BONGO	-50.01067	-37.99905	Bongo Nets d
29/11/2006 08:08	290	BONGO	-50.01038	-37.99902	Bongo Nets on board.
29/11/2006 08:07	290	BONGO	-50.01028	-37.999	Bongo Nets at the surface.
29/11/2006 07:51	290	BONGO	-50.0075	-37.99897	Bongo nets @ 400m and recovering
29/11/2006 07:40	290	BONGO	-50.00544	-37.99892	Bongo nets deployed
29/11/2006 07:36	289	CTD	-50.00544	-37.99892	CTD on deck.
29/11/2006 07:35	289	CTD	-50.00542	-37.99891	CTD at the surface.
29/11/2006 07:27	289	CTD	-50.00543	-37.99893	CTD @ 25m Commenced recovery.
29/11/2006 07:23	289	CTD	-50.00543	-37.99886	CTD deployed
29/11/2006 07:10	288	MINIBONGO	-50.00537	-38.00043	Mini Bongos on Deck

29/11/2006 07:09	288	MINIBONGO	-50.00517	-38.00039	Mini Bongos at the surface
29/11/2006 06:52	288	MINIBONGO	-50.00168	-38.00003	Mini Bongos @ 400m and Recovering
29/11/2006 06:42	288	MINIBONGO	-50.00009	-37.99985	Mini Bongos Deployed
29/11/2006 06:37	287	CTD	-50.00007	-37.99985	CTD recovered
29/11/2006 06:19	287	CTD	-50.00009	-37.99987	CTD @ 400m and recovering
29/11/2006 06:08	287	CTD	-50.00008	-37.99987	CTD deployed
29/11/2006 05:51	287	CTD	-50.00042	-37.99992	Vessel on D.P. ready to deploy
29/11/2006 05:44	287	CTD	-50.00042	-37.99683	Slowing for Process Station six
29/11/2006 04:45	286	MULTINET	-49.81172	-37.94758	Deck Secure proceeding to condensed process station 6
29/11/2006 04:34	286	MULTINET	-49.8132	-37.94832	Muli-net recovered
29/11/2006 04:31	286	MULTINET	-49.8149	-37.94877	Multinet @ Surface
29/11/2006 03:12	286	MULTINET	-49.85681	-37.95613	multinet @ 2224m wire out and recovering
29/11/2006 01:57	286	MULTINET	-49.90209	-37.96785	Muli-net deployed
29/11/2006 01:29	285	MULTINET	-49.90744	-37.96939	Multinet recovered due to problem with net
29/11/2006 01:23	285	MULTINET	-49.91173	-37.97089	Multinet Deployed
29/11/2006 00:54	284	LHPR	-49.91601	-37.97224	LHPR Recovered
28/11/2006 23:52	284	LHPR	-49.9734	-37.98694	LHPR @ 1913m increase speed to 3.5kts
28/11/2006 23:02	284	LHPR	-49.99932	-37.99988	LHPR Deployed @ 2.0kts
28/11/2006 22:15	283	RMT-25	-49.90975	-38.13458	RMT 25 on deck. Not feeling very well so repositioning for LHPR deployment!
28/11/2006 22:02	283	RMT-25	-49.91075	-38.1319	RMT 25 at the surface
28/11/2006 20:33	283	RMT-25	-49.95669	-38.04513	RMT 25 @ 1879m cable out. Commence hauling
28/11/2006 19:11	283	RMT-25	-49.99484	-37.98122	RMT 25 Deployed
28/11/2006 19:00	283	RMT-25	-50.00474	-37.97603	Slowing for RMT 25 deployment
28/11/2006 18:12	282	RMT-25	-50.01409	-38.18861	RMT 25 recovered. Repositioning vessel for next run
28/11/2006 18:06	282	RMT-25	-50.01457	-38.1839	RMT 25 @ Surface
28/11/2006 16:48	282	RMT-25	-50.02157	-38.10134	RMT 25 @ 740m and recovering
28/11/2006 16:24	282	RMT-25	-50.0238	-38.07564	RMT 25 Deployed @ 2.5kts
28/11/2006 16:20	282	RMT-25	-50.02398	-38.07176	Deploying RMT 25
28/11/2006 16:15	282	RMT-25	-50.03224	-38.04852	Slowing for RMT 25 deployment
28/11/2006 15:46	281	LHPR	-50.07971	-38.17571	LHPR recovered repositioning vessel for RMT 25 deployment.

28/11/2006 15:43	281	LHPR	-50.07943	-38.1721	LHPR @ surface
28/11/2006 14:26	281	LHPR	-50.03745	-38.06201	LHPR @ 2255m cable out
28/11/2006 14:19	281	LHPR	-50.03385	-38.05201	Increase to 3.5 knots
28/11/2006 13:23	281	LHPR	-50.01146	-37.99889	LHPR Deployed @ 2.0kts
28/11/2006 13:17		LHPR	-50.01011	-37.99585	V/L off DP preparing to deploy LHPR
28/11/2006 13:11	280	FRRF	-50.01011	-37.99582	FRRF recovered
28/11/2006 12:53	280	FRRF	-50.0101	-37.99588	FRRF @ 150m commence recovery
28/11/2006 12:39	280	FRRF	-50.01008	-37.99594	FRRF deployed
28/11/2006 12:30	279	GO-FLO	-50.01009	-37.99594	Go-flo recovered
28/11/2006 12:04	279	GO-FLO	-50.00804	-37.99666	commence recovery of go-flo
28/11/2006 11:50	279	GO-FLO	-50.00682	-37.99699	Go-flo @ depth 1000m bottles triggered bottles triggered
28/11/2006 11:21	279	GO-FLO	-50.0042	-37.99759	Deploying Go flo first bottle deployed first bottle deployed
28/11/2006 11:09	278	CTD	-50.00418	-37.99763	CTD Recovered
28/11/2006 10:45	278	CTD	-50.0042	-37.99764	CTD @ 140m Commenced recovery. Commenced recovery.
28/11/2006 10:39	278	CTD	-50.00419	-37.99763	CTD deployed
28/11/2006 10:31	277	BONGO	-50.00414	-37.9977	Bongo Nets on board.
28/11/2006 10:29	277	BONGO	-50.00398	-37.99782	Bongo Nets at the surface.
28/11/2006 10:11	277	BONGO	-50.00163	-37.99922	Bongo nets @ 400m and recovering
28/11/2006 10:00	277	BONGO	-50.00065	-37.99972	Bongo deployed
28/11/2006 09:55	276	CTD	-50.00065	-37.99972	CTD on deck.
28/11/2006 09:53	276	CTD	-50.00066	-37.99972	CTD at the surface.
28/11/2006 08:08	276	CTD	-50.00069	-37.99977	CTD @ 5114m Commencing recovery. Commencing recovery.
28/11/2006 06:39	276	CTD	-49.9996	-38.00069	CTD deployed
28/11/2006 06:31	276	CTD	-49.99962	-38.0007	Vessel on DP at station for CTD
28/11/2006 06:25	276	CTD	-49.9973	-38.00558	slowing for condensed station six
28/11/2006 05:13	275	RMT-25	-50.20243	-38.19042	Deck Secure proceeding to condensed process station 6
28/11/2006 04:52	275	RMT-25	-50.19688	-38.19278	RMT 25 recovered
28/11/2006 04:44	275	RMT-25	-50.19078	-38.18775	RMT 25 @ Surface
28/11/2006 03:36	275	RMT-25	-50.13601	-38.1485	RMT 25 @ 742m and recovering
28/11/2006 03:00	275	RMT-25	-50.10324	-38.12951	RMT deployed

28/11/2006 02:53		RMT-25	-50.0995	-38.12602	Vessel off DP preparing for RMT deployment
28/11/2006 02:27	274	FRRF	-50.09875	-38.12643	FRRF recovered
28/11/2006 02:13	274	FRRF	-50.09651	-38.12861	FRRF @ 150m commence recovery commence recovery
28/11/2006 02:04	274	FRRF	-50.09557	-38.12909	FRRF deployed
28/11/2006 02:03	274	FRRF	-50.09557	-38.1291	V/L on DP for FRRF
28/11/2006 01:51	273	RMT-25	-50.09271	-38.12884	RMT Recovered
27/11/2006 23:52	273	RMT-25	-50.00273	-38.0256	RMT 25 @ 2126m (cable out)
27/11/2006 22:50	273	RMT-25	-49.96331	-37.96272	RMT 25 deployed.
27/11/2006 22:39		RMT-25	-49.96056	-37.95161	Turning into wind and reducing speed for RMT 25 deployment.
27/11/2006 05:17			-52.90851	-40.10388	Gantry Secure thruster vents closed moving to Condensed Process station six thruster vents closed moving to Condensed Process station six thruster vents closed moving to Condensed Process station six
27/11/2006 05:06	272	BONGO	-52.90471	-40.10197	Bongo nets recovered
27/11/2006 04:49	272	BONGO	-52.90356	-40.10468	Bongo nets @ 400m
27/11/2006 04:38	272	BONGO	-52.90343	-40.10499	Bongo deployed
27/11/2006 04:33	271	FRRF	-52.90341	-40.10493	FRRF recovered
27/11/2006 04:16	271	FRRF	-52.90342	-40.10493	FRRF @ 150m
27/11/2006 04:05	271	FRRF	-52.90341	-40.10492	FRRF deployed
27/11/2006 03:59	271	FRRF	-52.9033	-40.10505	Vessel on D.P. ready to deploy
27/11/2006 03:54	271	FRRF	-52.90202	-40.10961	Slowing for FRRF station
27/11/2006 03:15	270	RMT-25	-53.00327	-40.13294	Deck Secure proceeding to process station 3
27/11/2006 03:09	270	RMT-25	-52.99781	-40.12731	RMT 25 recovered
27/11/2006 03:03	270	RMT-25	-52.99296	-40.12236	RMT 25 @ Surface
27/11/2006 02:44	270	RMT-25	-52.97964	-40.10841	RMT @ 43m
27/11/2006 02:42	270	RMT-25	-52.97779	-40.1059	RMT 25 deployed for target fishing
27/11/2006 02:04	269	RMT-25	-52.98532	-40.11484	RMT Recovered
26/11/2006 23:59	269	RMT-25	-52.86871	-40.09751	RMT 25 @ 2267m (cable out)
26/11/2006 22:54	269	RMT-25	-52.8057	-40.08132	RMT 25 Deployed
26/11/2006 22:40		RMT-25	-52.79239	-40.07781	Vessel out of DP and driving ahead for RMT 25 deployment.
26/11/2006 21:57		RMT-25	-52.79192	-40.07764	Vessel stopped on station in D.P. Awaiting RMT 25 deployment.

26/11/2006 21:50		RMT-25	-52.79234	-40.07772	Vessel approaching station. Reducing speed.
26/11/2006 20:26		RMT-25	-53.07691	-40.1167	Repositioning for RMT 25 deployment
26/11/2006 20:23	268	MULTINET	-53.07403	-40.11547	Muti Net on deck.
26/11/2006 20:21	268	MULTINET	-53.07259	-40.11496	Multinet @ Surface
26/11/2006 19:07	268	MULTINET	-53.01772	-40.09454	Multinet at 1987m and recovering
26/11/2006 18:09	268	MULTINET	-52.976	-40.08003	Multinet Deployed @ 2kt
26/11/2006 18:07	268	MULTINET	-52.97409	-40.0792	deploying multinet
26/11/2006 17:33	267	RMT-25	-52.96936	-40.07653	RMT 25 recovered
26/11/2006 17:26	267	RMT-25	-52.9627	-40.07285	RMT 25 @ Surface
26/11/2006 16:59	267	RMT-25	-52.94028	-40.05868	Hauling for recovery
26/11/2006 15:20	267	RMT-25	-52.85337	-40.02018	RMT 25 @ 2050m (cable out)
26/11/2006 14:25	267	RMT-25	-52.8061	-40.00328	RMT deployed
26/11/2006 14:09	266	ACOUSTIC	-52.79618	-39.99039	End of 3rd transect a/c head to wind and reduce to 2.5knots for RMT deployment a/c head to wind and reduce to 2.5knots for RMT deployment
26/11/2006 12:48	266	ACOUSTIC	-52.9553	-39.72734	Commence 3rd transect
26/11/2006 12:11	266	ACOUSTIC	-53.01755	-39.83493	End of 2nd transect
26/11/2006 09:29	266	ACOUSTIC	-52.69937	-40.36048	Commenecd second transect
26/11/2006 08:51	266	ACOUSTIC	-52.76463	-40.46207	Completed first transect. Repositioning for start of second transect.
26/11/2006 07:30	266	ACOUSTIC	-52.92395	-40.19898	Commenced first transect. Co 315 at 10kts
26/11/2006 07:15		ACOUSTIC	-52.93759	-40.17631	Vessel out of DP and positioning for start of acoustic survey run.
26/11/2006 05:52	265	ACOUSTIC	-52.97363	-40.30855	deck secure proceeding to acoustic survey run
26/11/2006 05:46	265	RMT-25	-52.96975	-40.31362	RMT 25 recovered
26/11/2006 05:38	265	RMT-25	-52.96352	-40.32156	RMT 25 @ Surface
26/11/2006 04:44	265	RMT-25	-52.9295	-40.36901	RMT @ 330m
26/11/2006 04:26	265	RMT-25	-52.91863	-40.38513	RMT 25 Deployed @ 2.5kts
26/11/2006 04:22	265	RMT-25	-52.91602	-40.38888	Continue deployment
26/11/2006 04:10	265	RMT-25	-52.90768	-40.40031	Stop deployment due to tangled cod ends
26/11/2006 04:07	265	RMT-25	-52.90536	-40.4035	Re-deploying RMT 25
26/11/2006 03:45	265	RMT-25	-52.89581	-40.41687	RMT 25 recovered
26/11/2006 03:34	265	RMT-25	-52.88835	-40.427	recovering RMT due to fault

26/11/2006 03:30	265	RMT-25	-52.88547	-40.43072	RMT 25 Deployed @ 2.5kts
26/11/2006 03:25	265	RMT-25	-52.88207	-40.43587	Deploying RMT 25
26/11/2006 03:22		RMT-25	-52.88115	-40.43781	Vessel off DP preparing for RMT deployment
26/11/2006 02:38		RMT-25	-52.88107	-40.43779	V/L on DP while RMT is prepared
26/11/2006 02:31	264	MULTINET	-52.87845	-40.43765	Muli-net recovered
26/11/2006 01:25	264	MULTINET	-52.83781	-40.39937	Multinet at 2034m and recovering
26/11/2006 00:23	264	MULTINET	-52.8035	-40.35264	Muli-net deployed
25/11/2006 23:21	262	MULTINET	-52.79926	-40.34025	Muli-net recovered
25/11/2006 22:34	263	TOW-FISH	-52.77937	-40.28921	Tow fish deployed
25/11/2006 22:08	262	MULTINET	-52.76966	-40.26289	Multinet at 2178m and recovering
25/11/2006 21:00	262	MULTINET	-52.74138	-40.18687	Multinet Deployed @2kt
25/11/2006 20:15		MULTINET	-52.72387	-40.14835	Vessel out of DP and moving clear. Rigging for Multnet deployment.
25/11/2006 20:09	261	MOORING	-52.72299	-40.14664	Ship positioned over mooring to confirm position. Vessel then moving off head to wind.
25/11/2006 19:52	261	MOORING	-52.72321	-40.14731	Rig slipped.
25/11/2006 19:51	261	MOORING	-52.7232	-40.14729	Main Buoy in the water.
25/11/2006 19:48	261	MOORING	-52.72322	-40.14732	Acoustic Recording Package in the water.
25/11/2006 19:40	261	MOORING	-52.72323	-40.14731	Acoustic Recording Package and Main Buoy attached.
25/11/2006 19:29	261	MOORING	-52.72322	-40.14729	SBE CTD connected and deployed
25/11/2006 18:36	261	MOORING	-52.72324	-40.14726	Trimsin cluster connected & deployed
25/11/2006 18:30	261	MOORING	-52.72324	-40.14728	Sediment trap & Aquadoop current meter connected and deployed
25/11/2006 17:55	261	MOORING	-52.72323	-40.14726	continue veering
25/11/2006 17:40	261	MOORING	-52.72321	-40.1473	stop to rig chain block on kevlar rope to improve lead
25/11/2006 17:18	261	MOORING	-52.72311	-40.14732	Acoustic release connected and deployed
25/11/2006 17:11	261	MOORING	-52.72311	-40.14733	weights deployed
25/11/2006 17:09	261	MOORING	-52.72312	-40.14734	commence mooring deployment
25/11/2006 16:42	261	MOORING	-52.72307	-40.14716	vessel stopped on DP stern over deployment pos'n HDG 240T stern over deployment pos'n HDG 240T
25/11/2006 16:27	261	MOORING	-52.72254	-40.14765	slowing for mooring site deployment
25/11/2006 15:51		MOORING	-52.8045	-40.03567	A/C to 323T proceeding towards chosen deployment site (52 43.387S 40 08.798W) (52 43.387S 40 08.798W)

25/11/2006 15:18		SWATH	-52.74652	-40.13887	A/C to 135T commence second swath run
25/11/2006 14:08		SWATH	-52.86529	-40.0881	v/l off DP commencing swath survey for mooring deployment
25/11/2006 13:59	260	MINIBONGO	-52.86527	-40.08815	Mini Bongos Recovered
25/11/2006 13:43	260	MINIBONGO	-52.86457	-40.0895	Mini bongo @ 400m commence hauling
25/11/2006 13:42	168	TOW-FISH	-52.8645	-40.08961	Tow fish recovered
25/11/2006 13:27	260	MINIBONGO	-52.86364	-40.09133	Mini bongo deployed
25/11/2006 13:21	259	CTD	-52.86357	-40.09131	CTD Recovered
25/11/2006 12:39	259	CTD	-52.8636	-40.0913	CTD @ 2000m Commencing recovery. Commencing recovery.
25/11/2006 12:01	259	CTD	-52.86361	-40.09132	CTD deployed
25/11/2006 11:52	258	BONGO	-52.86357	-40.09139	Bongo nets recovered
25/11/2006 11:35	258	BONGO	-52.86263	-40.09241	Bongo nets @ 400m and recovering
25/11/2006 11:24	258	BONGO	-52.86193	-40.09328	Bongo nets deployed
25/11/2006 11:18	257	CTD	-52.86193	-40.09328	CTD recovered
25/11/2006 11:08	257	CTD	-52.86193	-40.09331	CTD @ 30m and recovering
25/11/2006 11:04	257	CTD	-52.8619	-40.09331	CTD Deployed
25/11/2006 10:52	256	FRRF	-52.86191	-40.09333	FRRF on deck.
25/11/2006 10:51	256	FRRF	-52.86189	-40.09333	FRRF at the surface.
25/11/2006 10:39	256	FRRF	-52.8619	-40.09334	FRRF @ 150m commence recovery commence recovery
25/11/2006 10:28	256	FRRF	-52.86192	-40.0933	FRRF deployed
25/11/2006 10:22	255	GO-FLO	-52.86188	-40.09337	Go Flo recovered to deck. Setting up for FRRF.
25/11/2006 10:10	255	GO-FLO	-52.86138	-40.09404	Second Go Flo bottle removed
25/11/2006 10:02	255	GO-FLO	-52.86103	-40.0945	Third Go Flo bottle removed.
25/11/2006 09:59	255	GO-FLO	-52.8609	-40.0947	Fourth Go Flo bottle removed
25/11/2006 09:57	255	GO-FLO	-52.86081	-40.09479	Fifth Go Flo bottle removed
25/11/2006 09:55	255	GO-FLO	-52.86073	-40.09488	Sixth Go Flo bottle removed
25/11/2006 09:54	255	GO-FLO	-52.8607	-40.09495	Commenced Go Flo recovery
25/11/2006 09:37	255	GO-FLO	-52.85991	-40.0959	Go Flo wire at 1000m Trigger weight deployed.
25/11/2006 09:36	255	GO-FLO	-52.8599	-40.09593	Sixth Go Flo bottle attached
25/11/2006 09:34	255	GO-FLO	-52.8598	-40.09601	Fifth Go Flo bottle attached
25/11/2006 09:30	255	GO-FLO	-52.85961	-40.09624	Fourth Go Flo bottle attached

25/11/2006 09:27	255	GO-FLO	-52.85943	-40.09643	Third Go Flo bottle attached
25/11/2006 09:20	255	GO-FLO	-52.85911	-40.09679	Second Go Flo bottle attached.
25/11/2006 09:08	255	GO-FLO	-52.85903	-40.09685	Go Flo deployed with first bottle
25/11/2006 08:58	254	CTD	-52.85903	-40.09693	CTD on deck. Setting up for Go Flo.
25/11/2006 08:56	254	CTD	-52.85904	-40.09695	CTD at the surface.
25/11/2006 08:38	254	CTD	-52.85903	-40.09696	CTD @ 140m Commenced recovery. Commenced recovery.
25/11/2006 08:31	254	CTD	-52.85901	-40.09691	CTD deployed
25/11/2006 08:18		CTD	-52.85862	-40.09601	Vessel approaching CTD station. Setting up in DP. Midships gantry unlashed.
25/11/2006 08:08		CTD	-52.86429	-40.10138	Vessel approaching CTD station. Reducing speed and turning.
25/11/2006 06:00	253	RMT-25	-53.09037	-40.70085	Deck Secure proceeding to process station 3
25/11/2006 05:27	253	RMT-25	-53.0885	-40.67714	RMT 25 recovered cod ends recovered with use of Gilson winch cod ends recovered with use of Gilson winch
25/11/2006 05:11	253	RMT-25	-53.08454	-40.65982	RMT 25 @ Surface
25/11/2006 04:00	253	RMT-25	-53.05017	-40.56151	RMT 25 @ 822m (cable out)
25/11/2006 03:30	253	RMT-25	-53.03058	-40.51789	RMT 25 Deployed @ 2.5kts
25/11/2006 03:25	253	RMT-25	-53.0273	-40.51252	Deploying RMT 25
25/11/2006 03:08		RMT-25	-53.02538	-40.50542	Midships gantry secured vessel out of D.P. and moving off for RMT 25 deployment. vessel out of D.P. and moving off for RMT 25 deployment.
25/11/2006 02:56	252	FRRF	-53.0231	-40.50078	FRRF recovered
25/11/2006 02:40	252	FRRF	-53.02311	-40.50078	FRRF @ 150m commence recovery commence recovery
25/11/2006 02:29	252	FRRF	-53.02307	-40.50068	FRRF deployed
25/11/2006 02:16		FRRF	-53.02308	-40.50067	V/L on DP for FRRF
25/11/2006 02:13	251	LHPR	-53.02252	-40.49666	LHPR Recovered
25/11/2006 00:51	251	LHPR	-52.97053	-40.38069	LHPR @ 2290m cable out commence hauling commence hauling
25/11/2006 00:49	251	LHPR	-52.96923	-40.37846	Increase to 3.5 knots
24/11/2006 23:51	251	LHPR	-52.93773	-40.33649	LHPR Deployed @ 2.0kts
24/11/2006 23:38	250	LHPR	-52.93247	-40.32457	LHPR Recovered
24/11/2006 22:25	250	LHPR	-52.895	-40.21484	LHPR @ 2019m increase speed to 3.5kts commence hauling increase speed to 3.5kts commence hauling
24/11/2006 21:27	250	LHPR	-52.87442	-40.15507	LHPR Deployed @ 2.0kts

24/11/2006 21:23		LHPR	-52.87393	-40.1525	Vessel out of DP and moving off for LHPR re-deployment.
24/11/2006 20:35		LHPR	-52.87384	-40.15252	Vessel stopped and returned to full auto DP. Awaiting result of investigation into problem with LHPR.
24/11/2006 20:26	250	LHPR	-52.87191	-40.14504	LHPR on deck for investigation. Ship still moving ahead at 2kts.
24/11/2006 20:24	250	LHPR	-52.87118	-40.14246	LHPR deployment aborted returning unit to deck. returning unit to deck.
24/11/2006 20:22	250	LHPR	-52.87057	-40.14008	Commenced deployment of LHPR
24/11/2006 20:19		LHPR	-52.87018	-40.13891	Midships Gantry Secure vessel out of DP and moving off for LHPR deployment. vessel out of DP and moving off for LHPR deployment.
24/11/2006 20:11	249	CTD	-52.87022	-40.13888	CTD on deck.
24/11/2006 20:07	249	CTD	-52.87022	-40.13886	CTD at the surface.
24/11/2006 18:50	249	CTD	-52.87021	-40.13885	CTD @ 3733m
24/11/2006 17:42	249	CTD	-52.87018	-40.13883	CTD deployed
24/11/2006 17:30	248	GO-FLO	-52.87015	-40.1388	Go Flo recovered
24/11/2006 17:01	248	GO-FLO	-52.87017	-40.13929	Commence hauling go-flo
24/11/2006 16:50	248	GO-FLO	-52.87014	-40.13933	Go flo at depth (500m)
24/11/2006 16:40	248	GO-FLO	-52.87023	-40.13931	5th go-flo bottle attached to cable
24/11/2006 16:38	248	GO-FLO	-52.87022	-40.13922	4th go-flo bottle attached to cable
24/11/2006 16:35	248	GO-FLO	-52.87023	-40.13922	3rd glo-flo bottle attached to cable
24/11/2006 16:26	248	GO-FLO	-52.87021	-40.13926	2nd Go Flow bottle attached to the cable
24/11/2006 16:14	248	GO-FLO	-52.87024	-40.13929	Go Flo deployed with first bottle
24/11/2006 16:04	247	CTD	-52.87021	-40.13932	CTD recovered
24/11/2006 15:53	247	CTD	-52.87023	-40.13923	CTD @ 30m
24/11/2006 15:49	247	CTD	-52.87024	-40.13924	CTD deployed
24/11/2006 15:25	246	BONGO	-52.87025	-40.13923	Bongo nets recovered
24/11/2006 15:20	246	BONGO	-52.87025	-40.13925	Bongo nets @125m
24/11/2006 15:16	246	BONGO	-52.87023	-40.13933	Bongo nets deployed
24/11/2006 15:09	245	CTD	-52.87022	-40.13933	CTD recovered
24/11/2006 14:47	245	CTD	-52.87021	-40.13921	CTD @ 400m and recovering
24/11/2006 14:34	245	CTD	-52.87026	-40.13925	CTD deployed
24/11/2006 14:25	244	FRRF	-52.87026	-40.13926	FRRF recovered

24/11/2006 14:05	244	FRRF	-52.87023	-40.13927	FRRF @ 150m and recovering
24/11/2006 13:51	244	FRRF	-52.87028	-40.1392	FRRF Deployed
24/11/2006 13:46	243	CTD	-52.87025	-40.13923	CTD Recovered
24/11/2006 13:23	243	CTD	-52.87021	-40.13918	CTD @ 140m and recovering
24/11/2006 13:14	243	CTD	-52.87024	-40.13924	CTD Deployed
24/11/2006 13:07	242	MINIBONGO	-52.87023	-40.13924	Mini Bongos Recovered
24/11/2006 12:51	242	BONGO	-52.87024	-40.13928	Bongo nets @ 400m
24/11/2006 12:38	242	MINIBONGO	-52.87028	-40.13931	Mini Bongos Deployed
24/11/2006 12:35	241	CTD	-52.87023	-40.13926	CTD recovered
24/11/2006 11:50	241	CTD	-52.87031	-40.13922	CTD @ 2000m
24/11/2006 11:12	241	CTD	-52.87028	-40.1392	CTD deployed
24/11/2006 10:51		CTD	-52.87028	-40.13916	Vessel stopped on station in D.P. Setting up for CTD deployment.
23/11/2006 16:40		MOORING	-55.26694	-41.12083	Turned on swath for mooring postion
23/11/2006 16:39			-52.86811	-40.36564	Science suspended due to weather vessel hove to vessel hove to
23/11/2006 16:35	240	ACOUSTIC	-52.86748	-40.35793	Acoustic transect abandoned due to bad weather
23/11/2006 15:09	240	ACOUSTIC	-52.87419	-40.20403	Start acoustic transect PS3_T1 4-6
23/11/2006 14:11			-52.88163	-40.08742	Vessel moving off station to head 270 for swath survey
23/11/2006 13:50	239	CTD	-52.88104	-40.08784	CTD Recovered
23/11/2006 13:08	239	CTD	-52.87766	-40.08953	CTD @ 2000m
23/11/2006 12:31	239	CTD	-52.87573	-40.09108	CTD deployed
23/11/2006 12:20	238	BONGO	-52.87515	-40.09144	Bongo nets recovered
23/11/2006 12:03	238	BONGO	-52.87435	-40.09211	Bongo nets @ 400m
23/11/2006 11:52	238	BONGO	-52.87381	-40.09271	Bongo nets deployed
23/11/2006 11:46	237	CTD	-52.87354	-40.09297	CTD recovered
23/11/2006 11:36	237	CTD	-52.87351	-40.09299	CTD @ 30m
23/11/2006 11:31	237	CTD	-52.8735	-40.09298	CTD deployed
23/11/2006 11:21	236	FRRF	-52.87331	-40.09309	FRRF recovered
23/11/2006 11:02	236	FRRF	-52.87123	-40.09371	FRRF @ 150m commence recovery commence recovery
23/11/2006 10:51	236	FRRF	-52.87012	-40.09403	FRRF deployed
23/11/2006 10:38	235	GO-FLO	-52.8686	-40.09452	Go Flo recovered to deck.

23/11/2006 10:25	235	GO-FLO	-52.86718	-40.09492	Second Go Flo bottle removed
23/11/2006 10:17	235	GO-FLO	-52.86632	-40.09513	Third Go Flo bottle removed.
23/11/2006 10:14	235	GO-FLO	-52.866	-40.09523	Third Go Flo bottle removed.
23/11/2006 10:12	235	GO-FLO	-52.86578	-40.09532	Fifth Go Flo bottle removed
23/11/2006 10:11	235	GO-FLO	-52.86567	-40.09532	Sixth Go Flo bottle removed
23/11/2006 10:09	235	GO-FLO	-52.86553	-40.09537	Commenced recovery of Glo Fo
23/11/2006 09:55	235	GO-FLO	-52.86398	-40.09583	Go Flo wire at 1000m Trigger weight deployed.
23/11/2006 09:54	235	GO-FLO	-52.86379	-40.09587	Sixth Go Flo bottle attached
23/11/2006 09:51	235	GO-FLO	-52.86357	-40.09594	Fifth Go Flo bottle attached
23/11/2006 09:50	235	GO-FLO	-52.86338	-40.09599	Fourth Go Flo bottle attached
23/11/2006 09:46	235	GO-FLO	-52.86299	-40.09611	Third Go Flo bottle attached
23/11/2006 09:39	235	GO-FLO	-52.86199	-40.09639	Second Go Flo bottle attached.
23/11/2006 09:27	235	GO-FLO	-52.86037	-40.09687	Go Flo deployed with first bottle
23/11/2006 09:16	234	CTD	-52.86039	-40.09685	CTD on deck.
23/11/2006 09:15	234	CTD	-52.86037	-40.09687	CTD at the surface.
23/11/2006 08:56	234	CTD	-52.86033	-40.09684	CTD @ 140m Commenced recovery. Commenced recovery.
23/11/2006 08:49	234	CTD	-52.86033	-40.09685	CTD deployed
23/11/2006 08:41	233	BONGO	-52.86077	-40.09681	Bongo Nets on board.
23/11/2006 08:40	233	BONGO	-52.86074	-40.09678	Bongo Nets at the surface.
23/11/2006 08:23	233	BONGO	-52.8597	-40.09697	Bongo nets @400m commenced recovery. commenced recovery.
23/11/2006 08:13	233	BONGO	-52.85889	-40.09685	Bongo nets deployed
23/11/2006 08:06	232	CTD	-52.85888	-40.09684	CTD on deck.
23/11/2006 08:04	232	CTD	-52.85889	-40.09685	CTD at the surface.
23/11/2006 06:48	232	CTD	-52.85894	-40.09683	CTD @ 3728m
23/11/2006 05:41	232	CTD	-52.85886	-40.09707	CTD deployed
23/11/2006 05:28	231	FRRF	-52.85899	-40.09721	FRRF recovered
23/11/2006 05:14	231	FRRF	-52.85854	-40.09736	FRRF @ 150m
23/11/2006 05:05	231	FRRF	-52.85857	-40.09739	FRRF deployed
23/11/2006 05:00	231	FRRF	-52.85998	-40.09718	Slowing for Process Station Three
23/11/2006 04:51	230	RMT-25	-52.85001	-40.0797	Deck Secure proceeding to FRRF station

23/11/2006 04:42	230	RMT-25	-52.8515	-40.08156	RMT 25 recovered
23/11/2006 04:36	230	RMT-25	-52.85617	-40.08406	RMT @ Surface
23/11/2006 04:31	230	RMT-25	-52.85957	-40.08572	RMT 25 @ 49m (cable out)
23/11/2006 03:52	230	RMT-25	-52.88788	-40.09971	RMT 25 Deployed @ 2.5kts
23/11/2006 03:45	230	RMT-25	-52.8929	-40.10223	Deploying RMT 25
23/11/2006 03:39	230	RMT-25	-52.88895	-40.10126	Slowing for RMT 25 deployment
23/11/2006 03:16		RMT-25	-52.84867	-40.08505	deck secure moving off to look for targets
23/11/2006 03:11	229	RMT-25	-52.85033	-40.08674	RMT 25 recovered
23/11/2006 02:38	229	RMT-25	-52.87269	-40.10358	RMT 25 @ 53m (cable out)
23/11/2006 02:36	229	RMT-25	-52.87416	-40.10466	RMT 25 deployed
23/11/2006 02:21		RMT-25	-52.87516	-40.10566	Targets identified turn head to wind and prepare for RMT deployment turn head to wind and prepare for RMT deployment
23/11/2006 02:00		RMT-25	-52.82821	-40.0669	All secure a/c to run downwind looking for krill targets a/c to run downwind looking for krill targets
23/11/2006 01:42	228	RMT-25	-52.83486	-40.07409	RMT recovered
23/11/2006 01:26	228	RMT-25	-52.84443	-40.08351	RMT @ Surface
23/11/2006 01:17	228	RMT-25	-52.84982	-40.0889	Commence hauling RMT
23/11/2006 01:06	228	RMT-25	-52.85716	-40.09431	RMT 25 @ 54m (cable out)
23/11/2006 01:03	228	RMT-25	-52.85938	-40.09604	RMT 25 deployed
23/11/2006 00:56	228	RMT-25	-52.86356	-40.09849	Commence deploying RMT
23/11/2006 00:40			-52.86381	-40.10221	Targets identified turn head to wind and prepare for RMT deployment turn head to wind and prepare for RMT deployment
23/11/2006 00:29			-52.85557	-40.09373	Vessel off DP running down wind to search for RMT targets
22/11/2006 23:44			-52.85578	-40.09382	Weights recovered
22/11/2006 23:30			-52.8576	-40.09489	Weights @ 500m
22/11/2006 23:16			-52.8594	-40.09598	V/l moving ahead at 0.5knots on DP. Weights deployed on conducting wire.
22/11/2006 23:05			-52.86007	-40.09711	V/L on DP @ process station 4
22/11/2006 22:38			-52.85779	-40.09605	Vessel at Process Station No.3
22/11/2006 21:37			-52.94286	-40.14645	Ships speed 5 knots
22/11/2006 21:27			-52.96335	-40.15887	Commenced reducing speed to 5 knots.

22/11/2006 20:32	227	XBT	-53.13776	-40.26627	XBT Completed Increasing Speed
22/11/2006 20:27	227	XBT	-53.14803	-40.27096	XBT Deployed
22/11/2006 18:28			-53.52243	-40.46603	Deck Secure proceeding to process station 3
22/11/2006 18:21	226	CTD	-53.52325	-40.46501	CTD recovered
22/11/2006 17:28	226	CTD	-53.52319	-40.46509	CTD @ 2007m
22/11/2006 16:49	226	CTD	-53.52308	-40.46506	CTD deployed
22/11/2006 16:41	226	CTD	-53.52337	-40.46407	Vessel on D.P. ready to deploy
22/11/2006 16:36	226	CTD	-53.52211	-40.46416	Slowing for CTD station "J"
22/11/2006 12:34			-54.23816	-40.81356	Vessel moving off station
22/11/2006 12:30	225	CTD	-54.23814	-40.81356	CTD Recovered
22/11/2006 11:32	225	CTD	-54.23816	-40.81365	CTD @ 2013m
22/11/2006 10:54	225	CTD	-54.23815	-40.81363	CTD deployed
22/11/2006 10:50			-54.23814	-40.81366	Vessel stopped on station in DP midships gantry unlashed. midships gantry unlashed.
22/11/2006 09:04	224	XBT	-54.56465	-40.99199	XBT Completed Increasing Speed
22/11/2006 08:58	224	XBT	-54.57851	-40.99889	XBT Deployed
22/11/2006 05:47			-55.20557	-41.2467	Deck Secure proceeding to CTD I Station
22/11/2006 05:40	223	FRRF	-55.20672	-41.24673	FRRF recovered
22/11/2006 05:17	223	FRRF	-55.20668	-41.24675	FRRF @ 150m
22/11/2006 05:04	223	FRRF	-55.20666	-41.24673	FRRF deployed
22/11/2006 04:57	223	FRRF	-55.20708	-41.24645	Vessel on D.P. ready to deploy
22/11/2006 04:54	223	FRRF	-55.20708	-41.2433	Slowing for FRRF station
22/11/2006 04:40			-55.17622	-41.22623	Deck Secure proceeding to process station 2
22/11/2006 04:30	222	RMT-25	-55.17932	-41.22224	RMT 25 recovered
22/11/2006 04:13	222	RMT-25	-55.18851	-41.21113	recovering RMT due to fault possible net monitor possible net monitor
22/11/2006 04:07	222	RMT-25	-55.19136	-41.20702	RMT 25 @ 208m (cable out)
22/11/2006 03:54	222	RMT-25	-55.19727	-41.19772	RMT 25 Deployed @ 2.5kts
22/11/2006 03:50	222	RMT-25	-55.19911	-41.19497	Deploying RMT 25
22/11/2006 03:40	222	RMT-25	-55.2068	-41.18438	Slowing for RMT deployment
22/11/2006 01:42		RMT-25	-55.16308	-41.25328	Run down wind in preparation for RMT 25 target fishing
22/11/2006 01:40			-55.16318	-41.25311	Work continuing to rectify LHPR problem. Cable will require retermination

22/11/2006 00:20			-55.17597	-41.22564	V/L holding position while work is undertaken to rectify LHPR problem
22/11/2006 00:16	221	LHPR	-55.1779	-41.22266	LHPR Recovered
21/11/2006 23:55	221	LHPR	-55.18783	-41.20785	LHPR stopped at 605m cable out equipment failure commence recovery equipment failure commence recovery
21/11/2006 23:51	221	LHPR	-55.1898	-41.20503	Resume veering LHPR
21/11/2006 23:44	221	LHPR	-55.19241	-41.20128	LHPR stopped @ 484m cable out equipment problem equipment problem
21/11/2006 23:31	221	LHPR	-55.19863	-41.19252	LHPR Deployed @ 2.0kts
21/11/2006 22:10		LHPR	-55.29452	-41.2946	Repositioning vessel for LHPR deployment
21/11/2006 22:06	220	MULTINET	-55.29093	-41.29206	Multinet Recovered
21/11/2006 22:03	220	MULTINET	-55.28861	-41.29066	Multinet @ Surface
21/11/2006 20:49	220	MULTINET	-55.23562	-41.25872	Multinet at 1925m and recovering
21/11/2006 19:43	220	MULTINET	-55.19134	-41.2321	Multinet Deployed @ 2kt
21/11/2006 19:37			-55.19093	-41.22907	Turning vessel and reducing speed for Multinet deployment.
21/11/2006 18:31	219		-55.38504	-41.38531	Vessel proceeding back to process station
21/11/2006 18:24	219	RMT-25	-55.3769	-41.38231	RMT Recovered
21/11/2006 18:17	219	RMT-25	-55.37727	-41.38242	RMT @ Surface
21/11/2006 17:43	219	RMT-25	-55.33742	-41.36992	RMT 25 @ 495m (cable out)
21/11/2006 17:24	219	RMT-25	-55.32046	-41.36445	RMT 25 Deployed @ 2.5kts
21/11/2006 17:18	219	RMT-25	-55.31531	-41.36289	Deploying RMT 25
21/11/2006 17:17	219	RMT-25	-55.31442	-41.36288	ready to deploy
21/11/2006 17:14	219	RMT-25	-55.31467	-41.36977	Slowing for RMT deployment
21/11/2006 16:43	218	RMT-25	-55.39391	-41.45038	Vessel towards process station
21/11/2006 16:41	218	RMT-25	-55.39201	-41.44839	RMT 25 recovered
21/11/2006 15:29	218	RMT-25	-55.3326	-41.39283	RMT 25 @ 636m (cable out)
21/11/2006 15:00	218	RMT-25	-55.31128	-41.37365	RMT 25 deployed
21/11/2006 14:39	217	RMT-25	-55.30114	-41.36761	RMT 25 recovered
21/11/2006 12:36	217	RMT-25	-55.20031	-41.28934	RMT 25 @ 2266m (cable out)
21/11/2006 11:33	217	RMT-25	-55.148	-41.24559	RMT 25 Deployed
21/11/2006 10:17	216	ACOUSTIC	-55.20621	-41.63975	Completed Acoustic Survey relocating for RMT 25 deployment. relocating for RMT 25 deployment.

21/11/2006 07:35	216	ACOUSTIC	-55.20615	-40.85139	Commence Acoustic transect on 270T @ 10.0kts
21/11/2006 07:29			-55.2177	-40.84393	Turning vessel for start point of Acoustic Survey.
21/11/2006 06:58			-55.27505	-40.96806	deck secure proceeding to acoustic survey run
21/11/2006 06:52	215	RMT-25	-55.27238	-40.9651	RMT 25 recovered
21/11/2006 06:46	215	RMT-25	-55.26817	-40.95986	RMT 25 @ Surface
21/11/2006 06:11	215	RMT-25	-55.24501	-40.93156	RMT 25 @ 153m (cable out)
21/11/2006 06:05	215	RMT-25	-55.24056	-40.92718	RMT 25 Deployed @ 2.5kts
21/11/2006 05:59	215	RMT-25	-55.23582	-40.92272	Deploying RMT 25
21/11/2006 05:54	215	RMT-25	-55.233	-40.9272	Slowing for RMT deployment
21/11/2006 04:50			-55.33461	-41.20376	deck secure proceeding towards acoustic survey run
21/11/2006 04:38	214	RMT-25	-55.33108	-41.20453	RMT 25 recovered
21/11/2006 04:31	214	RMT-25	-55.32323	-41.19969	RMT 25 @ Surface
21/11/2006 03:29	214	RMT-25	-55.26932	-41.16689	RMT 25 @ 714m (cable out)
21/11/2006 03:00	214	RMT-25	-55.24562	-41.15184	RMT 25 Deployed
21/11/2006 02:50			-55.23961	-41.14896	V/L off DP preparing for RMT
21/11/2006 02:32	213	FRRF	-55.23961	-41.14891	FRRF recovered
21/11/2006 02:13	213	FRRF	-55.23961	-41.14895	FRRF @ 150m commence recovery commence recovery
21/11/2006 02:02	213	FRRF	-55.23961	-41.14916	FRRF deployed
21/11/2006 02:00			-55.23964	-41.14901	V/L on DP for FRRF
21/11/2006 01:30			-55.27728	-41.17763	LHPR secure a/c to run downwind a/c to run downwind
21/11/2006 01:28	211	LHPR	-55.27478	-41.17731	LHPR Recovered
21/11/2006 00:08	211	LHPR	-55.19111	-41.27729	LHPR@ 2439m (cable out)
21/11/2006 00:04	211	LHPR	-55.18744	-41.28309	Increase to 3.5 knots
20/11/2006 23:47	212	NEUSTON	-55.17713	-41.30252	Neuston sledge recovered
20/11/2006 23:10	212	NEUSTON	-55.15544	-41.34462	Neuston sledge deployed
20/11/2006 23:04	211	LHPR	-55.15143	-41.35178	LHPR Deployed @ 2.0kts
20/11/2006 23:00			-55.1497	-41.35534	V/L off DP preparing to deploy LHPR
20/11/2006 21:21	210	LHPR	-55.2927	-41.08158	LHPR on deck repositioning vessel for next run. repositioning vessel for next run.
20/11/2006 21:19	210	LHPR	-55.29088	-41.08513	LHPR at the surface.
20/11/2006 20:11	210	LHPR	-55.22736	-41.20331	LHPR @ 2050 commence hauling commence hauling

20/11/2006 20:08	210	LHPR	-55.22481	-41.20796	Increase to 3.5 knots
20/11/2006 19:17	210	LHPR	-55.19647	-41.26052	LHPR Deployed @ 2.0kts
20/11/2006 19:10			-55.1966	-41.2657	Vessel turning into wind and reducing speed for LHPR deployment.
20/11/2006 18:07			-55.31178	-41.01233	Vessel proceeding back to process station
20/11/2006 17:46	209	MULTINET	-55.30559	-41.03086	Multinet Recovered
20/11/2006 17:44	209	MULTINET	-55.30465	-41.03316	Multinet @ Surface
					Recommence hauling electronics not fixed. Hauling for recovery electronics not fixed.
20/11/2006 17:01	209	MULTINET	-55.28178	-41.08724	Hauling for recovery
20/11/2006 16:56	209	MULTINET	-55.27896	-41.09365	Hauling stopped due to problem with electronics for net monitor
20/11/2006 16:30	209	MULTINET	-55.26415	-41.12687	Multinet at 2284m and recovering
20/11/2006 15:11	209	MULTINET	-55.21935	-41.22666	Multinet Deployed @ 2kt
20/11/2006 15:08	209	MULTINET	-55.21768	-41.23057	Deploying the multinet
20/11/2006 15:03			-55.21633	-41.23394	Vessel moving off station to deploy multinet
20/11/2006 13:00			-55.21625	-41.23339	V/L sat on DP awaiting rigging of mulit net
20/11/2006 12:55	208	BONGO	-55.21625	-41.23336	Bongo nets recovered
20/11/2006 12:49	208	BONGO	-55.21553	-41.23384	Bongo nets @125m commenced recovery. commenced recovery.
20/11/2006 12:46	208	BONGO	-55.2153	-41.23403	Bongo nets deployed
20/11/2006 12:38	207	CTD	-55.2153	-41.23404	CTD recovered
20/11/2006 12:26	207	CTD	-55.21529	-41.23402	CTD @ 60m
20/11/2006 12:22	207	CTD	-55.2153	-41.23402	CTD deployed
20/11/2006 12:13	206	FRRF	-55.21532	-41.23404	FRRF recovered
20/11/2006 11:54	206	FRRF	-55.21531	-41.23404	FRRF @ 150m commence recovery commence recovery
20/11/2006 11:40	206	FRRF	-55.21528	-41.23403	FRRF deployed
20/11/2006 11:31	205	GO-FLO	-55.21516	-41.23418	go-flo recovered
20/11/2006 11:01	205	GO-FLO	-55.21299	-41.23689	commence recovery of go-flo
20/11/2006 10:46	205	GO-FLO	-55.21162	-41.23855	Go Flo wire at 1000m Trigger weight deployed.
20/11/2006 10:45	205	GO-FLO	-55.21156	-41.23861	Sixth Go Flo bottle attached
20/11/2006 10:43	205	GO-FLO	-55.21135	-41.23888	Fifth Go Flo bottle attached
20/11/2006 10:40	205	GO-FLO	-55.21113	-41.23918	Fourth Go Flo bottle attached
20/11/2006 10:37	205	GO-FLO	-55.21093	-41.23943	Third Go Flo bottle attached

20/11/2006 10:29	205	GO-FLO	-55.21038	-41.2401	Second Go Flo bottle attached.
20/11/2006 10:17	205	GO-FLO	-55.21005	-41.24052	Go-Flo deployed with first bottle.
20/11/2006 10:05	204	CTD	-55.21005	-41.24052	CTD on deck. Setting up for Go Flo.
20/11/2006 10:03	204	CTD	-55.21007	-41.24053	CTD at the surface.
20/11/2006 09:41	204	CTD	-55.21009	-41.24053	CTD @ 140m Commenced recovery. Commenced recovery.
20/11/2006 09:33	204	CTD	-55.21009	-41.24053	CTD deployed
20/11/2006 09:16	203	CTD	-55.21299	-41.23653	CTD on deck.
20/11/2006 09:14	203	CTD	-55.21306	-41.23645	CTD at the surface.
20/11/2006 08:37	203	CTD	-55.21303	-41.23644	CTD @ 2000m Commencing recovery. Commencing recovery.
20/11/2006 07:59	203	CTD	-55.21305	-41.2364	CTD deployed
20/11/2006 07:37	202	CTD	-55.21543	-41.23309	CTD on deck.
20/11/2006 07:35	202	CTD	-55.21543	-41.23305	CTD at the surface.
20/11/2006 06:27	202	CTD	-55.21069	-41.24018	CTD @ 3178m
20/11/2006 05:28	202	CTD	-55.20673	-41.24668	CTD deployed
20/11/2006 05:21	202	CTD	-55.20665	-41.24646	vessel on auto posn dp @ process station2
20/11/2006 05:09			-55.20621	-41.24471	Slowing for Process Station Two
20/11/2006 04:25			-55.20871	-41.47304	Deck Secure proceeding to process station 2
20/11/2006 04:17	201	RMT-25	-55.20965	-41.48898	RMT 25 recovered
20/11/2006 04:11	201	RMT-25	-55.21022	-41.49908	RMT 25 @ Surface
20/11/2006 03:46	201	RMT-25	-55.21269	-41.53811	RMT 25 @ 306m (cable out)
20/11/2006 03:29	201	RMT-25	-55.2144	-41.56429	RMT 25 Deployed @ 2.5kts
20/11/2006 03:22	201	RMT-25	-55.21501	-41.57498	Deploying RMT 25
20/11/2006 02:50	200	RMT-25	-55.21364	-41.58719	RMT Recovered
20/11/2006 01:56	200	RMT-25	-55.21184	-41.54712	RMT 25 @ 100m (cable out)
20/11/2006 01:51	200	RMT-25	-55.21098	-41.50945	RMT 25 Deployed
20/11/2006 01:27	199	RMT-25	-55.20986	-41.49183	RMT 25 recovered
19/11/2006 23:26	199	RMT-25	-55.20763	-41.32689	RMT 25 @ 1975m (cable out)
19/11/2006 22:27	199	RMT-25	-55.20644	-41.25129	RMT 25 Deployed
19/11/2006 22:21	199	RMT-25	-55.20615	-41.2437	Vessel out of DP and driving ahead for RMT 25 deployment.
19/11/2006 21:55			-55.20503	-41.23715	Vessel stopped in DP awaiting RMT 25 deployment.

19/11/2006 21:24	198	ACOUSTIC	-55.11643	-41.24543	Completed transect. Repositioning for RMT 25 deployment.
19/11/2006 20:02	198	ACOUSTIC	-55.11615	-41.63987	Commenced third transect on heading 090
19/11/2006 19:30	198	ACOUSTIC	-55.2061	-41.63998	Complete second transect A/C to 000T A/C to 000T
19/11/2006 16:44	198	ACOUSTIC	-55.20639	-40.85192	Commence 2nd leg of acoustic transect
19/11/2006 16:08	198	ACOUSTIC	-55.29547	-40.85516	Complete first transect A/C to 000T A/C to 000T
19/11/2006 14:48	198	ACOUSTIC	-55.29673	-41.24815	Commence leg 1 of acoustic transect
19/11/2006 14:11			-55.22789	-41.2045	All secure on deck moving off to begin acoustic survey moving off to begin acoustic survey
19/11/2006 14:03	197	BONGO	-55.22766	-41.20459	Bongo nets recovered
19/11/2006 13:45	197	BONGO	-55.22575	-41.20497	Bongo nets @400m commenced recovery. commenced recovery.
19/11/2006 13:31	197	BONGO	-55.22377	-41.20561	Bongo nets deployed
19/11/2006 13:29	196	BONGO	-55.2235	-41.2057	Bongo nets recovered
19/11/2006 13:12	196	BONGO	-55.22138	-41.20637	Bongo nets @400m commenced recovery. commenced recovery.
19/11/2006 13:01	196	BONGO	-55.22037	-41.20661	Bongo deployed
19/11/2006 12:54	195	CTD	-55.22041	-41.20664	CTD recovered
19/11/2006 12:36	195	CTD	-55.22038	-41.2066	CTD @ 400m commencing recovery. commencing recovery.
19/11/2006 12:24	195	CTD	-55.2204	-41.20668	CTD deployed
19/11/2006 11:58	194	CTD	-55.22037	-41.20664	CTD recovered
19/11/2006 11:39	194	CTD	-55.22034	-41.2067	CTD @ 140m Commenced recovery. Commenced recovery.
19/11/2006 11:29	194	CTD	-55.22034	-41.20675	CTD deployed
19/11/2006 11:22	193	FRRF	-55.21981	-41.20693	FRRF recovered
19/11/2006 11:01	193	FRRF	-55.21802	-41.20768	FRRF @ 150m commence recovery commence recovery
19/11/2006 10:51	193	FRRF	-55.21764	-41.2083	FRRF deployed
19/11/2006 10:41	192	GO-FLO	-55.21741	-41.20871	Go Flo recovered to deck. Setting up for FRRF.
19/11/2006 10:29	192	GO-FLO	-55.21671	-41.2099	Second Go Flo bottle removed
19/11/2006 10:21	192	GO-FLO	-55.21621	-41.21074	Third Go Flo bottle removed.
19/11/2006 10:17	192	GO-FLO	-55.21599	-41.21115	Fourth Go Flo bottle removed
19/11/2006 10:15	192	GO-FLO	-55.21586	-41.21132	Fifth Go Flo bottle removed
19/11/2006 10:13	192	GO-FLO	-55.21575	-41.21146	Sixth Go Flo bottle removed
19/11/2006 10:11	192	GO-FLO	-55.21564	-41.21175	Commenced Go Flo recovery

19/11/2006 09:54	192	GO-FLO	-55.21464	-41.21344	Go Flo wire at 1000m Trigger weight deployed.
19/11/2006 09:53	192	GO-FLO	-55.21459	-41.2135	Sixth Go Flo bottle attached
19/11/2006 09:51	192	GO-FLO	-55.21448	-41.21379	Fifth Go Flo bottle attached
19/11/2006 09:49	192	GO-FLO	-55.21436	-41.21399	Fourth Go Flo bottle attached
19/11/2006 09:46	192	GO-FLO	-55.2142	-41.2143	Third Go Flo bottle attached
19/11/2006 09:38	192	GO-FLO	-55.21372	-41.21516	Second Go Flo bottle attached.
19/11/2006 09:24	192	GO-FLO	-55.21332	-41.21608	Go-Flo deployed with first bottle.
19/11/2006 09:07	191	CTD	-55.21335	-41.21608	CTD on deck. Setting up for Go Flo.
19/11/2006 09:06	191	CTD	-55.21333	-41.21598	CTD at the surface.
19/11/2006 09:04	191	CTD	-55.21332	-41.21606	Recovering CTD
19/11/2006 08:58	191	CTD	-55.21332	-41.21604	CTD at depth 40m
19/11/2006 08:54	191	CTD	-55.21336	-41.21605	CTD deployed. One bottle short.
19/11/2006 08:42	191	CTD	-55.21387	-41.21357	Broken bottle found on CTD. Deployment held while a new bottle is found and fitted.
19/11/2006 08:15	190	CTD	-55.21503	-41.20891	CTD on deck
19/11/2006 08:13	190	CTD	-55.21502	-41.20912	CTD at the surface.
19/11/2006 07:34	190	CTD	-55.21476	-41.2128	CTD @ 2000m Commencing recovery. Commencing recovery.
19/11/2006 06:57	190	CTD	-55.21408	-41.21743	CTD Deployed
19/11/2006 06:54	190	CTD	-55.214	-41.21791	Clear to deploy CTD
19/11/2006 06:37	189	CTD	-55.21352	-41.22125	CTD Recovered
19/11/2006 05:30	189	CTD	-55.20908	-41.23557	CTD @ 3172m and commence recovery
19/11/2006 04:34	189	CTD	-55.20609	-41.24596	CTD Deployed
19/11/2006 04:31	189	CTD	-55.2061	-41.24592	Clear to deploy CTD
19/11/2006 04:26	188	FRRF	-55.20608	-41.24596	FRRF Recovered
19/11/2006 04:10	188	FRRF	-55.20608	-41.24596	FRRF @ 150m commence recovery commence recovery
19/11/2006 04:02	188	FRRF	-55.2061	-41.2459	FRRF deployed
19/11/2006 03:59	188	FRRF	-55.20618	-41.24576	Clear to deploy FRRF
19/11/2006 03:56			-55.20638	-41.24525	Vessel on station in DP. Midships gantry unlashed.
19/11/2006 03:46			-55.20304	-41.24538	Vessel slowing for station
19/11/2006 03:08	187	MOCNESS	-55.21069	-41.31152	Mocness Recovered
19/11/2006 03:05	187	MOCNESS	-55.20995	-41.30718	Mocness @ Surface

19/11/2006 01:51	187	MOCNESS	-55.1952	-41.2208	Mocness @ 2376m cable out commence hauling commence hauling
19/11/2006 00:33	187	MOCNESS	-55.18171	-41.13068	Mocness deployed @ 2.0kts
19/11/2006 00:25			-55.17951	-41.12466	Vessel of DP preparing for mocness
18/11/2006 23:35			-55.17602	-41.1257	V/L on DP awaiting de-rigging of RMT and rigging of Mocness
18/11/2006 23:26	186	RMT-25	-55.17453	-41.11836	RMT Recovered
18/11/2006 22:41	186	RMT-25	-55.16595	-41.06349	RMT 25 at the surface. Gilson winch required to land net on deck.
18/11/2006 22:39	186	RMT-26	-55.1655	-41.06134	Hauling RMT for recovery
18/11/2006 22:14	186	RMT-25	-55.15914	-41.03013	RMT 25 Deployed
18/11/2006 22:00	186	RMT-25	-55.15714	-41.02041	Turning ship and setting up for RMT 25 deployment
18/11/2006 21:26	185	RMT-25	-55.16775	-41.07081	RMT 25 on Deck
18/11/2006 21:21	185	RMT-25	-55.16626	-41.06442	RMT 25 at the surface
18/11/2006 21:14	185	RMT-25	-55.16399	-41.05488	Hauling RMT for recovery
18/11/2006 20:33	185	RMT-25	-55.15154	-41.00195	RMT 25 Deployed
18/11/2006 20:15	185	RMT-25	-55.14996	-40.99466	Turning ship and setting up for RMT 25 deployment
18/11/2006 18:00			-55.24912	-41.45708	Vessel heading downwind looking for targets while repairs are made to RMT 25 wire
18/11/2006 17:26	184	LHPR	-55.24189	-41.43667	LHPR Recovered
18/11/2006 16:16	184	LHPR	-55.21803	-41.31376	LHPR @ 2017m and commence recovering
18/11/2006 16:11	184	LHPR	-55.21734	-41.30616	Increase to 3.5 knots
18/11/2006 15:23	184	LHPR	-55.21179	-41.24517	LHPR Deployed @ 2.0kts
18/11/2006 15:20	184	LHPR	-55.2116	-41.24134	Deploying LHPR
18/11/2006 15:15			-55.21109	-41.24029	Midships Gantry Secure vessel out of DP and moving off for LHPR deployment. vessel out of DP and moving off for LHPR deployment.
18/11/2006 15:08	183	MINIBONGO	-55.21042	-41.2406	Mini Bongos Recovered
18/11/2006 14:50	183	MINIBONGO	-55.20924	-41.24121	Mini Bongos @ 400m and Recovering
18/11/2006 14:38	183	MINIBONGO	-55.20842	-41.24166	Mini Bongos Deployed
18/11/2006 14:30	181	CTD	-55.20842	-41.24165	CTD recovered
18/11/2006 13:54	181	CTD	-55.20837	-41.24172	Commence hauling CTD
18/11/2006 13:52	182	MOORING	-55.2084	-41.24172	Release test successful hydrophone recovered hydrophone recovered
18/11/2006 13:49	182	MOORING	-55.20838	-41.24169	Hydrophone deployed for accoustic release test
18/11/2006 13:48	181	CTD	-55.20838	-41.24171	CTD @ 2000m

18/11/2006 13:10	181	CTD	-55.2084	-41.24166	CTD deployed
18/11/2006 12:58	180	BONGO	-55.20845	-41.24168	Bongo nets recovered
18/11/2006 12:42	180	BONGO	-55.20737	-41.24233	Bongo nets @400m commenced recovery. commenced recovery.
18/11/2006 12:30	180	BONGO	-55.20734	-41.2422	Bongo deployed
18/11/2006 12:24	179	CTD	-55.20742	-41.24257	CTD recovered
18/11/2006 12:13	179	CTD	-55.20745	-41.24264	CTD @ 40m
18/11/2006 12:09	179	CTD	-55.20745	-41.24263	CTD deployed
18/11/2006 12:00	178	FRRF	-55.20743	-41.24267	FRRF recovered
18/11/2006 11:44	178	FRRF	-55.20741	-41.24261	FRRF @ 150m commence recovery commence recovery
18/11/2006 11:32	178	FRRF	-55.20741	-41.24262	FRRF deployed
18/11/2006 11:23	177	GO-FLO	-55.20739	-41.24268	go-flo recovered
18/11/2006 11:11	177	GO-FLO	-55.2074	-41.24282	2nd Go Flow bottle removed
18/11/2006 11:04	177	GO-FLO	-55.20732	-41.2431	3rd glo-flo bottle removed
18/11/2006 11:00	177	GO-FLO	-55.20716	-41.24351	Fourth Go Flo bottle removed
18/11/2006 10:59	177	GO-FLO	-55.20712	-41.24367	Fifth Go Flo bottle removed
18/11/2006 10:57	177	GO-FLO	-55.20704	-41.24389	Sixth Go Flo bottle removed
18/11/2006 10:56	177	GO-FLO	-55.207	-41.24402	Commenced recovery of Go Flo
18/11/2006 10:39	177	GO-FLO	-55.20659	-41.24456	Go Flo wire at 1000m Trigger weight deployed.
18/11/2006 10:38	177	GO-FLO	-55.20655	-41.24462	Sixth Go Flo bottle attached
18/11/2006 10:35	177	GO-FLO	-55.20636	-41.24466	Fifth Go Flo bottle attached
18/11/2006 10:33	177	GO-FLO	-55.20625	-41.24469	Fourth Go Flo bottle attached
18/11/2006 10:29	177	GO-FLO	-55.20607	-41.24474	Third Go Flo bottle attached
18/11/2006 10:21	177	GO-FLO	-55.20602	-41.24476	Second Go Flo bottle attached.
18/11/2006 10:09	177	GO-FLO	-55.206	-41.24482	Deploying Go flo with first bottle
18/11/2006 09:57	176	CTD	-55.206	-41.24483	CTD on deck
18/11/2006 09:54	176	CTD	-55.20602	-41.2448	CTD at the surface.
18/11/2006 09:35	176	CTD	-55.20602	-41.24492	CTD @ 140m Commenced recovery. Commenced recovery.
18/11/2006 09:29	176	CTD	-55.20602	-41.24487	CTD deployed
18/11/2006 09:18	175	BONGO	-55.2059	-41.2434	Bongo Nets on board.
18/11/2006 09:17	175	BONGO	-55.20589	-41.24347	Bongo Nets at the surface.

18/11/2006 09:00	175	BONGO	-55.20573	-41.24534	Bongo nets @400m commenced recovery. commenced recovery.
18/11/2006 08:49	175	BONGO	-55.20595	-41.2463	Bongo nets deployed
18/11/2006 08:42	174	CTD	-55.20593	-41.2462	CTD on deck
18/11/2006 08:39	174	CTD	-55.20591	-41.24626	CTD at the surface.
18/11/2006 07:30	174	CTD	-55.20595	-41.24625	CTD @ 3187m Commenced recovery. Commenced recovery.
18/11/2006 06:30	174	CTD	-55.20593	-41.24617	CTD Deployed
18/11/2006 06:19	174	CTD	-55.20603	-41.24568	Vessel on DP at station for CTD
18/11/2006 06:10			-55.20723	-41.23555	Vessel slowing for station
18/11/2006 03:33	173	XBT	-55.63398	-41.28847	XBT Deployed
17/11/2006 23:49			-56.22574	-41.83286	All secure on deck. Resume transect
17/11/2006 23:38	172	XBT	-56.22087	-41.82053	XBT deployed (successful)
17/11/2006 23:32	171	XBT	-56.22082	-41.82075	XBT deployed (failed)
17/11/2006 23:30			-56.22085	-41.82075	WX Conditions unsuitable for CTD deployment deploy XBT then proceed to p2 deploy XBT then proceed to p2
17/11/2006 23:15			-56.2207	-41.81425	V/L on station for CTD deployment
17/11/2006 21:31	170	XBT	-56.52668	-42.0399	XBT Deployed
17/11/2006 21:30	170	XBT	-56.52852	-42.0425	Clear to deploy XBT
17/11/2006 19:45	169	XBT	-56.83856	-42.25856	XBT Deployed
17/11/2006 19:44	169	XBT	-56.8405	-42.25986	Clear to deploy XBT
17/11/2006 18:10	168	TOW-FISH	-57.12275	-42.41609	Tow fish deployed
17/11/2006 18:07	168	TOW-FISH	-57.12583	-42.42042	Deploying Tow fish
17/11/2006 18:02	168	TOW-FISH	-57.13093	-42.42725	Vessel reduce speed to 4kt for towfish deployment
17/11/2006 17:55	167	XBT	-57.14053	-42.44111	XBT Deployed
17/11/2006 17:54	167	XBT	-57.14206	-42.44318	Clear to deploy XBT
17/11/2006 15:40			-57.53236	-42.67197	Gantry secured moving off station moving off station
17/11/2006 15:34	166	CTD	-57.53236	-42.67192	CTD recovered
17/11/2006 15:31	166	CTD	-57.53236	-42.67192	CTD at Surface
17/11/2006 14:29	145	TOW-FISH	-57.53233	-42.67196	Tow fish recovered
17/11/2006 14:20	166	CTD	-57.53237	-42.67197	CTD stopped @ 3054m
17/11/2006 13:25	166	CTD	-57.53336	-42.673	CTD deployed

17/11/2006 13:15			-57.53343	-42.6731	V/L on DP for CTD
17/11/2006 13:03	165	LHPR	-57.5243	-42.67124	LHPR Recovered
17/11/2006 11:58	165	LHPR	-57.46978	-42.64056	LHPR @ 1931m cable out commence hauling commence hauling
17/11/2006 11:52	165	LHPR	-57.46463	-42.63641	Increase to 3.5 knots
17/11/2006 11:01	165	LHPR	-57.43837	-42.61703	LHPR Deployed @ 2.0kts
17/11/2006 10:56			-57.43632	-42.61567	Midships Gantry Secure vessel out of DP and moving off for LHPR deployment. vessel out of DP and moving off for LHPR deployment.
17/11/2006 10:47	164	BONGO	-57.43628	-42.61564	Bongo Nets on board.
17/11/2006 10:46	164	BONGO	-57.43632	-42.61569	Bongo Nets at the surface.
17/11/2006 10:29	164	BONGO	-57.43692	-42.61625	Bongo nets @400m commenced recovery. commenced recovery.
17/11/2006 10:20	164	BONGO	-57.43813	-42.61731	Bongo nets deployed
17/11/2006 10:13	163	CTD	-57.43812	-42.61728	CTD on deck
17/11/2006 10:11	163	CTD	-57.43813	-42.61728	CTD at the surface.
17/11/2006 10:04	163	CTD	-57.43812	-42.6173	CTD at deph (cable out 10m)
17/11/2006 10:02	163	CTD	-57.43812	-42.61728	CTD deployed
17/11/2006 09:47	162	MINIBONGO	-57.43816	-42.61733	Mini Bongos on Deck
17/11/2006 09:46	162	MINIBONGO	-57.43816	-42.6173	Mini Bongos at the surface
17/11/2006 09:30	162	MINIBONGO	-57.43815	-42.61729	Mini Bongos @ 400m and Recovering
17/11/2006 09:21	162	MINIBONGO	-57.43816	-42.61732	Mini Bongos Deployed
17/11/2006 09:16	161	CTD	-57.43815	-42.61731	CTD on deck
17/11/2006 09:15	161	CTD	-57.43814	-42.61733	CTD at the surface.
17/11/2006 08:56	161	CTD	-57.43813	-42.61733	CTD @ 400m Commenced recovery. Commenced recovery.
17/11/2006 08:45	161	CTD	-57.43811	-42.61732	CTD deployed
17/11/2006 08:33			-57.43768	-42.61586	Vessel approaching station and setting up in DP
17/11/2006 07:02			-57.35985	-43.11202	Deck Secure proceeding to CTD E Station
17/11/2006 06:38	160	RMT-25	-57.35029	-43.0758	RMT Recovered
17/11/2006 06:29	160	RMT-25	-57.34649	-43.0601	RMT 25 @ Surface
17/11/2006 06:05	160	RMT-25	-57.33835	-43.01331	RMT 25 @ 140m cable out and commence hauling
17/11/2006 05:46	160	RMT-25	-57.32989	-42.97868	RMT 25 Deployed
17/11/2006 05:42	160	RMT-25	-57.32903	-42.97107	Deploying RMT 25

17/11/2006 05:23	159	RMT-25	-57.32427	-42.93196	RMT Recovered
17/11/2006 05:17	159	RMT-25	-57.32189	-42.91633	RMT 25 @ Surface
17/11/2006 04:15	159	RMT-25	-57.29135	-42.80884	RMT 25 @ 841m cable out and recovering
17/11/2006 03:42	159	RMT-25	-57.27877	-42.7514	RMT 25 Deployed @ 2.5kts
17/11/2006 03:33	159	RMT	-57.27587	-42.73376	Clear to deploy RMT
17/11/2006 03:13	158	FRRF	-57.26863	-42.71573	FRRF recovered
17/11/2006 02:57	158	FRRF	-57.26866	-42.71575	FRRF @ 150m commence recovery commence recovery
17/11/2006 02:48	158	FRRF	-57.26866	-42.71571	FRRF deployed
17/11/2006 02:40			-57.26863	-42.71567	V/L on DP for FRRF
17/11/2006 02:33	157	RMT-25	-57.26876	-42.70792	RMT 25 recovered
17/11/2006 00:33	157	RMT-25	-57.37526	-42.63967	RMT 25 @ 2379m (cable out)
16/11/2006 23:21	157	RMT-25	-57.4469	-42.62638	RMT Deployed
16/11/2006 23:15	157	RMT-25	-57.45306	-42.62359	Commence RMT 25 deployment
16/11/2006 23:00			-57.4654	-42.61276	Turning head to wind and reducing to 2.5kts for RMT 26 deployment.
16/11/2006 21:10			-57.34114	-42.64286	Vessel stopped in D.P. Rigging for RMT 25 deployment.
16/11/2006 19:51	156	ACOUSTIC	-57.52701	-42.76992	Broke off Transect
16/11/2006 19:25	156	ACOUSTIC	-57.59765	-42.75663	Resumed Transect on heading 355 @ 10kts.
16/11/2006 18:40	156	ACOUSTIC	-57.58483	-42.59693	Complete transect due to ice
16/11/2006 16:21	156	ACOUSTIC	-57.21457	-42.65304	Commence Acoustic transect @ 10.0kts
16/11/2006 14:58	155	MOCNESS	-57.32874	-42.64098	Mocness recovered
16/11/2006 13:45	155	MOCNESS	-57.38214	-42.63089	Mocness @ 2089m cable out commence hauling commence hauling
16/11/2006 12:35	155	MOCNESS	-57.43283	-42.61892	Mocness deployed @ 2.0kts
16/11/2006 12:30	155	MOCNESS	-57.43676	-42.61802	Commence mocness deployment
16/11/2006 12:26		MOCNESS	-57.43818	-42.61734	Off station preparing for mocness deployment preparing for mocness deployment
16/11/2006 12:17	154	FRRF	-57.4382	-42.61737	FRRF recovered
16/11/2006 12:01	154	FRRF	-57.43818	-42.61734	FRRF @ 150m commence recovery commence recovery
16/11/2006 11:50	154	FRRF	-57.43815	-42.61736	FRRF deployed
16/11/2006 11:38	153	GO-FLO	-57.43814	-42.61732	Go-Flo recovered
16/11/2006 11:10	153	GO-FLO	-57.43815	-42.61733	Commence hauling go-flo
16/11/2006 10:56	153	GO-FLO	-57.43817	-42.61731	Go-flo @ depth 1000m bottles triggered bottles triggered

16/11/2006 10:26	153	GO-FLO	-57.43814	-42.61728	Go-Flo deployed
16/11/2006 10:11	152	CTD	-57.43818	-42.61728	CTD recovered
16/11/2006 10:09	152	CTD	-57.43816	-42.61731	CTD at the surface.
16/11/2006 09:48	152	CTD	-57.43817	-42.61732	CTD @ 140m Commenced recovery. Commenced recovery.
16/11/2006 09:41	152	CTD	-57.43817	-42.61733	CTD deployed
16/11/2006 09:29	151	BONGO	-57.43818	-42.61731	Bongo Nets on board.
16/11/2006 09:28	151	BONGO	-57.4382	-42.61731	Bongo Nets at the surface.
16/11/2006 09:12	151	BONGO	-57.43818	-42.61731	Bongo nets @400m commenced recovery. commenced recovery.
16/11/2006 09:03	151	BONGO	-57.43817	-42.61731	Bongo nets deployed
16/11/2006 09:00			-57.43831	-42.61738	Vessel on station in DP midships gantry unlashed. midships gantry unlashed.
16/11/2006 08:55			-57.43884	-42.61807	Vessel approaching CTD station. Setting up in DP.
16/11/2006 07:21	150	XBT	-57.69293	-42.85154	XBT Deployed
16/11/2006 05:33	149	XBT	-57.98137	-42.95079	XBT Deployed
16/11/2006 01:38			-58.59172	-43.32988	All secure on deck moving off station moving off station
16/11/2006 01:24	148	CTD	-58.5917	-43.32983	CTD recovered
16/11/2006 00:25	148	CTD	-58.59169	-43.3298	Resumed recovery of CTD
16/11/2006 00:15	148	CTD	-58.59168	-43.32979	Stop hauling CTD @ 2822m cable out due to compressed air supply problem
16/11/2006 00:10	148	CTD	-58.59166	-43.32982	Acoustic release test unsuccessful continue hauling CTD continue hauling CTD
15/11/2006 23:53	148	CTD	-58.59167	-43.32982	CTD stopped @3000m Hydrophone deployed for acoustic release test Hydrophone deployed for acoustic release test
15/11/2006 23:49	148	CTD	-58.59168	-43.32983	CTD @ 3034m
15/11/2006 22:55	148	CTD	-58.59172	-43.32988	CTD deployed
15/11/2006 22:46			-58.59201	-43.32998	Vessel on station in DP. Midships gantry unlashed.
15/11/2006 20:45	147	XBT	-58.87658	-43.51152	XBT Deployed
15/11/2006 17:09	146	XBT	-59.54518	-43.96823	XBT Deployed
15/11/2006 12:40	145	TOW-FISH	-60.02219	-45.37481	V/L back to 12 knots
15/11/2006 12:35	145	TOW-FISH	-60.02758	-45.39854	Tow fish deployed increase speed increase speed
15/11/2006 12:30	145	TOW-FISH	-60.02953	-45.40843	v/l @ 4 knots commence tow fish deployment
15/11/2006 12:25		TOW-FISH	-60.03348	-45.42655	Commence slowing for Tow Fish deployment
09/11/2006 20:42	144	ACOUSTIC	-59.74473	-44.18406	End of CS3 Transect 2

09/11/2006 19:21	144	ACOUSTIC	-59.90306	-43.86844	Start of CS3 Transect 2
09/11/2006 18:45	144	ACOUSTIC	-59.83855	-43.74638	Complete first transect A/C to 225T A/C to 225T
09/11/2006 17:24	144	ACOUSTIC	-59.67681	-44.05561	passing condensed station
09/11/2006 16:03	144	ACOUSTIC	-59.52129	-44.37309	commence acoustic transect on 135T @ 10.0kts
09/11/2006 15:30	143	RMT-25	-59.49627	-44.50029	deck secure proceeding to acoustic survey run
09/11/2006 15:15	143	RMT-25	-59.49573	-44.47504	RMT 25 recovered
09/11/2006 14:00	143	RMT-25	-59.51101	-44.34245	RMT 25 @ 875m (cable out)
09/11/2006 13:27	143	RMT-25	-59.52513	-44.29033	RMT deployed
09/11/2006 13:13	143	RMT-25	-59.5313	-44.26666	Commence RMT 25 deployment
09/11/2006 13:00	142	RMT-25	-59.53535	-44.25422	RMT 25 recovered
09/11/2006 09:55	142	RMT-25	-59.66625	-44.05962	RMT 25 Deployed
09/11/2006 09:43			-59.67581	-44.05417	Midships gantry secured vessel out of D.P. and moving off for RMT 25 deployment. vessel out of D.P. and moving off for RMT 25 deployment.
09/11/2006 09:24	141	BONGO	-59.6758	-44.05422	Bongo Nets on board.
09/11/2006 09:23	141	BONGO	-59.67585	-44.05434	Bongo Nets at the surface.
09/11/2006 09:07	141	BONGO	-59.67669	-44.05611	Bongo nets @400m commenced recovery. commenced recovery.
09/11/2006 08:57	141	BONGO	-59.67741	-44.05691	Bongo nets deployed
09/11/2006 08:56	140	BONGO	-59.6774	-44.05698	Bongo Nets on board.
09/11/2006 08:55	140	BONGO	-59.67741	-44.05697	Bongo Nets at the surface.
09/11/2006 08:40	140	BONGO	-59.67852	-44.05822	Bongo nets @400m commenced recovery. commenced recovery.
09/11/2006 08:29	140	BONGO	-59.67915	-44.0589	Bongo nets deployed
09/11/2006 08:23	139	CTD	-59.67868	-44.05867	CTD on deck
09/11/2006 08:22	139	CTD	-59.67863	-44.05863	CTD at the surface.
09/11/2006 08:21	139	CTD	-59.67859	-44.05861	Commenced hauling CTD
09/11/2006 08:13	139	CTD	-59.67848	-44.05851	CTD @ 30m.
09/11/2006 08:09	139	CTD	-59.6785	-44.05851	CTD deployed
09/11/2006 08:02	138	MINIBONGO	-59.67814	-44.05806	Mini Bongos on Deck
09/11/2006 08:01	138	MINIBONGO	-59.67821	-44.05811	Mini Bongos at the surface
09/11/2006 07:45	138	MINIBONGO	-59.67942	-44.05925	Mini Bongos @ 400m and Recovering
09/11/2006 07:35	138	MINIBONGO	-59.67995	-44.05978	Mini Bongos Deployed

09/11/2006 07:30	137	CTD	-59.67995	-44.05982	CTD on deck
09/11/2006 07:28	137	CTD	-59.67996	-44.05975	CTD at the surface.
09/11/2006 07:15	137	CTD	-59.67993	-44.05975	CTD @ 400m commencing recovery. commencing recovery.
09/11/2006 07:00	137	CTD	-59.67994	-44.05977	CTD deployed
09/11/2006 06:49	137	CTD	-59.67994	-44.05973	Vessel on D.P. ready to deploy
09/11/2006 06:38	137	CTD	-59.6742	-44.05467	Slowing for CTD Deployment
09/11/2006 05:25	136	RMT-25	-59.50013	-44.36374	Deck Secure proceeding to condensed process station 3
09/11/2006 05:19	136	RMT-25	-59.5028	-44.36057	RMT 25 recovered
09/11/2006 04:17	136	RMT-25	-59.54434	-44.29817	RMT 25 @ 769m (cable out)
09/11/2006 03:49	136	RMT-25	-59.5633	-44.26847	RMT 25 Deployed @ 2.5kts
09/11/2006 03:44	136	RMT-25	-59.56696	-44.26288	Deploying RMT 25
09/11/2006 03:34	135	RMT-25	-59.57357	-44.25108	RMT 25 recovered
09/11/2006 03:24	135	RMT-25	-59.58006	-44.23904	RMT 25 @ Surface
09/11/2006 02:45	135	RMT-25	-59.60373	-44.19914	RMT 25 @ 82m (cable out)
09/11/2006 02:35	135	RMT-25	-59.60917	-44.19012	RMT deployed
09/11/2006 01:50			-59.56306	-44.29456	All secure aft a/c to run downwind in preparation for redeploy a/c to run downwind in preparation for redeploy
09/11/2006 01:36	134	RMT-25	-59.56921	-44.28591	RMT 25 recovered
08/11/2006 23:39	134	RMT-25	-59.62978	-44.14189	RMT 25 @ 2277m (cable out)
08/11/2006 22:36	134	RMT-25	-59.65979	-44.04981	RMT 25 Deployed
08/11/2006 22:24		RMT-25	-59.66402	-44.04499	Turn into wind and reducing speed for RMT 25 deployment.
08/11/2006 20:19	133	LHPR	-59.49737	-44.35849	LHPR on deck. Rigging aft deck for RMT 25 target fishing.
08/11/2006 20:18	133	LHPR	-59.49799	-44.35707	LHPR @ surface
08/11/2006 19:11	133	LHPR	-59.5417	-44.25359	LHPR @ 1967m increase speed to 3.5kts increase speed to 3.5kts
08/11/2006 18:20	133	LHPR	-59.56886	-44.21105	LHPR Deployed @ 2.0kts
08/11/2006 18:18	133	LHPR	-59.56972	-44.20976	Deploying LHPR @ 2.0kts
08/11/2006 17:40	132	MOCNESS	-59.58689	-44.18693	Mocness recovered setting up LHPR setting up LHPR
08/11/2006 16:20	132	MOCNESS	-59.63824	-44.13841	Mocness @ 2302m wire out
08/11/2006 15:00	132	MOCNESS	-59.67877	-44.06323	Mocness deployed @ 2.0kts
08/11/2006 14:55			-59.67989	-44.05958	Gantry secured vessel out of DP and moving off for Mocness deployment. vessel out of

					DP and moving off for Mocness deployment.
08/11/2006 14:18	131	FRRF	-59.6799	-44.0596	FRRF recovered
08/11/2006 14:03	131	FRRF	-59.6799	-44.05957	FRRF @ 150m commence recovery commence recovery
08/11/2006 13:50	131	FRRF	-59.67993	-44.05953	FRRF deployed
08/11/2006 13:40	130	GO-FLO	-59.67991	-44.05957	Go flow recovered
08/11/2006 12:54	130	GO-FLO	-59.67995	-44.05958	Go-flo @ depth 1000m bottles triggered bottles triggered
08/11/2006 12:24	130	GO-FLO	-59.67991	-44.05957	Commence deployment of Go Flow
08/11/2006 12:10	129	CTD	-59.6799	-44.05959	CTD recovered
08/11/2006 11:48	129	CTD	-59.67989	-44.05964	CTD @ 140m
08/11/2006 11:41	129	CTD	-59.67989	-44.05957	CTD deployed
08/11/2006 11:28	128	BONGO	-59.67992	-44.05959	Bongo nets recovered
08/11/2006 11:12	128	BONGO	-59.68014	-44.05978	Bongo nets @400m commenced recovery. commenced recovery.
08/11/2006 11:02	128	BONGO	-59.68011	-44.05977	Bongo nets deployed
08/11/2006 10:54	127	CTD	-59.68011	-44.05978	CTD on deck
08/11/2006 10:52	127	CTD	-59.68013	-44.05978	CTD at the surface.
08/11/2006 09:26	127	CTD	-59.68015	-44.05982	CTD @ 4038m Commenced recovery. Commenced recovery.
08/11/2006 08:02	127	CTD	-59.6801	-44.0599	CTD deployed
08/11/2006 07:50			-59.68062	-44.05683	Vessel in D.P. Midships gantry unlashed.
08/11/2006 07:40			-59.66032	-44.07518	Vessel approaching CTD station. Reducing speed and turning.
08/11/2006 07:00	126	MOCNESS	-59.57682	-44.23497	Deck Secure proceeding to DP station
08/11/2006 06:47	126	MOCNESS	-59.58582	-44.21967	Mocness recovered
08/11/2006 06:43	126	MOCNESS	-59.58835	-44.21561	Mocness @ surface
08/11/2006 05:24	126	MOCNESS	-59.634	-44.14099	Mocness @ 2290m cable out commence hauling commence hauling
08/11/2006 04:05	126	MOCNESS	-59.67383	-44.05825	Mocness deployed @ 2.0kts
08/11/2006 04:00	126	MOCNESS	-59.67586	-44.05224	Deploying Mocness
08/11/2006 03:56		MOCNESS	-59.67658	-44.04995	moving off station for Mocness deployment
08/11/2006 03:47	125	FRRF	-59.67658	-44.05001	FRRF recovered
08/11/2006 03:30	125	FRRF	-59.67661	-44.04993	FRRF @ 150m
08/11/2006 03:18	125	FRRF	-59.67663	-44.04991	FRRF deployed
08/11/2006 03:12	125	FRRF	-59.67698	-44.04957	Vessel on DP for FRRF deployment

08/11/2006 03:05	125	FRRF	-59.67614	-44.04548	Slowing for FRRF station
08/11/2006 01:39	124	LHPR	-59.6227	-44.21443	LHPR Recovered
08/11/2006 00:21	124	LHPR	-59.67312	-44.08158	LHPR @ 2376m increase speed to 3.5kts commence hauling increase speed to 3.5kts commence hauling
07/11/2006 23:19	124	LHPR	-59.70065	-44.00924	LHPR deployed @ 2.5kts
07/11/2006 22:15	123	RMT-25	-59.66499	-43.95855	RMT 25 on deck. Not feeling very well so repositioning for LHPR deployment!
07/11/2006 22:04	123	RMT-25	-59.66944	-43.94991	RMT 25 @ Surface
07/11/2006 21:56	123	RMT-25	-59.67444	-43.94004	RMT 25 @ 95m (cable out)
07/11/2006 21:46	123	RMT-25	-59.67999	-43.92774	RMT 25 Deployed
07/11/2006 21:19	123	RMT-25	-59.67158	-43.94589	Repositioning for RMT 25 deployment
07/11/2006 20:57			-59.71334	-43.87638	Turning back into wind. Speed 10kts.
07/11/2006 20:47			-59.72698	-43.91631	Turning towards the north est to run across the wind.
07/11/2006 20:07			-59.68262	-44.05469	Vessel passing through Condensed Station No.3. Turning and running down wind. Speed 10kts.
07/11/2006 18:26			-59.94623	-44.21405	Moving off station
07/11/2006 18:10	122	TOW-FISH	-59.94577	-44.2147	Tow fish deployed
07/11/2006 18:04			-59.94574	-44.21471	midships gantry secure
07/11/2006 18:02	122	TOW-FISH	-59.94575	-44.21471	deploying tow fish Gantry Secure hove to till conditions improve
07/11/2006 17:57	121	CTD	-59.94573	-44.21468	CTD recovered Bongo nets recovered
07/11/2006 16:13	121	CTD	-59.94163	-44.23121	CTD @ 4668m and recovering Bongo nets @ 400m and recovering
07/11/2006 14:49	121	CTD	-59.94072	-44.23487	CTD deployed Bongo deployed
07/11/2006 14:39			-59.94095	-44.23329	Vessel on DP for CTD vessel stopped on D.P. for Bongo deployment
07/11/2006 13:17			-60.11105	-44.4873	Gantry lashed moving off station moving off station complete acoustic survey proceeding towards condensed station 6
07/11/2006 13:09	120	CTD	-60.11017	-44.48918	CTD recovered Commence 3rd leg of acoustic transect
07/11/2006 11:15	120	CTD	-60.10283	-44.51985	CTD @ 5079m End of 2nd leg of acoustic transect
07/11/2006 09:44	120	CTD	-60.09786	-44.53339	CTD deployed Commence 2nd leg of acoustic transect
07/11/2006 09:38			-60.09787	-44.53338	Vessel stopped in D.P. midships gantry unlashed. Completed first transect. Repositioning for start of second transect.
07/11/2006 09:23			-60.12839	-44.51293	Vessel clear of ice. Commenced first transect. Co 180 at 10kts
07/11/2006 06:33	119	MOCNESS	-60.39974	-44.49772	Deck Secure proceeding to CTD A station Midships gantry secured. Vessel out of DP

					and repositioning for start of Acoustic Survey
07/11/2006 06:19	119	MOCNESS	-60.39772	-44.48771	Mocness recovered Bongo Nets on board.
07/11/2006 06:14	119	MOCNESS	-60.39628	-44.48096	Mocness @ surface Bongo Nets at the surface.
07/11/2006 05:07	119	MOCNESS	-60.37723	-44.38527	Mocness @ 1993m cable out commence hauling commence hauling Bongo nets @ 400m and recovering
07/11/2006 03:59	119	MOCNESS	-60.36138	-44.2965	Mocness deployed @ 2.0kts Bongo Nets d
07/11/2006 03:54	119	MOCNESS	-60.36123	-44.28954	Deploying Mocness Bongo Nets on board.
07/11/2006 03:49	119	MOCNESS	-60.36449	-44.28825	slowing for Mocness deployment Bongo Nets at the surface.
07/11/2006 02:36	118	RMT-25	-60.41171	-44.54394	RMT 25 recovered. Repositioning vessel for mocness deployment Bongo nets @ 400m and recovering
07/11/2006 01:05	118	RMT-25	-60.42316	-44.38548	RMT 25 @ 1724m (cable out) Bongo nets deployed
07/11/2006 00:09	118	RMT-25	-60.44744	-44.30547	RMT 25 Deployed CTD on deck.
07/11/2006 00:01	118	RMT-25	-60.44933	-44.2927	Commence RMT 25 deployment CTD at the surface.
06/11/2006 22:33	117	RMT-25	-60.39564	-44.69137	RMT 25 on Deck repositioning for next run. repositioning for next run. CTD @ 25m Commenced recovery.
06/11/2006 22:28	117	RMT-25	-60.39941	-44.68738	RMT 25 on surface CTD deployed
06/11/2006 22:00	117	RMT-25	-60.42118	-44.67202	RMT 25 @ 184m (cable out) Mini Bongos on Deck
06/11/2006 21:49	117	RMT-25	-60.43021	-44.67368	RMT 25 Deployed Mini Bongos at the surface
06/11/2006 21:42	117	RMT-25	-60.43351	-44.68032	Reduce Speed for deployment of RMT 25 Mini Bongos @ 400m and Recovering
06/11/2006 20:45	116	ACOUSTIC	-60.3849	-44.49683	End of transect - A/C to run back up transect for RMT target fishing Mini Bongos Deployed
06/11/2006 19:24	116	CTD	-60.32376	-44.73921	A/C 116 CTD recovered
06/11/2006 19:05	116	CTD	-60.33298	-44.79531	A/C 065 CTD @ 400m and recovering
06/11/2006 18:33	116	CTD	-60.38084	-44.83746	A/c to 026T CTD deployed
06/11/2006 17:16	116	ACOUSTIC	-60.43883	-44.59006	Commence acoustics transect on course 296T @ 6.0 kts due to ice and viz on course 296T @ 6.0 kts due to ice and viz Vessel on D.P. ready to deploy
06/11/2006 16:21	115	RMT-25	-60.43004	-44.59114	RMT 25 recovered Slowing for Process Station six
06/11/2006 16:12	115	RMT-25	-60.4343	-44.57946	RMT 25 @ Surface Deck Secure proceeding to condensed process station 6
06/11/2006 15:07	115	RMT-25	-60.47433	-44.49848	RMT 25 @ 760m (cable out) Muli-net recovered
06/11/2006 14:39	115	RMT-25	-60.49091	-44.46345	RMT Deployed Multinet @ Surface
06/11/2006 14:11	115	RMT-25	-60.46799	-44.49561	Commence RMT 25 deployment multinet @ 2224m wire out and recovering

06/11/2006 13:27	114	RMT-25	-60.40881	-44.66374	RMT recovered a/c to run downwind to reposition for next deployment a/c to run downwind to reposition for next deployment Muli-net deployed
06/11/2006 11:41	114	RMT-25	-60.43309	-44.5123	Stop veering RMT 1823m cable out 1823m cable out Multinet recovered due to problem with net
06/11/2006 10:51	114	RMT-25	-60.45309	-44.43474	RMT 25 Deployed Multinet Deployed
06/11/2006 10:35			-60.4548	-44.41529	Vessel turning and reducing speed for RMT 25 deployment. LHPR Recovered
06/11/2006 09:56			-60.43197	-44.60628	Midships Gantry Secure vessel out of DP and positioning for RMT 25 deployment vessel out of DP and positioning for RMT 25 deployment LHPR @ 1913m increase speed to 3.5kts
06/11/2006 09:53	113	BONGO	-60.43196	-44.60628	Bongo Nets on board. LHPR Deployed @ 2.0kts
06/11/2006 09:51	113	BONGO	-60.43198	-44.60621	Bongo Nets at the surface. RMT 25 on deck. Not feeling very well so repositioning for LHPR deployment!
06/11/2006 09:35	113	BONGO	-60.43212	-44.60537	Bongo nets @400m commenced recovery. commenced recovery. RMT 25 at the surface
06/11/2006 09:24	113	BONGO	-60.43225	-44.60464	Bongo nets deployed RMT 25 @ 1879m cable out. Commence hauling
06/11/2006 09:23	112	BONGO	-60.43224	-44.60462	Bongo Nets on board. RMT 25 Deployed
06/11/2006 09:22	112	BONGO	-60.43225	-44.60459	Bongo Nets at the surface. Slowing for RMT 25 deployment
06/11/2006 09:06	112	BONGO	-60.43224	-44.60457	Bongo nets @400m commenced recovery. commenced recovery. RMT 25 recovered. Repositioning vessel for next run
06/11/2006 08:56	112	BONGO	-60.43215	-44.6045	Deployed Bongo Nets RMT 25 @ Surface
06/11/2006 08:52			-60.43224	-44.60437	Vessel repositioned and in DP RMT 25 @ 740m and recovering
06/11/2006 08:42		RMT-25	-60.4381	-44.61934	Repositioning Vessel away from Ice Bergs. RMT 25 Deployed @ 2.5kts
06/11/2006 08:25	111	CTD	-60.43816	-44.61925	CTD deployed Deploying RMT 25
06/11/2006 08:05	110	MINIBONGO	-60.43878	-44.61985	Mini Bongos on Deck Slowing for RMT 25 deployment
06/11/2006 08:04	110	MINIBONGO	-60.43875	-44.61968	Mini Bongos at the surface LHPR recovered repositioning vessel for RMT 25 deployment.
06/11/2006 07:49	110	MINIBONGO	-60.43905	-44.61749	Mini Bongos @ 400m and Recovering LHPR @ surface
06/11/2006 07:39	110	MINIBONGO	-60.43929	-44.61606	Mini Bongos Deployed LHPR @ 2255m cable out
06/11/2006 07:31	109	CTD	-60.4394	-44.6162	CTD on deck Increase to 3.5 knots
06/11/2006 07:29	109	CTD	-60.43952	-44.61627	CTD at the surface. LHPR Deployed @ 2.0kts
06/11/2006 07:12	109	CTD	-60.44015	-44.61662	CTD @ 400m V/L off DP preparing to deploy LHPR
06/11/2006 07:02	109	CTD	-60.44016	-44.61662	CTD deployed FRRF recovered

06/11/2006 06:09	108	FRRF	-60.48999	-44.71972	Deck Secure proceeding to condensed process station 2 FRRF @ 150m commence recovery
06/11/2006 06:03	108	FRRF	-60.48998	-44.71977	FRRF recovered FRRF deployed
06/11/2006 05:48	108	FRRF	-60.48998	-44.71974	FRRF @ 150m commence recovery commence recovery Go-flo recovered
06/11/2006 05:33	108	FRRF	-60.48998	-44.7198	FRRF deployed commence recovery of go-flo
06/11/2006 05:25	108	FRRF	-60.48997	-44.71909	Vessel on DP for FRRF deployment Go-flo @ depth 1000m bottles triggered bottles triggered
06/11/2006 05:20	108	FRRF	-60.48696	-44.71587	Slowing for FRRF station Deploying Go flo first bottle deployed first bottle deployed
06/11/2006 04:55	107	RMT-25	-60.45876	-44.82167	Deck Secure proceeding to FRRF station CTD Recovered
06/11/2006 04:46	107	RMT-25	-60.46073	-44.82073	RMT 25 recovered CTD @ 140m Commenced recovery. Commenced recovery.
06/11/2006 04:04	107	RMT-25	-60.47473	-44.75138	RMT 25 @ 76m (cable out) CTD deployed
06/11/2006 03:58	107	RMT-25	-60.4774	-44.74206	RMT 25 Deployed Bongo Nets on board.
06/11/2006 03:53	107	RMT-25	-60.47976	-44.73386	Deploying RMT 25 Bongo Nets at the surface.
06/11/2006 03:44	107	RMT-25	-60.47805	-44.73739	Slowing for RMT deployment Bongo nets @ 400m and recovering
06/11/2006 03:10	106	RMT-25	-60.46187	-44.82622	RMT 25 recovered Bongo deployed
06/11/2006 01:54	106	RMT-25	-60.49101	-44.6958	RMT 25 @ 729m (cable out) CTD on deck.
06/11/2006 01:30	106	RMT-25	-60.49864	-44.64882	RMT 25 deployed CTD at the surface.
06/11/2006 01:23	106	RMT-25	-60.50119	-44.63524	Commence deployment of RMT 25 CTD @ 5114m Commencing recovery. Commencing recovery.
06/11/2006 00:20	105	LHPR	-60.43489	-44.87974	LHPR Recovered CTD deployed
05/11/2006 23:44	105	LHPR	-60.45407	-44.79847	LHPR cable @1032m stop veering increase to 3.5knots commence hauling stop veering Vessel on DP at station for CTD commence hauling
05/11/2006 23:16	105	LHPR	-60.46542	-44.75633	LHPR Deployed @ 2.0kts slowing for condensed station six
05/11/2006 23:13	105	LHPR	-60.46674	-44.75115	Commence LHPR deployment Deck Secure proceeding to condensed process station 6
05/11/2006 20:36	104	MOCNESS	-60.35293	-44.59445	Mocness on deck. Moving vessel to next location. RMT 25 recovered
05/11/2006 20:33	104	MOCNESS	-60.35399	-44.59194	Mocness @ surface RMT 25 @ Surface
05/11/2006 19:55	104	MOCNESS	-60.37674	-44.56051	Commenced hauling Mocness RMT 25 @ 742m and recovering
05/11/2006 19:32	104	MOCNESS	-60.38402	-44.53341	Mocness @ 1022m cable out RMT deployed
05/11/2006 18:55	104	MOCNESS	-60.3903	-44.51951	Mocness deployed increasing to 0.7kts increasing to 0.7kts Vessel off DP preparing for RMT deployment

05/11/2006 18:52	104	MOCNESS	-60.39037	-44.51906	Deploying Mocness @ 0.3 kts FRRF recovered
05/11/2006 18:48	104	MOCNESS	-60.39049	-44.51842	Vessel on D.P. ready to deploy Mocness @ 0.3 Kts FRRF @ 150m commence recovery commence recovery
05/11/2006 15:57	103	FRRF	-60.41924	-44.67735	FRRF recovered FRRF deployed
05/11/2006 15:37	103	FRRF	-60.41926	-44.67734	FRRF deployed V/L on DP for FRRF
05/11/2006 15:28	102	GO-FLO	-60.41924	-44.67733	Go flow recovered RMT Recovered
05/11/2006 14:54	102	GO-FLO	-60.41924	-44.67738	commence recovery of go-flo RMT 25 @ 2126m (cable out)
05/11/2006 14:39	102	GO-FLO	-60.41926	-44.67736	Go-flo @ depth 1000m bottles triggered bottles triggered RMT 25 deployed.
05/11/2006 14:09	102	GO-FLO	-60.41901	-44.67886	Commence deployment of Go Flow Turning into wind and reducing speed for RMT 25 deployment.
05/11/2006 13:54	101	CTD	-60.41895	-44.67932	CTD recovered Gantry Secure thruster vents closed moving to Condensed Process station six thruster vents closed moving to Condensed Process station six thruster vents closed moving to Condensed Process station six
05/11/2006 13:31	101	CTD	-60.41897	-44.67931	CTD @ 140m Commenced recovery. Commenced recovery. Bongo nets recovered
05/11/2006 13:24	101	CTD	-60.41895	-44.67932	CTD deployed Bongo nets @ 400m
05/11/2006 13:03	100	BONGO	-60.41897	-44.6793	Bongo nets recovered Bongo deployed
05/11/2006 12:46	100	BONGO	-60.41896	-44.67929	Bongo nets @ 400m FRRF recovered
05/11/2006 12:34	100	BONGO	-60.4189	-44.67927	Bongo nets deployed FRRF @ 150m
05/11/2006 12:25	99	CTD	-60.41905	-44.67833	CTD recovered FRRF deployed
05/11/2006 11:48	99	CTD	-60.42041	-44.67092	CTD @ 1175m Vessel on D.P. ready to deploy
05/11/2006 11:22	99	CTD	-60.42027	-44.66969	CTD deployed Slowing for FRRF station
05/11/2006 02:55			-60.70616	-44.06887	v/l on DP awaiting daylight to proceed to condensed station awaiting daylight to proceed to condensed station Deck Secure proceeding to process station 3
05/11/2006 02:33	98	RMT-25	-60.70631	-44.06863	RMT recovered RMT 25 recovered
05/11/2006 01:48	98	RMT-25	-60.72356	-44.01167	Commence hauling RMT RMT 25 @ Surface
05/11/2006 01:42	98	RMT-25	-60.72782	-44.00517	Stop veering RMT 309m cable out 309m cable out RMT @ 43m
05/11/2006 01:28	98	RMT-25	-60.73798	-43.98893	RMT deployed RMT 25 deployed for target fishing
05/11/2006 01:22	98	RMT-25	-60.74259	-43.98161	Commence deployment of RMT 25 RMT Recovered
05/11/2006 01:07	97	NEUSTON	-60.74925	-43.97441	Neuston sledge recovered RMT 25 @ 2267m (cable out)
05/11/2006 00:48	97	NEUSTON	-60.76248	-43.96107	Neuston sledge deployed RMT 25 Deployed
05/11/2006 00:27	97	NEUSTON	-60.77128	-43.94671	A/C head to wind prepare for Neuston net deployment prepare for Neuston net

					deployment Vessel out of DP and driving ahead for RMT 25 deployment.
05/11/2006 00:24	97	NEUSTON	-60.7082	-44.06808	Neuston net deployed Vessel stopped on station in D.P. Awaiting RMT 25 deployment.
04/11/2006 23:24	96	RMT-25	-60.67146	-44.00826	RMT recovered Vessel approaching station. Reducing speed.
04/11/2006 23:18	96	RMT-25	-60.67702	-44.00127	Net on surface Repositioning for RMT 25 deployment
04/11/2006 22:30	96	RMT-25	-60.7331	-43.94441	RMT 25 @ 327m (cable out) Muti Net on deck.
04/11/2006 22:16	96	RMT-25	-60.6706	-44.00926	RMT 25 Deployed Multinet @ Surface
04/11/2006 21:16	95	RMT-25	-60.67538	-44.06455	RMT on deck. Repositioning vessel for next drive. Multinet at 1987m and recovering
04/11/2006 21:11	95	RMT-25	-60.67821	-44.05461	RMT @ Surface Multinet Deployed @ 2kt
04/11/2006 20:11	95	RMT-25	-60.70382	-43.95695	RMT 25 @ 363m (cable out) deploying multinet
04/11/2006 19:57	95	RMT-25	-60.70838	-43.93408	Deployed RMT 25 RMT 25 recovered
04/11/2006 19:35	94	NEUSTON	-60.71128	-43.89745	Neuston Net clear on deck RMT 25 @ Surface
04/11/2006 19:34	94	NEUSTON	-60.71111	-43.89573	Neuston Net clear of the water Hauling for recovery
04/11/2006 19:27	94	NEUSTON	-60.70991	-43.88366	Deployed Neuston Net RMT 25 @ 2050m (cable out)
02/11/2006 20:41	93	RMT-25	-60.56866	-48.60874	Terminated transect due to proximity of ice bergs RMT deployed
02/11/2006 19:22	93	RMT-25	-60.64073	-48.20576	Passing through start position for 290 transect End of 3rd transect a/c head to wind and reduce to 2.5knots for RMT deployment a/c head to wind and reduce to 2.5knots for RMT deployment
02/11/2006 19:07	93	RMT-25	-60.67247	-48.17112	A/C to 290 for next transect Commence 3rd transect
02/11/2006 18:34	93	ACOUSTIC	-60.73258	-48.26631	Complete first transect A/C to 020T A/C to 020T End of 2nd transect
02/11/2006 15:51	93	ACOUSTIC	-60.57326	-49.11994	Commence Acoustic transect on course 110T @ 10.0kts Commenecd second transect
02/11/2006 15:07	92	RMT-25	-60.56374	-49.23573	RMT 25 recovered Completed first transect. Repositioning for start of second transect.
02/11/2006 14:01	92	RMT-25	-60.57294	-49.13016	RMT 25 @ 694m (cable out) commence hauling commence hauling Commenced first transect. Co 315 at 10kts
02/11/2006 13:27	92	RMT-25	-60.57611	-49.07714	RMT Deployed Vessel out of DP and positioning for start of acoustic survey run.
02/11/2006 13:22	92	RMT-25	-60.57689	-49.069	Commence deployment of RMT 25 deck secure proceeding to acoustic survey run
02/11/2006 13:09	91	RMT-25	-60.5795	-49.04936	RMT recovered RMT 25 recovered
02/11/2006 13:02	91	RMT-25	-60.5818	-49.03688	RMT on surface RMT 25 @ Surface
02/11/2006 12:35	91	RMT-27	-60.59097	-48.99076	Hauling RMT for recovery RMT @ 330m
02/11/2006 11:02	91	RMT-25	-60.62313	-48.83965	Commence hauling RMT RMT 25 Deployed @ 2.5kts
02/11/2006 10:55	91	RMT-25	-60.62533	-48.82921	RMT 25 @ 2073m (cable out) Continue deployment

02/11/2006 09:54	91	RMT-25	-60.64292	-48.72767	RMT 25 Deployed Stop deployment due to tangled cod ends
02/11/2006 09:37			-60.64751	-48.70066	Gantry secured vessel out of DP and moving off for RMT 25 deployment. vessel out of DP and moving off for RMT 25 deployment. Re-deploying RMT 25
02/11/2006 09:31	90	BONGO	-60.6475	-48.70063	Bongo Nets on board. RMT 25 recovered
02/11/2006 09:29	90	BONGO	-60.64749	-48.70065	Bongo Nets at the surface. recovering RMT due to fault
02/11/2006 09:13	90	BONGO	-60.6475	-48.70065	Bongo nets @400m commenced recovery. commenced recovery. RMT 25 Deployed @ 2.5kts
02/11/2006 09:02	90	BONGO	-60.64752	-48.70063	Bongo nets deployed Deploying RMT 25
02/11/2006 09:00	89	BONGO	-60.64751	-48.70063	Bongo Nets on board. Vessel off DP preparing for RMT deployment
02/11/2006 08:59	89	BONGO	-60.64752	-48.70063	Bongo Nets at the surface. V/L on DP while RMT is prepared
02/11/2006 08:44	89	BONGO	-60.64751	-48.70063	Bongo nets @400m commenced recovery. commenced recovery. Muli-net recovered
02/11/2006 08:33	89	BONGO	-60.64754	-48.70064	Bongo nets deployed Multinet at 2034m and recovering
02/11/2006 08:29	88	CTD	-60.64753	-48.70063	CTD on deck Muli-net deployed
02/11/2006 08:26	88	CTD	-60.64755	-48.70064	CTD at the surface. Muli-net recovered
02/11/2006 08:25	88	CTD	-60.64753	-48.70068	CTD @ 40m Commenced recovery. Commenced recovery. Tow fish deployed
02/11/2006 08:20	88	CTD	-60.64752	-48.70065	CTD deployed Multinet at 2178m and recovering
02/11/2006 07:55	87	MINIBONGO	-60.64752	-48.70069	Mini Bongos @ 400m and Recovering Multinet Deployed @2kt
02/11/2006 07:44	87	MINIBONGO	-60.64752	-48.70065	Deploying Mini Bongo Nets Vessel out of DP and moving clear. Rigging for Multnet deployment.
02/11/2006 07:38	86	CTD	-60.64752	-48.70065	CTD on deck Ship positioned over mooring to confirm position. Vessel then moving off head to wind.
02/11/2006 07:35	86	CTD	-60.64751	-48.70065	CTD at the surface. Rig slipped.
02/11/2006 07:19	86	CTD	-60.64753	-48.70066	Commenced CTD recovery Main Buoy in the water.
02/11/2006 07:18	86	CTD	-60.64753	-48.70061	CTD @ 400m Acoustic Recording Package in the water.
02/11/2006 07:07	86	CTD	-60.64752	-48.70063	CTD deployed Acoustic Recording Package and Main Buoy attached.
02/11/2006 06:58	86	CTD	-60.64755	-48.70045	Vessel on D.P. ready to deploy SBE CTD connected and deployed
02/11/2006 04:51	85	RMT-25	-60.49292	-49.14841	Deck Secure proceeding to DP station Trimsin cluster connected & deployed
02/11/2006 04:38	85	RMT-25	-60.49593	-49.1465	RMT 25 recovered Sediment trap & Aquadoop current meter connected and deployed
02/11/2006 04:30	85	RMT-25	-60.50021	-49.13692	RMT 25 @ Surface continue veering
02/11/2006 03:58	85	RMT-25	-60.51016	-49.08978	RMT 25 @ 100m (cable out) stop to rig chain block on kevlar rope to improve lead
02/11/2006 03:45	85	RMT-25	-60.51502	-49.06797	RMT 25 Deployed Acoustic release connected and deployed

02/11/2006 03:41	85	RMT-25	-60.51638	-49.06186	Deploying RMT 25 weights deployed
02/11/2006 03:04	84	RMT-25	-60.52038	-49.03595	RMT 25 recovered scientists off for 20' meal break scientists off for 20' meal break commence mooring deployment
02/11/2006 01:55	84	RMT-25	-60.54959	-48.94243	Commence hauling RMT vessel stopped on DP stern over deployment pos'n HDG 240T stern over deployment pos'n HDG 240T
02/11/2006 01:46	84	RMT-25	-60.55322	-48.93079	Stop veering RMT 690m cable out 690m cable out slowing for mooring site deployment
02/11/2006 01:26	84	RMT-25	-60.56156	-48.90379	RMT deployed A/C to 323T proceeding towards chosen deployment site (52 43.387S 40 08.798W) (52 43.387S 40 08.798W)
02/11/2006 01:18	84	RMT-25	-60.56478	-48.89291	Deployment delayed problem with net release gear problem with net release gear A/C to 135T commence second swath run
02/11/2006 01:14	84	RMT-25	-60.56657	-48.88714	Commence deployment of RMT 25 v/l off DP commencing swath survey for mooring deployment
02/11/2006 00:32	83	MOCNESS	-60.57435	-48.86484	Mocness recovered Mini Bongos Recovered
01/11/2006 23:18		MOCNESS	-60.60666	-48.78137	Mocness @ 2116m cable out commence hauling commence hauling Mini bongo @ 400m commence hauling
01/11/2006 22:05	83	MOCNESS	-60.64666	-48.7032	Mocness deployed Tow fish recovered
01/11/2006 22:00			-60.64843	-48.69697	Vessel out of DP moving off for Mocness deployment. Mini bongo deployed
01/11/2006 21:36			-60.64843	-48.69703	Midships Gantry Secure awaiting Mocness deployment. awaiting Mocness deployment. CTD Recovered
01/11/2006 21:29	82	BONGO	-60.64843	-48.69702	Bongo nets recovered CTD @ 2000m Commencing recovery. Commencing recovery.
01/11/2006 21:27	82	BONGO	-60.64842	-48.69701	Bongo Nets at the surface. CTD deployed
01/11/2006 21:12	82	BONGO	-60.64844	-48.69696	Bongo nets @400m commenced recovery. commenced recovery. Bongo nets recovered
01/11/2006 21:00	82	BONGO	-60.64837	-48.69716	Bongo nets deployed Bongo nets @ 400m and recovering
01/11/2006 20:54			-60.64836	-48.69704	Vessel on station in DP. Bongo nets deployed
01/11/2006 20:50			-60.64871	-48.69615	Vessel setting up in DP. Midships gantry unlashed. CTD recovered
01/11/2006 19:40		CTD	-60.50768	-48.77213	Repositioning vessel for Bongo Net deployment. CTD @ 30m and recovering
01/11/2006 19:36	81	MOCNESS	-60.50801	-48.76787	Mocness recovered CTD Deployed
01/11/2006 19:33	81	MOCNESS	-60.50983	-48.76715	Mocness @ surface FRRF on deck.
01/11/2006 18:21	81	MOCNESS	-60.55997	-48.73785	Mocness @ 2145m cable out commence hauling commence hauling FRRF at the surface.

01/11/2006 17:05	81	MOCNESS	-60.61132	-48.72558	Mocness deployed FRRF @ 150m commence recovery commence recovery
01/11/2006 17:02	81	MOCNESS	-60.61353	-48.72444	Deploying Mocness FRRF deployed
01/11/2006 16:54	81	MOCNESS	-60.61904	-48.72183	V/L head to wind and 2Kts through the water ready to deploy Go Flo recovered to deck. Setting up for FRRF.
01/11/2006 16:50	81	MOCNESS	-60.61726	-48.71641	slowing for Mocness deployment Second Go Flo bottle removed
01/11/2006 15:57	80	LHPR	-60.54377	-48.75435	LHPR Recovered Third Go Flo bottle removed.
01/11/2006 15:53	80	LHPR	-60.54821	-48.75496	LHPR @ surface Fourth Go Flo bottle removed
01/11/2006 14:47	80	LHPR	-60.62112	-48.74346	LHPR cable @1961m stop veering increase to 3.5knots commence hauling stop veering Fifth Go Flo bottle removed commence hauling
01/11/2006 13:54	80	LHPR	-60.64778	-48.70302	LHPR Deployed @ 2.0kts Sixth Go Flo bottle removed
01/11/2006 13:47	80	LHPR	-60.64926	-48.69765	V/L off DP preparing for LHPR deployment Commenced Go Flo recovery
01/11/2006 13:18	79	FRRF	-60.6494	-48.69766	FRRF recovered Go Flo wire at 1000m Trigger weight deployed.
01/11/2006 13:02	79	FRRF	-60.64938	-48.69765	FRRF @ 150m commence recovery commence recovery Sixth Go Flo bottle attached
01/11/2006 12:51	79	FRRF	-60.64932	-48.69758	FRRF deployed Fifth Go Flo bottle attached
01/11/2006 12:45	78	GO-FLO	-60.64937	-48.6976	Go-flo recovered Fourth Go Flo bottle attached
01/11/2006 12:13	78	GO-FLO	-60.64936	-48.69749	commence recovery of go-flo Third Go Flo bottle attached
01/11/2006 12:00	78	GO-FLO	-60.64927	-48.69746	Go-flo @ depth 1000m bottles triggered bottles triggered Second Go Flo bottle attached.
01/11/2006 11:26	78	GO-FLO	-60.64927	-48.69743	Commence deployement of Go-flo Go Flo deployed with first bottle
01/11/2006 11:13	77	CTD	-60.64925	-48.69743	CTD recovered to deck CTD on deck. Setting up for Go Flo.
01/11/2006 10:54	77	CTD	-60.64923	-48.69744	CTD @ 140m Commenced recovery. Commenced recovery. CTD at the surface.
01/11/2006 10:48	77	CTD	-60.64923	-48.69745	CTD deployed CTD @ 140m Commenced recovery. Commenced recovery.
01/11/2006 10:39	76	BONGO	-60.64926	-48.69745	Bongo Nets at the surface. CTD deployed
01/11/2006 10:36	76	BONGO	-60.64926	-48.69745	Bongo Nets on board. Vessel approaching CTD station. Setting up in DP. Midships gantry unlashed.
01/11/2006 10:20	76	BONGO	-60.64868	-48.69727	Bongo nets @400m commenced recovery. commenced recovery. Vessel approaching CTD station. Reducing speed and turning.
01/11/2006 10:11	76	BONGO	-60.64834	-48.69705	Bongo nets deployed Deck Secure proceeding to process station 3
01/11/2006 10:03	75	CTD	-60.64833	-48.69704	CTD on deck RMT 25 recovered cod ends recovered with use of Gilson winch cod ends recovered with use of Gilson winch
01/11/2006 10:01	75	CTD	-60.64834	-48.69707	CTD at the surface. RMT 25 @ Surface

01/11/2006 09:20	75	CTD	-60.6483	-48.69703	CTD @ depth 1650m. Commencing recovery RMT 25 @ 822m (cable out)
01/11/2006 08:48	75	CTD	-60.64834	-48.697	CTD deployed RMT 25 Deployed @ 2.5kts
01/11/2006 08:42			-60.64836	-48.69695	Vessel on station in DP. Midships gantry unlashed. Deploying RMT 25
01/11/2006 08:39			-60.64845	-48.69662	Approaching revised position. Setting up in DP Midships gantry secured vessel out of D.P. and moving off for RMT 25 deployment. vessel out of D.P. and moving off for RMT 25 deployment.
01/11/2006 08:18		FFRF	-60.62372	-48.67202	Revised position of CTD deployment due to proximity of ice. FRRF recovered
01/11/2006 06:38	74	FRRF	-60.42583	-48.77746	Gantry Secure moving to Condensed Process station one moving to Condensed Process station one FRRF @ 150m commence recovery commence recovery
01/11/2006 06:30	74	FRRF	-60.42586	-48.77748	FRRF recovered FRRF deployed
01/11/2006 06:12	74	FRRF	-60.42598	-48.77752	FRRF @ 150m V/L on DP for FRRF
01/11/2006 06:03	74	FRRF	-60.42596	-48.77746	FRRP deployed LHPR Recovered
01/11/2006 05:56	74	FRRF	-60.42595	-48.77751	V/l on Auto Position DP ready to deploy FRRF LHPR @ 2290m cable out commence hauling commence hauling
01/11/2006 05:50	74	FRRF	-60.42619	-48.78359	Slowing for FRRF station Increase to 3.5 knots
01/11/2006 05:32	73	RMT-25	-60.40529	-48.80015	Deck Secure proceeding to FRRF station LHPR Deployed @ 2.0kts
01/11/2006 05:15	73	RMT-25	-60.40913	-48.80232	RMT 25 recovered LHPR Recovered
01/11/2006 05:07	73	RMT-25	-60.41563	-48.79732	RMT 25 @ Surface LHPR @ 2019m increase speed to 3.5kts commence hauling increase speed to 3.5kts commence hauling
01/11/2006 03:39	73	RMT-25	-60.48624	-48.75872	RMT 25 @ 1917m wire out wire out LHPR Deployed @ 2.0kts
01/11/2006 02:31	73	RMT-25	-60.53885	-48.74578	RMT 25 deployed Vessel out of DP and moving off for LHPR re-deployment.
01/11/2006 02:24	73	RMT-25	-60.54471	-48.74413	Commence deployment of RMT 25 Vessel stopped and returned to full auto DP. Awaiting result of investigation into problem with LHPR.
01/11/2006 01:21	72	LHPR	-60.57278	-48.7471	LHPR Recovered LHPR on deck for investigation. Ship still moving ahead at 2kts.
01/11/2006 00:21		LHPR	-60.63023	-48.70728	Stop veering LHPR 1834m cable out increase to 3.5knots commence recovery increase to 3.5knots LHPR deployment aborted returning unit to deck. returning unit to deck.
31/10/2006 23:33	72	LHPR	-60.65986	-48.69972	LHPR Deployed @ 2.0kts Commenced deployment of LHPR
31/10/2006 23:31	72	LHPR	-60.66104	-48.70008	Commence deployment of LHPR Midships Gantry Secure vessel out of DP and moving off for LHPR deployment. vessel out of DP and moving off for LHPR deployment.
31/10/2006 22:38		LHPR	-60.65092	-48.70434	Repositioning vessel for LHPR deployment CTD on deck.
31/10/2006 22:35		CTD	-60.65345	-48.70368	Condenced Station Position Fixed @ 60 39.9'S 048 42.1'W CTD at the surface.
31/10/2006 22:31	71	RMT-25	-60.65663	-48.70299	RMT 25 on Deck CTD @ 3733m

31/10/2006 22:20	71	RMT-25	-60.66495	-48.70193	Commence Recovery of RMT CTD deployed
31/10/2006 21:48	71	RMT-25	-60.68968	-48.69487	RMT 25 @ 119m (cable out) Go Flo recovered
31/10/2006 21:33	71	RMT-25	-60.70181	-48.68686	RMT 25 Deployed Commence hauling go-flo
31/10/2006 21:22			-60.70792	-48.68256	Vessel out of DP moving off for RMT 25 deployment. Go flo at depth (500m)
31/10/2006 20:40			-60.70789	-48.6829	Vessel set up in DP 5th go-flo bottle attached to cable
31/10/2006 20:33		GO-FLO	-60.70782	-48.68288	Commenced reducing speed. 4th go-flo bottle attached to cable
31/10/2006 20:22	62	TOW-FISH	-60.68641	-48.75951	Tow Fish on deck 3rd glo-flo bottle attached to cable
31/10/2006 20:19	62	GO-FLO	-60.67933	-48.7765	Approaching ice edge. Commenced recovering Tow Fish 2nd Go Flow bottle attached to the cable
31/10/2006 19:19	70	XBT	-60.54237	-49.06845	XBT Deployed Go Flo deployed with first bottle
31/10/2006 17:13	69	XBT	-60.13637	-49.20936	XBT Deployed CTD recovered
31/10/2006 14:32	68	XBT	-59.73592	-49.46991	XBT Deployed CTD @ 30m
31/10/2006 11:45	67	XBT	-59.36034	-49.65833	1st XBT failed XBT redeployed XBT redeployed CTD deployed
31/10/2006 11:40	67	XBT	-59.34041	-49.66815	XBT deployed Bongo nets recovered
31/10/2006 09:34	66	XBT	-58.9249	-49.87587	XBT Deployed Bongo nets @125m
31/10/2006 07:35	65	XBT	-58.53883	-50.0599	XBT Deployed Bongo nets deployed
31/10/2006 05:08	64	XBT	-58.1239	-50.22527	XBT Deployed CTD recovered
31/10/2006 02:16			-57.66249	-50.38754	All secure on deck complete process station 1. A/C to 166 degrees increase to 10 knots heading towards CS1 complete process station 1. A/C to 166 degrees CTD @ 400m and recovering heading towards CS1
31/10/2006 01:50	63	MOCNESS	-57.66893	-50.39983	Mocness recovered CTD deployed
31/10/2006 00:46	63	MOCNESS	-57.70472	-50.41985	Mocness @ 1835m cable out commence hauling commence hauling FRRF recovered
30/10/2006 23:44	63	MOCNESS	-57.73039	-50.43437	Mocness deployed FRRF @ 150m and recovering
30/10/2006 23:40	63	MOCNESS	-57.74168	-50.43655	Commence mocness deployment FRRF Deployed
30/10/2006 23:38			-57.74235	-50.4366	Vessel off DP preparing for mocness deployment preparing for mocness deployment CTD Recovered
30/10/2006 23:30	62	TOW-FISH	-57.74229	-50.4367	Tow fish deployed CTD @ 140m and recovering
30/10/2006 23:06	61	GO-FLO	-57.74229	-50.43674	go-flo recovered CTD Deployed
30/10/2006 22:53	61	GO-FLO	-57.74233	-50.43669	Go flo at depth (50m) Mini Bongos Recovered
30/10/2006 22:52	61	GO-FLO	-57.74231	-50.43674	Deploying Go flo (six bottles together) Bongo nets @ 400m
30/10/2006 22:34			-57.74227	-50.43678	Vessel on station in DP. Midships gantry unlashed. Mini Bongos Deployed

30/10/2006 22:18	60	ACOUSTIC	-57.74613	-50.44049	Completed transect. CTD recovered
30/10/2006 21:44	60	ACOUSTIC	-57.74232	-50.60632	Commenced leg six of Transect course 270 course 270 CTD @ 2000m
30/10/2006 20:19	60	ACOUSTIC	-57.51149	-50.59725	Commenced leg five of Transect course 180 course 180 CTD deployed
30/10/2006 19:47	60	ACOUSTIC	-57.51701	-50.43993	Commenced leg four of Transect course 270 course 270 Vessel stopped on station in D.P. Setting up for CTD deployment.
30/10/2006 17:03	60	ACOUSTIC	-57.9675	-50.43943	commence leg 3 of transect course 000T course 000T Turned on swath for mooring postion
30/10/2006 16:26	60	ACOUSTIC	-57.96545	-50.27084	Complete first transect A/C to 270T A/C to 270T Science suspended due to weather vessel hove to vessel hove to
30/10/2006 15:06	60	ACOUSTIC	-57.74169	-50.27047	Commence Acoustic transect on 180T @ 12.0kts Acoustic transect abandoned due to bad weather
30/10/2006 14:16		RMT-25	-57.63832	-50.49445	RMT secure A/C and increase speed to relocate to start of acoustic transect A/C and increase speed to relocate to start of acoustic transect Start acoustic transect PS3_T1 4-6
30/10/2006 14:05	59	RMT-25	-57.64543	-50.48976	RMT 25 recovered Vessel moving off station to head 270 for swath survey
30/10/2006 13:34	59	CTD	-57.66298	-50.47979	Hauling for recovery CTD Recovered
30/10/2006 12:22	59	RMT-25	-57.70161	-50.45936	Commence hauling RMT CTD @ 2000m
30/10/2006 12:18	59	RMT-25	-57.70424	-50.4582	Stop veering RMT 1731m cable out 1731m cable out CTD deployed
30/10/2006 11:24	59	RMT-25	-57.73566	-50.44222	RMT 25 deployed Bongo nets recovered
30/10/2006 11:20	59	RMT-25	-57.73819	-50.44079	Commence deployment of RMT 25 Bongo nets @ 400m
30/10/2006 11:00	58	RMT-25	-57.74649	-50.4258	RMT 25 recovered Bongo nets deployed
30/10/2006 10:52	58	RMT-25	-57.74943	-50.41779	RMT 25 @ Surface CTD recovered
30/10/2006 09:53	58	RMT-25	-57.77226	-50.35788	Commence Recovery of RMT CTD @ 30m
30/10/2006 09:43	58	RMT-25	-57.7764	-50.34698	RMT 25 @ 750m (cable out) CTD deployed
30/10/2006 09:21	58	RMT-25	-57.78544	-50.32191	RMT 25 Deployed FRRF recovered
30/10/2006 09:11		RMT-25	-57.78559	-50.32151	All ready on deck. Vessel out of DP and working up to speed for RMT 25 deployment. FRRF @ 150m commence recovery commence recovery
30/10/2006 07:47			-57.78986	-50.31066	Vessel on station in DP awaiting RMT 25 deployment FRRF deployed
30/10/2006 07:32		RMT-25	-57.78973	-50.30812	Approaching RMT 25 deployment position. Setting up in DP to await deployment. Go Flo recovered to deck.
30/10/2006 05:19		RMT-25	-57.71413	-50.56711	Deck secure proceeding 5' downwind of Process station ready for RMT25 deployment at 0600 proceeding 5' downwind of Process station ready for RMT25 deployment at 0600 Second Go Flo bottle removed

30/10/2006 05:06	57	LHPR	-57.71614	-50.56774	LHPR Recovered Third Go Flo bottle removed.
30/10/2006 05:04	57	LHPR	-57.71707	-50.56468	LHPR @ surface Third Go Flo bottle removed.
30/10/2006 04:02	57	LHPR	-57.73512	-50.46758	LHPR @ 1854m increase speed to 3.5kts increase speed to 3.5kts Fifth Go Flo bottle removed
30/10/2006 03:15	57	LHPR	-57.74377	-50.43228	LHPR Deployed @ 2.0kts Sixth Go Flo bottle removed
30/10/2006 03:07	57	LHPR	-57.74759	-50.43161	Slowing for LHPR deployment Commenced recovery of Glo Fo
30/10/2006 02:07			-57.80074	-50.69754	All secure on deck a/c to run back to process station a/c to run back to process station Go Flo wire at 1000m Trigger weight deployed.
30/10/2006 01:53	56	RMT-25	-57.7991	-50.68837	RMT recovered Sixth Go Flo bottle attached
30/10/2006 00:33	56	RMT-25	-57.78165	-50.59807	Commence hauling RMT Fifth Go Flo bottle attached
30/10/2006 00:15	56	RMT-25	-57.77588	-50.57856	Stop veering RMT 1175m cable out 1175m cable out Fourth Go Flo bottle attached
29/10/2006 23:41	56	RMT-25	-57.76618	-50.54229	RMT 25 Deployed Third Go Flo bottle attached
29/10/2006 23:34	56	RMT-25	-57.76419	-50.53501	Commence deployement of RMT 25 Second Go Flo bottle attached.
29/10/2006 23:23	55	RMT-25	-57.76248	-50.53007	RMT 25 recovered Go Flo deployed with first bottle
29/10/2006 23:05	55	RMT-25	-57.75783	-50.50813	RMT 25 heaved up to 100m (cable out) CTD on deck.
29/10/2006 22:40	55	RMT-25	-57.75774	-50.50776	RMT 25 @ 154m (cable out) CTD at the surface.
29/10/2006 22:25	55	RMT-25	-57.74909	-50.45961	RMT 25 Deployed CTD @ 140m Commenced recovery. Commenced recovery.
29/10/2006 22:00			-57.74462	-50.43041	Midships Gantry Secure vessel out of DP and positioning for RMT 25 deployment vessel out of DP and positioning for RMT 25 deployment CTD deployed
29/10/2006 21:55	54	MINIBONGO	-57.74461	-50.43042	Mini Bongos Recovered Bongo Nets on board.
29/10/2006 21:54	54	MINIBONGO	-57.74456	-50.43064	Mini Bongos at the surface Bongo Nets at the surface.
29/10/2006 21:32	54	MINIBONGO	-57.74303	-50.43559	Mini Bongos @ 400m and Recovering Bongo nets @400m commenced recovery. commenced recovery.
29/10/2006 21:19	54	MINIBONGO	-57.74252	-50.43721	Deploying Mini Bongo Bongo nets deployed
29/10/2006 21:06			-57.74209	-50.43785	Vessel on station in DP. Midships gantry unlashed. CTD on deck.
29/10/2006 20:56			-57.74456	-50.44589	Approaching Process Station 1. Setting up in DP CTD at the surface.
29/10/2006 20:22	53	LHPR	-57.75878	-50.59927	LHPR @ surface CTD @ 3728m
29/10/2006 20:22	53	LHPR	-57.75878	-50.59927	LHPR recovered repositioning vessel for Mini Bongo deployment. repositioning vessel for Mini Bongo deployment. CTD deployed
29/10/2006 19:03	53	LHPR	-57.74219	-50.43792	LHPR cable out 2394m Commenced recovery FRRF recovered
29/10/2006 17:56	53	LHPR	-57.74271	-50.43657	Deploying LHPR FRRF @ 150m

29/10/2006 17:47		-57.74535	-50.37731	gantry secure increasing speed for LHPR deployment increasing speed for LHPR deployment FRRF deployed
29/10/2006 17:42	52 CTD	-57.74548	-50.37999	CTD recovered Slowing for Process Station Three
29/10/2006 17:03	52 CTD	-57.74548	-50.39012	CTD @ 2000m Deck Secure proceeding to FRRF station
29/10/2006 16:25	52 CTD	-57.74546	-50.39957	CTD deployed RMT 25 recovered
29/10/2006 15:45	52 CTD	-57.74551	-50.39951	CTD deployment delayed due to wire jumping off drum RMT @ Surface
29/10/2006 15:38	51 BONGO	-57.74542	-50.40011	Bongo nets recovered RMT 25 @ 49m (cable out)
29/10/2006 15:09	51 BONGO	-57.74483	-50.40952	Bongo nets @400m RMT 25 Deployed @ 2.5kts
29/10/2006 14:58	51 BONGO	-57.74448	-50.41352	Bongo nets deployed Deploying RMT 25
29/10/2006 14:51	50 CTD	-57.74442	-50.41391	CTD recovered Slowing for RMT 25 deployment
29/10/2006 14:41	50 CTD	-57.74428	-50.41574	CTD @ 60m deck secure moving off to look for targets
29/10/2006 14:37	50 CTD	-57.74422	-50.41623	CTD deployed RMT 25 recovered
29/10/2006 14:24	49 FRRF	-57.74459	-50.41174	FRRF recovered RMT 25 @ 53m (cable out)
29/10/2006 14:09	49 FRRF	-57.74438	-50.41433	FRRF @ 150m RMT 25 deployed
29/10/2006 13:59	49 FRRF	-57.74422	-50.41688	FRRF deployed Targets identified turn head to wind and prepare for RMT deployment turn head to wind and prepare for RMT deployment
29/10/2006 13:46	48 GO-FLO	-57.74475	-50.41194	go-flo recovered All secure a/c to run downwind looking for krill targets a/c to run downwind looking for krill targets
29/10/2006 13:16	48 GO-FLO	-57.74433	-50.41937	Commence recovery of go-flo RMT recovered
29/10/2006 12:58	48 GO-FLO	-57.74394	-50.42448	Go-flow @ depth 1000m bottles triggered bottles triggered RMT @ Surface
29/10/2006 12:27	48 GO-FLO	-57.74344	-50.43338	Go-Flo deployed Commence hauling RMT
29/10/2006 12:15	47 CTD	-57.74375	-50.4283	CTD recovered RMT 25 @ 54m (cable out)
29/10/2006 11:57	47 CTD	-57.74349	-50.43164	CTD @ 140m RMT 25 deployed
29/10/2006 11:50	47 CTD	-57.74337	-50.43282	CTD deployed Commence deploying RMT
29/10/2006 11:41	46 BONGO	-57.74396	-50.429	Bongo nets recovered Targets identified turn head to wind and prepare for RMT deployment turn head to wind and prepare for RMT deployment
29/10/2006 11:24	46 BONGO	-57.74304	-50.43412	Bongo nets @400m Vessel off DP running down wind to search for RMT targets
29/10/2006 11:14	46 BONGO	-57.74227	-50.43785	Bongo nets deployed Weights recovered
29/10/2006 11:05	45 CTD	-57.74209	-50.4386	CTD recovered Weights @ 500m
29/10/2006 09:38	45 CTD	-57.74209	-50.43858	CTD at deph (cable out 4063m). Commenced recovery. V/l moving ahead at 0.5knots on DP. Weights deployed on conducting wire.

29/10/2006 08:28	45	CTD	-57.74217	-50.43854	CTD deployed V/L on DP @ process station 4
29/10/2006 08:21			-57.74218	-50.43857	Vessel on station in DP. Vessel at Process Station No.3
29/10/2006 08:12			-57.74224	-50.43672	Midships gantry unlashed Ships speed 5 knots
29/10/2006 08:11			-57.74224	-50.43648	Approaching Process Station 1. Setting up in DP Commenced reducing speed to 5 knots.
29/10/2006 06:41			-57.49888	-50.51263	Gantry Secure moving to Process station one moving to Process station one XBT Completed Increasing Speed
29/10/2006 06:34	44	FRRF	-57.49924	-50.51195	FRRF recovered XBT Deployed
29/10/2006 06:16	44	FRRF	-57.49925	-50.51193	FRRF @ 150m Deck Secure proceeding to process station 3
29/10/2006 06:03	44	FRRF	-57.49927	-50.51194	FRRF deployed CTD recovered
29/10/2006 05:56	44	FRRF	-57.49947	-50.51164	Vessel on DP for FRRF deployment CTD @ 2007m
29/10/2006 05:51	44	FRRF	-57.49884	-50.50664	Slowing for FRRF station CTD deployed
29/10/2006 05:31	43	RMT-25	-57.44501	-50.51752	Deck Secure proceeding to DP station Vessel on D.P. ready to deploy
29/10/2006 05:11	43	RMT-25	-57.45288	-50.51519	RMT Recovered Slowing for CTD station "J"
29/10/2006 05:02	43	RMT-25	-57.45943	-50.5141	RMT 25 @ Surface Vessel moving off station
29/10/2006 03:58	43	RMT-25	-57.50876	-50.50677	RMT 25 @ 766m CTD Recovered
29/10/2006 03:41		RMT-25	-57.49923	-50.51194	Bridge Informed by U.I.C. that RMT will be deployed till 0200 then vessel to proceed in direction of Process Station one stopping at 0300 for deployment of FRRF then vessel to proceed in direction of Process Station one CTD @ 2013m
29/10/2006 03:30	43	RMT-25	-57.53066	-50.50526	RMT 25 Deployed CTD deployed
29/10/2006 03:24	43	RMT-25	-57.53512	-50.50532	Deploying RMT Vessel stopped on station in DP midships gantry unlashed. midships gantry unlashed.
29/10/2006 02:38	42	RMT-25	-57.54536	-50.50589	RMT Recovered XBT Completed Increasing Speed
29/10/2006 02:26	42	RMT-25	-57.55389	-50.49981	RMT 25 @ Surface XBT Deployed
29/10/2006 00:32	42	RMT-25	-57.627	-50.4497	Commence hauling Deck Secure proceeding to CTD I Station
29/10/2006 00:24	42	RMT-25	-57.63226	-50.44641	Stop veering out cable at 1895m FRRF recovered
28/10/2006 23:31	42	RMT-25	-57.66753	-50.42721	RMT 25 Deployed FRRF @ 150m
28/10/2006 22:43	41	RMT-25	-57.61767	-50.39899	RMT 25 recovered. Repositioning vessel for next run FRRF deployed
28/10/2006 22:37	41	RMT-25	-57.62293	-50.39765	RMT 25 @ Surface Vessel on D.P. ready to deploy
28/10/2006 22:32	41	RMT-25	-57.62744	-50.39676	RMT 25 commenced recovery Slowing for FRRF station
28/10/2006 21:32	41	RMT-25	-57.67511	-50.39387	Stopped veering out cable at 338m. Deck Secure proceeding to process station 2

28/10/2006 21:18	41	RMT-25	-57.68598	-50.39344	RMT 25 Deployed RMT 25 recovered
28/10/2006 21:01			-57.6957	-50.39106	Midships Gantry Secure vessel out of DP and positioning for RMT 25 deployment vessel out of DP and positioning for RMT 25 deployment recovering RMT due to fault possible net monitor possible net monitor
28/10/2006 20:56	40	CTD	-57.6955	-50.39173	CTD recovered RMT 25 @ 208m (cable out)
28/10/2006 20:54	40	CTD	-57.69543	-50.39199	CTD at the surface. RMT 25 Deployed @ 2.5kts
28/10/2006 20:49	40	CTD	-57.69519	-50.3926	CTD at depth (40m) commenced recovery commenced recovery Deploying RMT 25
28/10/2006 20:44	40	CTD	-57.69505	-50.39287	CTD deployed Slowing for RMT deployment
28/10/2006 20:40			-57.6794	-50.39387	Vessel on station in DP. Midships gantry unlashed. Run down wind in preparation for RMT 25 target fishing
28/10/2006 19:52	39	MOCNESS	-57.63762	-50.36547	Mocness recovered Repositioning Vessel for CTD deployment Repositioning Vessel for CTD deployment Work continuing to rectify LHPR problem. Cable will require retermination
28/10/2006 19:50	39	MOCNESS	-57.68296	-50.39369	Mocness @ surface V/L holding position while work is undertaken to rectify LHPR problem
28/10/2006 18:44	39	MOCNESS	-57.68132	-50.37961	Mocness @ 1952m and hauling LHPR Recovered
28/10/2006 17:34	39	MOCNESS	-57.72223	-50.38383	Mocness deployed LHPR stopped at 605m cable out equipment failure commence recovery equipment failure commence recovery
28/10/2006 17:30	39	MOCNESS	-57.725	-50.3836	Deploying Mocness Resume veering LHPR
28/10/2006 17:24	38	MOCNESS	-57.72854	-50.38368	Mocness recovered LHPR stopped @ 484m cable out equipment problem equipment problem
28/10/2006 17:18	38	MOCNESS	-57.73306	-50.38358	Recovering Mocness No readings No readings LHPR Deployed @ 2.0kts
28/10/2006 17:17	38	MOCNESS	-57.73384	-50.38347	Mocness deployed Repositioning vessel for LHPR deployment
28/10/2006 17:13	38	MOCNESS	-57.73645	-50.38365	Deploying Mocness Multinet Recovered
28/10/2006 17:07			-57.7398	-50.38369	Gantry Lashed preparing to deploy mocness preparing to deploy mocness Multinet @ Surface
28/10/2006 16:58	37	CTD	-57.74121	-50.38464	CTD recovered Multinet at 1925m and recovering
28/10/2006 16:40	37	CTD	-57.74132	-50.38998	CTD @ 400m Multinet Deployed @ 2kt
28/10/2006 16:29	37	CTD	-57.74138	-50.39249	CTD deployed Turning vessel and reducing speed for Multinet deployment.
28/10/2006 15:51	36	CTD	-57.74178	-50.40053	CTD recovered Vessel proceeding back to process station
28/10/2006 14:23	36	CTD	-57.74215	-50.4085	CTD@ depth 4099m cable out RMT Recovered
28/10/2006 13:10	36	CTD	-57.74289	-50.4218	CTD deployed RMT @ Surface

28/10/2006 12:33	35	CTD	-57.74288	-50.42182	CTD recovered to deck RMT 25 @ 495m (cable out)
28/10/2006 12:10	35	CTD	-57.7429	-50.4218	CTD stopped @140m RMT 25 Deployed @ 2.5kts
28/10/2006 12:02	35	CTD	-57.7429	-50.4218	CTD deployed Deploying RMT 25
28/10/2006 11:41	34	FRRF	-57.74289	-50.42174	FRRF recovered ready to deploy
28/10/2006 11:27	34	FRRF	-57.74287	-50.42386	Commence recovery of FRRF Slowing for RMT deployment
28/10/2006 11:16	34	FRRF	-57.74273	-50.42543	FRRF deployed Vessel towards process station
28/10/2006 11:06	33	GO-FLO	-57.74266	-50.42599	Go flow recovered RMT 25 recovered
28/10/2006 10:36	33	GO-FLO	-57.74189	-50.43121	Commence Recovery of Go-Flo RMT 25 @ 636m (cable out)
28/10/2006 10:20	33	GO-FLO	-57.74196	-50.43355	Go-Flo at depth (1000m) RMT 25 deployed
28/10/2006 09:55	33	GO-FLO	-57.74241	-50.43807	Vessel tracking in DP to maintain lead on the Go-Flo wire RMT 25 recovered
28/10/2006 09:51	33	GO-FLO	-57.74236	-50.43831	Go-Flo deployed RMT 25 @ 2266m (cable out)
28/10/2006 09:36	32	CTD	-57.74238	-50.43838	CTD recovered RMT 25 Deployed
28/10/2006 09:35	32	CTD	-57.74237	-50.43837	CTD at the surface. Completed Acoustic Survey relocating for RMT 25 deployment. relocating for RMT 25 deployment.
28/10/2006 08:31	32	CTD	-57.74226	-50.43837	Resumed recovery of CTD direct to deck. Commence Acoustic transect on 270T @ 10.0kts
28/10/2006 08:18	32	CTD	-57.74224	-50.43836	CTD recovery held. Problem with the CTD (cable out 3820m) Turning vessel for start point of Acoustic Survey.
28/10/2006 08:11	32	CTD	-57.74217	-50.43839	CTD at deph (cable out 4065m) Commencing recovery deck secure proceeding to acoustic survey run
28/10/2006 07:00	32	CTD	-57.74218	-50.43842	CTD deployed RMT 25 recovered
28/10/2006 06:44	31	FRRF	-57.74205	-50.43814	FRRF recovered RMT 25 @ Surface
28/10/2006 06:24	31	FRRF	-57.74137	-50.43646	FRRF @ 150m RMT 25 @ 153m (cable out)
28/10/2006 06:16	31	FRRF	-57.74101	-50.43557	FRRF deployed RMT 25 Deployed @ 2.5kts
28/10/2006 06:09	31	FRRF	-57.74101	-50.43556	V/l on Auto Position DP ready to deploy FRRF Deploying RMT 25
28/10/2006 06:00	31	FRRF	-57.74246	-50.44123	Slowing for Process Station One Slowing for RMT deployment
28/10/2006 04:43			-57.65328	-50.13435	Deck Secure proceeding to DP station deck secure proceeding towards acoustic survey run
28/10/2006 04:18	30	LHPR	-57.66153	-50.16789	LHPR Recovered RMT 25 recovered
28/10/2006 04:14	30	LHPR	-57.66383	-50.17481	LHPR @ surface RMT 25 @ Surface
28/10/2006 02:35	30	RMT-25	-57.72621	-50.37216	Commence hauling RMT 25 @ 714m (cable out)

28/10/2006 02:34	30	RMT-25	-57.72671	-50.37424	Stop veering out cable at 2808m RMT 25 Deployed
28/10/2006 01:20	30	RMT-25	-57.76551	-50.53438	LHPR Deployed V/L off DP preparing for RMT
28/10/2006 00:10	29	RMT-25	-57.7537	-50.3561	RMT 25 recovered to deck due to fault with a wire FRRF recovered
28/10/2006 00:00	29	RMT-25	-57.75306	-50.34204	RMT 25 Deployed FRRF @ 150m commence recovery commence recovery
27/10/2006 22:54			-57.73108	-50.35153	Turning back towards the East FRRF deployed
27/10/2006 21:10			-57.74134	-50.11534	Turning back towards the west one mile north of east bound track V/L on DP for FRRF
27/10/2006 21:00			-57.73692	-50.16156	Steaming North for one mile LHPR secure a/c to run downwind a/c to run downwind
27/10/2006 19:32	29	RMT-25	-57.74856	-50.37249	RMT deployment aborted due to technical problems. Vessel reversed course and increased speed to 5kts for fish finding while repairs made to the RMT LHPR Recovered
27/10/2006 18:55	29	RMT-25	-57.7493	-50.3289	Vessel Head to wind @ 2.5Kts ready to deploy RMT ready to deploy RMT LHPR@ 2439m (cable out)
27/10/2006 18:40			-57.74926	-50.36774	Vessel moving off station Increase to 3.5 knots
27/10/2006 18:22			-57.74862	-50.36464	Midships Gantry Secure rigging RMT wire rigging RMT wire Neuston sledge recovered
27/10/2006 18:13	28	MINIBONGO	-57.74849	-50.37193	Mini Bongos Recovered Neuston sledge deployed
27/10/2006 17:52	28	MINIBONGO	-57.74695	-50.38033	Mini Bongos @ 400m and Recovering LHPR Deployed @ 2.0kts
27/10/2006 17:37	28	MINIBONGO	-57.74549	-50.38536	Mini Bongos Deployed V/L off DP preparing to deploy LHPR
27/10/2006 17:32	27	MINIBONGO	-57.74522	-50.3873	Mini Bongos Recovered LHPR on deck repositioning vessel for next run. repositioning vessel for next run.
27/10/2006 17:15	27	MINIBONGO	-57.74409	-50.3931	Mini Bongos @ 400m and Recovering LHPR at the surface.
27/10/2006 17:02	27	MINIBONGO	-57.74296	-50.3978	Mini Bongos Deployed LHPR @ 2050 commence hauling commence hauling
27/10/2006 16:53	26	CTD	-57.74297	-50.39991	CTD recovered Increase to 3.5 knots
27/10/2006 16:10	26	CTD	-57.74303	-50.41022	CTD @ 2000m LHPR Deployed @ 2.0kts
27/10/2006 15:32	26	CTD	-57.74302	-50.42025	CTD deployed Vessel turning into wind and reducing speed for LHPR deployment.
27/10/2006 15:19	25	BONGO	-57.74294	-50.42358	Bongo nets recovered from 400m Vessel proceeding back to process station
27/10/2006 14:50	25	BONGO	-57.74267	-50.43003	Bongo nets deployed Multinet Recovered
27/10/2006 14:49	24	BONGO	-57.74266	-50.43025	Bongo nets recovered from 400m Multinet @ Surface
27/10/2006 14:31	24	BONGO	-57.74254	-50.43478	Commence recovery of bongo nets Recommence hauling electronics not fixed. Hauling for recovery electronics not fixed. Hauling for recovery
27/10/2006 14:20	24	BONGO	-57.74247	-50.43674	Bongo nets deployed Hauling stopped due to problem with electronics for net monitor
27/10/2006 14:14	23	CTD	-57.74243	-50.4375	CTD recovered Multinet at 2284m and recovering

27/10/2006 14:01	23	CTD	-57.74245	-50.43754	CTD stopped at 20m Multinet Deployed @ 2kt
27/10/2006 13:57	23	CTD	-57.74246	-50.43748	CTD deployed Deploying the multinet
27/10/2006 13:55	23	CTD	-57.74246	-50.43748	Clear to deploy CTD Vessel moving off station to deploy multinet
27/10/2006 13:45	22	FRRF	-57.74284	-50.43359	FRRF recovered V/L sat on DP awaiting rigging of mulit net
27/10/2006 13:28	22	FRRF	-57.74285	-50.4336	Commence recovery of FRRF Bongo nets recovered
27/10/2006 13:10	22	FRRF	-57.74282	-50.43382	FRRF deployed Bongo nets @125m commenced recovery. commenced recovery.
27/10/2006 12:56	21	GO-FLO	-57.74347	-50.42523	go-flo recovered Bongo nets deployed
27/10/2006 12:15	21	GO-FLO	-57.74289	-50.43034	commence recovery of go-flo CTD recovered
27/10/2006 11:56	21	GO-FLO	-57.74247	-50.43423	6th go-flo bottle attatched to cable CTD @ 60m
27/10/2006 11:53	21	GO-FLO	-57.7424	-50.4348	5th go-flo bottle attached to cable CTD deployed
27/10/2006 11:50	21	GO-FLO	-57.74235	-50.43545	4th go-flo bottle attached to cable FRRF recovered
27/10/2006 11:46	21	GO-FLO	-57.74225	-50.43626	3rd glo-flo bottle attached to cable FRRF @ 150m commence recovery commence recovery
27/10/2006 11:36	21	GO-FLO	-57.74211	-50.43784	2nd Go Flow bottle attached to the cable FRRF deployed
27/10/2006 11:20	21	GO-FLO	-57.74202	-50.43838	Commence deployment of Go Flow go-flo recovered
27/10/2006 10:57	20	CTD	-57.74202	-50.43837	CTD recovered commence recovery of go-flo
27/10/2006 10:55	20	CTD	-57.74202	-50.43837	CTD at the surface. Go Flo wire at 1000m Trigger weight deployed.
27/10/2006 10:41	20	CTD	-57.74202	-50.43837	CTD Commenced recovery Commenced recovery Sixth Go Flo bottle attached
27/10/2006 10:39	20	CTD	-57.74201	-50.4384	CTD at deph (cable out 140m) Fifth Go Flo bottle attached
27/10/2006 10:33	20	CTD	-57.74198	-50.43838	CTD deployed Fourth Go Flo bottle attached
27/10/2006 09:42	19	CTD	-57.74201	-50.43837	CTD recovered Third Go Flo bottle attached
27/10/2006 09:40	19	CTD	-57.74202	-50.43835	CTD at the surface. Second Go Flo bottle attached.
27/10/2006 08:11	19	CTD	-57.74202	-50.43835	CTD at deph (cable out 4050m) Commencing recovery Go-Flo deployed with first bottle.
27/10/2006 06:59	19	CTD	-57.74201	-50.43835	CTD deployed CTD on deck. Setting up for Go Flo.
27/10/2006 06:26	18	FRRF	-57.74197	-50.43806	FRRF recovered from 120m CTD at the surface.
27/10/2006 06:18	18	FRRF	-57.74197	-50.43811	FRRF deployed CTD @ 140m Commenced recovery. Commenced recovery.
27/10/2006 06:05	18	FRRF	-57.74216	-50.43781	Vessel on DP for FRRF deployment CTD deployed
27/10/2006 05:51	17	TOW-FISH	-57.75106	-50.40468	Towed Fish recovered proceeding to DP station proceeding to DP station CTD on deck.
27/10/2006 05:39	17	TOW-FISH	-57.75568	-50.38854	recovering Towed Fish CTD at the surface.

27/10/2006 05:36	17	TOW-FISH	-57.75633	-50.38717	Slowing to recover Towed Fish CTD @ 2000m Commencing recovery. Commencing recovery.
27/10/2006 03:21	16	MOCNESS	-57.73076	-50.50701	Mocness recovered CTD deployed
27/10/2006 03:17	16	MOCNESS	-57.73057	-50.50261	Mocness @ surface CTD on deck.
27/10/2006 02:45	16	MOCNESS	-57.73047	-50.4698	Commence recovery of mocness CTD at the surface.
27/10/2006 02:44	16	MOCNESS	-57.73044	-50.46861	Stopped veering mocness cable at 1000m CTD @ 3178m
27/10/2006 02:27	17	TOW-FISH	-57.7305	-50.451	Tow fish deployed CTD deployed
27/10/2006 02:02	16	MOCNESS	-57.72809	-50.42646	Mocness deployed vessel on auto posn dp @ process station2
27/10/2006 00:54	16	MOCNESS	-57.72455	-50.34996	Alter course head to swell reduce speed to 2kt and prepare for deployment of Mocness head to swell Slowing for Process Station Two
26/10/2006 20:44			-57.13095	-51.17834	Rochester Cable tests completed increasing speed and altering course for Process Station 1. Deck Secure proceeding to process station 2
26/10/2006 20:08	3	CPR	-57.013	-51.54339	CPR recovered to deck. Commencing load and conductivity test on Rochester Cable. RMT 25 recovered
26/10/2006 20:02	3	CPR	-57.01297	-51.57041	Commenced recovering CPR RMT 25 @ Surface
26/10/2006 19:58			-57.12294	-51.19002	Turning vessel to run with the sea and reducing speed for CPR recovery. RMT 25 @ 306m (cable out)
26/10/2006 11:47	2	MAGNET	-56.20563	-54.4992	Magnetometer recovered RMT 25 Deployed @ 2.5kts
26/10/2006 11:40	2	MAGNET	-56.20237	-54.48801	commence recovery of magnetometer Deploying RMT 25
25/10/2006 21:12	15	XBT	-54.78682	-53.77049	XBT Aborted resuming track towards XBT10 position. resuming track towards XBT10 position. RMT Recovered
25/10/2006 19:39	15	XBT	-54.78548	-53.7712	XBT Deployed RMT 25 @ 100m (cable out)
25/10/2006 19:35	15	XBT	-54.54975	-53.88036	Altering into weather for XBT deployment. RMT 25 Deployed
25/10/2006 19:10			-54.49177	-53.90282	Essential Deck/Sci work completed. Vessel A/C towards XBT10 position. RMT 25 recovered
25/10/2006 16:25			-54.54581	-54.55138	Vessel A/C down weather to allow essential deck/ Sci work deck/ Sci work RMT 25 @ 1975m (cable out)
25/10/2006 15:49	14	XBT	-54.44743	-54.6566	Vessel @ 11.5kts RMT 25 Deployed
25/10/2006 15:38	14	XBT	-54.43491	-54.68534	XBT Failed increasing speed to 11.5 kts increasing speed to 11.5 kts Vessel out of DP and driving ahead for RMT 25 deployment.
25/10/2006 15:36	14	XBT	-54.43486	-54.69009	XBT Deployed Vessel stopped in DP awaiting RMT 25 deployment.
25/10/2006 15:32	13	XBT	-54.43454	-54.69992	XBT Failed Completed transect. Repositioning for RMT 25 deployment.

25/10/2006 15:31	13	XBT	-54.43437	-54.70245	XBT Deployed Commenced third transect on heading 090
25/10/2006 15:27	13	XBT	-54.43315	-54.71309	Slowing to 6.0 kts and altering down weather for XBT deployment Complete second transect A/C to 000T A/C to 000T
25/10/2006 13:15			-54.18342	-54.96832	Vessel @ 11.5kts Commence 2nd leg of acoustic transect
25/10/2006 13:10		XBT	-54.17477	-54.98149	XBTs complete resume track and increase speed resume track and increase speed Complete first transect A/C to 000T A/C to 000T
25/10/2006 13:03	12	XBT	-54.17338	-55.0006	XBT failed Commence leg 1 of acoustic transect
25/10/2006 13:00	12	XBT	-54.17277	-55.00898	XBT deployed All secure on deck moving off to begin acoustic survey moving off to begin acoustic survey
25/10/2006 12:56	11	XBT	-54.17193	-55.02046	XBT failed Bongo nets recovered
25/10/2006 12:53	11	XBT	-54.17125	-55.02884	XBT deployed Bongo nets @400m commenced recovery. commenced recovery.
25/10/2006 12:45			-54.16611	-55.05284	a/c to run down swell reduce speed reduce speed Bongo nets deployed
25/10/2006 11:18			-53.94488	-55.33986	v/l at 11.5 knots Bongo nets recovered
25/10/2006 11:14	10	XBT	-53.93824	-55.34935	XBT deplolyed Bongo nets @400m commenced recovery. commenced recovery.
25/10/2006 11:04	9	XBT	-53.93118	-55.36006	XBT Failed Bongo deployed
25/10/2006 11:00	9	XBT	-53.93074	-55.36069	XBT Deployed CTD recovered
25/10/2006 10:54	9		-53.913	-55.38507	Slowing to 6.0 kts for XBT deployment CTD @ 400m commencing recovery. commencing recovery.
25/10/2006 09:26	8		-53.69288	-55.66072	Vessel @ 11.5kts CTD deployed
25/10/2006 09:23	8	XBT	-53.68535	-55.67051	XBT Completed Increasing Speed CTD recovered
25/10/2006 09:19	8	XBT	-53.69039	-55.66401	XBT Completed Increasing Speed CTD @ 140m Commenced recovery. Commenced recovery.
25/10/2006 09:10	8	XBT	-53.66799	-55.69425	XBT Deployed CTD deployed
25/10/2006 09:05	8		-53.66041	-55.70395	Slowing to 6.0 kts for XBT deployment FRRF recovered
25/10/2006 07:35	7		-53.70041	-55.65162	Vessel @ 11.5kts FRRF @ 150m commence recovery commence recovery
25/10/2006 07:28	7	XBT	-53.42418	-56.00729	XBT Failed increasing speed to 11.5 kts increasing speed to 11.5 kts FRRF deployed
25/10/2006 07:22	7	XBT	-53.45386	-55.97062	XBT Deployed Go Flo recovered to deck. Setting up for FRRF.
25/10/2006 07:17	6	XBT	-53.41461	-56.0198	XBT Failed Second Go Flo bottle removed
25/10/2006 07:14	6	XBT	-53.45044	-55.97498	XBT Deployed Third Go Flo bottle removed.
25/10/2006 07:10	6		-53.4048	-56.03353	Slowing to 6.0 kts for XBT deployment Fourth Go Flo bottle removed
25/10/2006 05:45	5		-53.19355	-56.30502	Vessel @ 11.5kts Fifth Go Flo bottle removed

25/10/2006 05:37	5	XBT	-53.17804	-56.32597	XBT Failed increasing speed to 11.5 kts increasing speed to 11.5 kts Sixth Go Flo bottle removed
25/10/2006 05:26	5	XBT	-53.16354	-56.34411	XBT Deployed Commenced Go Flo recovery
25/10/2006 05:23	4	XBT	-53.15998	-56.34842	XBT Failed Go Flo wire at 1000m Trigger weight deployed.
25/10/2006 05:20	4	XBT	-53.15617	-56.35302	XBT Deployed Sixth Go Flo bottle attached
25/10/2006 05:12	4		-53.14354	-56.36778	Slowing to 6.0 kts for XBT deployment Fifth Go Flo bottle attached
24/10/2006 20:54	3	CPR	-51.72058	-57.58259	CPR deployed to 60m Fourth Go Flo bottle attached
24/10/2006 20:46	3	CPR	-51.70105	-57.60213	CPR deployed Third Go Flo bottle attached
24/10/2006 20:41	2	MAGNET	-51.69041	-57.6149	Magnetometer deployed to 200m Second Go Flo bottle attached.
24/10/2006 20:33	2	MAGNET	-51.67691	-57.63011	Magnetometer deployed Go-Flo deployed with first bottle.
24/10/2006 20:14	1	CTD	-51.66645	-57.64222	CTD recovered CTD on deck. Setting up for Go Flo.
24/10/2006 20:10	1	CTD	-51.66764	-57.64292	CTD at Depth (30m) CTD at the surface.
24/10/2006 20:05	1	CTD	-51.66825	-57.64303	Trial deployment of CTD Recovering CTD

Appendix 5: JR152 & JR159 Cruise Report

27/09/06-20/10/06

David Pond

Introduction

During the 3 weeks prior to JR161 the JCR was primarily engaged in logistical duties with limited time allocated to science activities. Forty eight hours were allocated to AFI16-16 for larval fish sampling using the RMT8 and neuston net. A further 6 days were allocated to mooring deployments, the western core box and acoustic calibrations. A PCO_2 analyser was also operated during this leg of the cruise. Sea conditions were generally rough during the 3 weeks and science time was lost from all science activities.

Non-toxic pumped seawater sampling

David Pond

During passage from Montivideo samples were taken from the ships non-toxic pumped seawater supply. Large volume filtrations 100-125 litres were taken for PCB analysis and smaller volume filtrations taken for stable isotope (^{13}C and ^{15}N) and fatty acid analysis (Table1).

Details of samples taken form the non-toxic pumped sea water filtrations for fatty acid, stable isotope and PCB analysis.

DP Event	Date	Time (ship)	Lat	Long	Nº carbouys	Salinity	Temp	Fluor.
PCB1	29/09/2006	20:25	40 02.50	56 04.43	4	-	-	-
PCB2	30/11/2006	05:11	41 44.65	56 17.02	5	34.04	5.15	1.00
PCB3	30/11/2006	10:30	42 52.58	56 25.50	5	34.02	7.29	0.43
PCB4	30/09/2006	16:10	44 03.52	56 34.57	5	34.00	7.31	0.40
PCB5	30/11/2006	22:11	45 19.41	56 44.53	5	34.07	7.43	0.65
PCB6	01/11/2006	04:11	46 31.85	56 54.32	4	34.03	7.18	1.58
PCB7	01/10/2006	01:12	47 40.68	57 03.79	4	34.03	5.7	0.47
PCB8	01/10/2006	16:00	48 50.87	57 13.47	5	34.02	5.61	0.41
PCB9	13/10/2006	10:20	53 19 60	39 35 11	5	33.92	0.58	0.36

Report on pCO_2 activities

Nick Hardman-Mountford , Elizabeth Jones

Introduction

This report describes the implementation of pCO_2 (partial pressure of carbon dioxide) monitoring on James Clark Ross (JCR) during cruise JR152/159 during 3-21 October 2006. A Natural Environment Research Council (NERC) Capital Equipment Grant to CASIX covered the provision and temporary installation of the pCO_2 system on JCR. The pCO_2 system was built by the engineering company Dartcom. Participation in the cruise was through an Antarctic Funding Initiative (AFI) Collaborative Gearing Scheme (CGS) bid (CGS8/28). This funded sending Nick Hardman-Mountford (CASIX-PML, pCO_2 instrument expert) and Elizabeth Jones (CASIX-UEA, pCO_2 researcher) on the first scientific voyage of JCR with this instrument, with the aims of a) providing validation data for British Antarctic Survey (BAS) modeling activities over the long-term, b) tailoring the system to JCR for use in specific Southern Ocean conditions (e.g. large diatoms, sea ice), c) to train BAS and shipside in the necessary procedures for future near-autonomous operation.

Expectations prior to departure were that PML would install the instrument in Immingham prior to the ship's departure south. BAS would ensure the necessary NMEA and ancillary data streams were output to the instrument and that e-mail communications for the instrument were established. It was also intended that the instrument would run with basic shipside support (Deck Engineer) on the leg south to gain important data from the Atlantic Ocean. Mark Preston (BAS) would then take over science support of the instrument at first port of embarkation for scientific personnel.

The instrument was successfully installed in Immingham, although the NMEA/ancillary data streams and e-mail communications were not working adequately on departure from Immingham. Jeremy Robst (BAS) endeavoured to implement these during the leg south (departure 4th Sep 2006) but these were not implemented by the time of a major incident with the instrument on the 22nd Sep, at which point the instrument was turned off to await repair in Stanley. Therefore, the repair of the instrument has become the primary goal of this trip. The prior stated aims have also all been achieved as best possible.

Summary of problems and actions taken to recover system performance

Flooding of valve tray gas loop

Initial assessment

Analysis of the data file from the leg south showed a short-lived spike in pCO_2 on 12 Sep, coinciding with a quick clean of the equilibrator by the Deck Engineer. This in itself may not be indicative of a problem. On 14th Sep humidity in the equilibrator cycle began to increase and reached 100% on 15th Sep. This would have triggered an alarm, but no metatext record is entered for this event. pCO_2 values were reduced due to the high humidity. The software was closed and restarted on 21st Sep although the reasons for this are not specified. The high humidity and low pCO_2 continued until 22nd Sep when another quick clean took place. Both pCO_2 and pressure values jumped at this point, 10-fold in the case of pCO_2. At this point Dartcom were contacted and the system turned off. The changes in the equilibrator cycle were reflected in the other cycles to a lesser degree.

Initial inspection of the valve tray showed water had got into the valve tray via the equilibrator-in gas line. The marine air and equilibrator pumps were still working. Attempts to blow out some of the water through the V3 vent valve were initially unsuccessful, suggesting this valve could be stuck. However, it continued to make the right noises when turned on and off and further attempts showed this valve to be working properly. All the other valves were working properly.

Causes

Water in the valve tray was fresh, not saline, so the flooding appears to have happened when the equilibrator was filled up for cleaning. Inspection of data for the leg south showed problems to have occurred following cleaning of the equilibrator (12th and 22nd Sep). This suggests that the equilibrator was overfilled, allowing water to push all the way through the gas lines and explains the high humidity and pCO_2 values on all readings.

Actions taken

To attempt to dry out the valve tray components, the filters and various bits of tubing were disconnected and dried out using a low oven (40-60°C). A peristaltic pump was used to suck water out of the solenoid valve manifold, humidity sensor housings, LICOR and other sections of the gas loop, until thoroughly dry. A hairdryer was used to dry the humidity sensor.

Following this action, the LICOR was still not providing absorption output values so, in reference to the manual, the optical bench was taken apart for cleaning. The interior was covered in dry salts so was cleaned with a 50% ethanol solution, clean cotton swabs and lens tissues. This was not entirely effective, although it allowed some tarnishing of the gold and scratches (presumably from dried salts) to be identified. A second clean with a high-grade solvent cleaner (designed for electronic systems) improved the reflectivity of the gold tube, source and receptor ends.

Once all components were cleaned and dry, tubing was refitted. For the most part existing tubing and collars/clamps were reused, although a new length was required between the Swagelok T-piece and the input air filter, as this had been damaged during removal. Some new collars and clamps were also fitted. The tray was pressurized to 1.6 bar using the nitrogen standard and left overnight with the input pressure turned off. Reduction in pressure was negligible. Joints were also tested with Snoop and no leaks were found.

Recalibration of the LICOR was undertaken using software provided by LICOR. The zero for CO_2 was calculated using the nitrogen standard and the span gas used for CO_2 was the 450ppm standard as this gave the least variable reading (actual value used was 449.03ppm, as provided by UEA calibration of gases). The nitrogen gas was also used to zero the H_2O channel but marine air had to be used as the span gas because this allowed a positive dew point to be entered (the LICOR calibration software can only take positive dewpoints although the LICOR itself can read negative dewpoints). Dewpoints were calculated from relative humidity and temperature in the loop using the Magnus formulae (obtained from UK National Physical Laboratory website http://www.npl.co.uk/thermal/faqs_humidity.html#dewpoint). Recalibration was attempted after both the initial and second cleans.

Overnight operation of the LICOR following the initial clean showed an increasing trend in pCO_2 although H_2O values remained stable. The low LICOR pressure values also showed an increasing trend. The second clean and recalibration appeared to reduce the high frequency variability on the pCO_2 readings but did not fix the increasing trend in pCO_2 or pressure. Breathing into the valve tray and around joints produced no CO_2 spikes, suggesting no leaks in the tray.

Ultimately, the problem with the LICOR could not be solved during the cruise. However, post-processing corrections applied to data collected between leaving KEP (9 Oct) and arrival in Stanley (20 Oct) may provide useable data for some of this period (data from after the 18^{th} Oct appears to be best). Dartcom/PML have provided a replacement LICOR and filters, sent out with personnel for the next leg (JR161).

Swagelok taps were sent out from PML and UEA to be fitted to the gas lines in the top of the equilibrator. These will be closed during future cleaning to prevent water getting through the lines.

Dartcom are looking into a retrospective modification to the dryer design, allowing a flood reservoir to be fitted to the input gas lines.

The cleaning schedule has been amended to avoid this problem reoccurring.

Flow and LICOR pressure readings

Initial assessment

In addition to the other LICOR and valve tray problems, barometric pressure readings from the LICOR and flow meter readings were found to be extremely low (2-300mb and 3-7 sccm, respectively) when the system was restarted in Stanley.

Causes

These problems were probably caused by over-pressurisation of the valve tray, although the point at which this occurred is not apparent from the data files.

Actions taken

Mark Preston replaced the flow meter with a new unit provided by Dartcom. The LICOR was replaced with a new unit provided by Dartcom/PML on return to Stanley.

Final state

Flow meter working properly.

Low 250 ppm CO_2 standard

Initial assessment

The regulator on the 250ppm cylinder showed only 100 bar remaining, i.e. 100 bar had been used. The other two cylinders had used 10-20 bar each. This suggests a leak but no leak was identified on the cylinder or regulator. The pressure in this cylinder did not drop significantly during the cruise.

Causes

The cause of this problem is uncertain, but was probably a leak that has been fixed.

Actions taken

The cylinder and regulator were tested for leaks. No further actions were taken with respect to the fitting. Replacement standards for all gases were ordered from PML to be sent from the UK on RRS Ernest Shackleton and then transferred to JCR. If these are not required they can be returned to PML for use on other pCO_2 systems or retained by BAS for next season (to be discussed).

Final state

The regulator and cylinder appear to be functioning properly, but need to be monitored.

Lack of NMEA/Ancillary data stream

Initial assessment

Jeremy Robst (IT support) was aware of the need to provide an NMEA/ancillary data feed to the pCO_2 system but had not been able to implement this during the leg south. He logged a metatext message that these were 'to do' on 3rd Sep. Jeremy was not aware that underway NMEA (including GPS) and ancillary data were required during the leg south, so these were not logged by the ship. Therefore no ancillary data concurrent with pCO_2 data exists prior to this cruise.

Causes

During the cruise, attempts to provide the NMEA and ancillary data strings were held up because BAS data output strings do not normally have a check sum term.

Actions taken

Contact with Dartcom established the checksum was needed. This was then implemented by Jeremy Robst for the BAS strings.

The GPS string coordinates need the number of satellites to be output for the data to be logged in preference to the Iridium, when Iridium is showing zero.

Final state

GPS co-ordinates, ancillary data and some NMEA data are now being received by the pCO2 system and logged, where appropriate.

Lack of e-mail communications

Initial assessment

Attempts during the leg south to e-mail data from the pCO_2 system via the ship's mailserver were unsuccessful. Jeremy Robst was not able to fix this prior to this cruise. During the cruise it was found that the pCO_2 system would e-mail only the first address of the three listed, that it would do this for every record rather than waiting for a buffer to fill up and that attempts to change the mailserver or input a new DNS server would hang the system.

Causes

The probable cause of the mail only being sent to the first address was identified as being the structure of the e-mail addresses. All three e-mail addresses were surrounded by angle brackets and separated by semi-colons, as follows:

```
<pco2@pml.ac.uk;colin@dartcom.co.uk;jpro@bas.ac.uk>
```

The BAS sendmail system interprets this as an attempt to use a routeing address format. When sending multiple addresses BAS use the format:

```
<pco2@pml.ac.uk>,<colin@dartcom.co.uk>,<jpro@bas.ac.uk>
```

Note the angle brackets are around individual addresses, not the whole list. Also, addresses are separated by a comma, according to the RFC, but most e-mail systems accept either a comma or semicolon, including BAS systems. Section 3.4 of RFC2822 has details (http://www.faqs.org/rfcs/rfc2822.html).

Actions taken

Dartcom were contacted with these details to determine any changes to the source code that were necessary. This is not straightforward because the routine used by Dartcom has been used successfully for many other applications over many years.

An interim solution was provided by Jeremy Robst: the pCO_2 system sends an e-mail to a single onboard e-mail address which then concatenates the mime output into one file and sends it out to other e-mail recipients every 6 hours.

Final state

The interim on-board system is working properly. A software upgrade by Dartcom is pending.

Dryer blockage

Initial assessment

During testing of the valve tray, it was noticed that the marine air line was blocked.

Causes and actions taken

This was initially thought to be caused by the input filter to the line being frozen, so this was defrosted and an inverted funnel fitted to the input to prevent water accumulating at the narrow aperture of the filter input. However, this was found not to be the cause of the problem. The blockage was then traced to the dryer. Turning off the dryer for a while released the blockage and quite a bit of water was pumped from the dryer reservoir. It appears that the dryer was frozen, perhaps from being left in cooling mode when the pCO_2 system control screen was changed from automatic to manual operation. Gas lines were disconnected from the dryer and all water was removed form the dryer before turning the dryer back on. The dryer gradually reduced the humidity of the marine air and equilibrator gases, but with a much lower efficiency than before. Rebooting the live pCO2 software fixed this problem and caused the dryer to work efficiently again.

The problem repeated on 18th Oct during normal operation. The marine air lines into and then out from the dryer were systematically disconnected to check that this was where the blockage could be found. The system was than powered down, the equilibrator in and out gas lines to/from the dryer were disconnected (to prevent any water ingress when the dryer was turned off) and the whole system was left to stand for 2 hours, allowing time for the dryer to thaw out. The system was then powered up and the dryer pump operated in manual mode to empty the water reservoirs (although nothing was found in these). Finally, when satisfied that there was no water in the dryer, all the gas lines to the dryer were reconnected and the system switched back to automatic operation. This procedure should be followed if the problem recurs.

Final state

The dryer is working properly.

While continued running in manual mode for testing the system may have caused the dryer to freeze up the first time, this is not certain and was certainly not the case the second time. Prolonged system testing is unusual away from Dartcom, however, modifications to the control system are required so that the dryer is not left either cooling or turned off for prolonged periods, e.g. while systems are being tested. The former could cause freezing and the latter could allow water ingress to the valve tray.

Other activities

During the cruise, Mark Preston was trained in the day-to-day scientific support of the instrument, including equilibrator cleaning procedures.

Elizabeth Jones supplemented the pCO_2 data obtained with water samples for dissolved inorganic carbon (DIC) and total alkalinity (TA). These were taken from the ships non-toxic underway seawater supply and fixed with mercuric chloride for analysis back at UEA. Samples were taken coincident with CTD stations in the western core box and every 6 hours along the transect from South Georgia to Stanley, with a higher frequency of every 3 hours in the vicinity of the Polar Front.

Remote sensing support was provided to the cruise by the NERC Earth Observation Data Service (NEODAS), hosted at PML. Composites of SST and chlorophyll data from satellite were provided every 2-3 days (see Fig. 1). Cloud covered much of the area of work, but information on the position of the Polar Front and areas of bloom developed off South Georgia was useful.

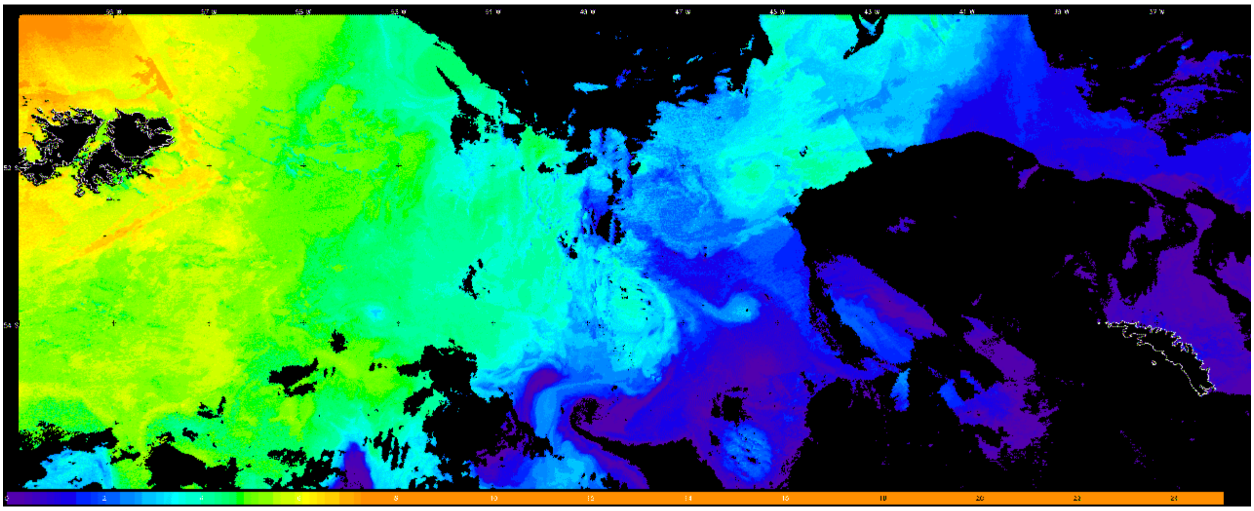

Fig. 1. SST composite from MODIS Aqua for the period 26 Sep to 2 Oct 2006, showing te position of the Polar Front between the Falklands (left) and South Georgia (right). Provided by NEODAS.

Lessons learned

Communication is the key to successful operations.

Breakdown in communication at a number of points, both technical and personal, have been behind a number of the problems encountered. If near-real time (NRT) e-mail communications between the pCO_2 system and Dartcom/PML had been established on departure from Immingham, the water ingress problems could have been spotted earlier and the severe damage to the system potentially avoided. A gap in the communication of the need for ship's underway data logging meant that valuable data collected by the pCO_2 instrument on the leg south cannot be processed to the highest possible standards. Conversely, good communications between the ship, PML and Dartcom during this cruise have allowed for many of the problems encountered to be adequately dealt with and repairs made where necessary. Good communications between the ship and Dartcom/PML, by telephone and e-mail, must be maintained if this trial is to succeed.

Training of pCO2 system operators is essential.

Another contributing factor to the problems encountered has been the lack of adequate training so far. This was looked into and accepted as not feasible before the cruise, but must be prioritised for the future. Simon Wright (shipside, Deck Engineer)was given very basic level training before departure from Immingham, which he passed on to Doug Trevy (shipside, Deck Engineer) when the crew changed over. Mark Preston has been trained in operation of the system for this season during this cruise but should attend further training at Dartcom if he is to be responsible for the instrument over future seasons. Ideally, more than one responsible person needs to be trained so operations are not dependent on one person and it would also be useful if both BAS technical personnel and the ship's Deck Engineers could be trained.

Appropriate spare parts should be kept on board

Expense precludes providing a full set of spare parts for each pCO_2 system, but provision of a basic set of Swagelok fittings, tubing, Snoop leak detector, filters and regulator as a minimum has proved useful on this cruise. Spare gas cylinders should also be provided in future (these have been ordered). Other (small) parts can be transported by scientific personnel heading south, as has been undertaken during the changeover between this cruise and JR161.

Major risks to the system are water ingress and over-pressurisation.

These risks are well known and the diagnostic sensors in the tray have worked adequately in alerting to these. These failure modes are the most likely to cause full system shutdown so must be avoided at all costs. Any evidence of these must be treated with the utmost urgency.

Southern Ocean specific problems

So far, the harsh Southern Ocean environment has not caused significant problems for the instrument. The freezing-up of the marine air line may be partly attributable to negative air temperatures, but this has only been a minor issue and appropriate procedures have been established to deal with it. The cruise has not encountered blockage by large diatoms but these may become an issue later in the season. It has also not been exposed to the lowest temperatures or sea ice. Ongoing assessment of these possible issues needs to be undertaken throughout the season.

Conclusion

Despite a difficult start, the operation of the pCO_2 system throughout this cruise has been broadly successful, although with provisos to data quality. Good communication between the ship and PML/Dartcom appear to be the key to successful implementation of the trial throughout the season, so these must be maintained at all times.

Gene Flow in Antarctic Fishes (AFI6-16):

Jenny Rock, Bill Hutchinson (leg 1); Martin Collins, leg 2

This research examines the influence of oceanographic processes, bathymetry and life history variation on dispersal and gene flow in two Antarctic fishes (*Champsocephalus gunnari, Notothenia rossii*) that differ in the distribution of eggs and larvae and longevity. Molecular markers (microsatellites and mtDNA) are being used to characterise population structure at both circumpolar and regional geographic scales, which will then be compared with predictions from oceanographic models.

Objectives

Broadly, to quantify the degree of population genetic structuring, larval dispersal, and influence of oceanography on two fish species with contrasting life histories. Specifically for **JR 152**, to sample aggregations of *C. gunnari* and *N. rossii* larvae for genetic analysis to test dispersal patterns predicted by oceanographic modelling.

Sampling will occur:
a) at a coarse-scale level across the Scotia Sea, including the area between the southern and northern extremes (South Orkneys and South Georgia/Shag Rocks, respectively) and between South Georgia and Shag Rocks themselves;

b) at a fine-scale level along the coast of South Georgia, e.g. comparing NW with NE waters, and N coast with SW coast.

Work at sea to date (20-10-06; end of first leg of cruise)

To collect larval fish of both species, two types of fishing gear are prepared for use: the Neuston net and RMT8 net. Due to weather conditions and other constraints of sampling time, to date we have been unable to deploy the neuston net. The RMT8 (rigged with paired nets) has been deployed a total of seven times. Six of these deployments involved fishing each of the paired nets sequentially for approximately 30 minutes each at depths ranging from 20-90 m; the 7th deployment had to be aborted due to poor weather after only a few minutes fishing. Deployments were made onto or over shelf waters, generally between 100-250 m, and occurred in two locations: Royal Bay (54.30 S, 36.0 W) and Shag Rocks (53.40 S, 41.0 W).

Due to previously mentioned constraints, nets were deployed at suboptimal times (daylight hours) and due to weather conditions were limited to depths greater than 20 m (which is also considered suboptimal for sampling larval aggregations). Catch was extremely low for larvae, as well as for pelagic crustaceans such as krill and amphipods.

At Royal Bay two larvae were caught at depths of between 30-50 m, both of these were identified as *Chaenocephalus aceratus*. At Shag Rocks 5 larvae and two eggs were caught. One larvae, captured at approximately 30 m depth was identified as the target species *C. gunnari* and measured 33mm total length. Three larvae were identified as putative *Patagonotothen larseni* (these identifications will be confirmed using molecular methods) with total lengths ranging from 27-33 mm. One larvae was significantly damaged by the net and will be identified by molecular methods, as will the two eggs.

A further 24 h of fishing time remains allocated to JR152 for the second leg of the cruise, to be carried out by Martin Collins.

Acoustic Report

Peter Enderlein, Sophie Fielding, Nathan Cunningham, Mark Preston

Introduction:

The EK60 has been run routinely on the JCR since 2003. Detailed operating instructions can be found in either the cruise reports of JR96, JR100 and JR116 or within the operating protocols that can be found on the EK60 computing machines. The EK60 was run continuously throughout this cruise with a 2 second ping rate, although logging of the data was not continuous due to network issues and the running of the swath bathymetry system.

SSU settings

During the passage from Stanley to South Georgia, the swath bathymetry (EM120) system was switched on and run through the SSU grouped with the EA500. The EM120 was set to active, whilst the EA500 was passive and time usage was calculated. The EK60 maintained a 2 second ping rate and was independent of the SSU. Interference from the EM120 is obvious.

During the Western Core Box the EK60 and EA500 were run together through the SSU, the EM120 and ADCP was switched off. Mode was EM EA&EK TO. The EM120 trigger was off. The EA500 was in active mode and set to external trigger by the bridge, the SSU trigger was on and time usage was set to Tx Pulse. The EK60 trigger was on and the time usage was calculated. Ping control by the ER60 software was set to 2 seconds. The bridge was asked to turn off the bridge Doppler logger to prevent shelf interference. All other ships echosounders, apart from the EA500, should be turned off if the Captain is willing.

A new group on the SSU has been established in order to undertake combined EK60, EA500 and ADCP measurements at a frequency acceptable to both the biologists and physicists (note the WCB needs a minimum of a 2 second ping rate for the EK60).

Survey for?	**Mode**	**Group**									
		EM120		**EA600**		**EK60**		**TOPAS**		**ADCP**	
		Trigger	Time usage	Trigger	Time usage	Trigger	Time usage	Trigger	Time usage	Trigger	Time usage
Swath bathymetry	EM&EA EK TO AD	Active, external	Calculated	Passive, external	Calculated	Active, internal, interference	User defined	x	x	Active, internal, interference	User defined
Biology/EK60	EM EK&EA TO AD	Off	x	Active, external	TX pulse	Active, external	Calculated	x	x	x	X
Physics/ADCP	EM EK EA TO AD	Off	Off	Off	Off	Off	Off	x	x	Active, internal	User defined
Biology/physics compromise	EM EA&EK&AD TO	Off	Off	Active, external	Tx Pulse	Active, external	Calculated	x	x	Active&, external	Tx pulse

* EM = EM120 swath bathymetry, EA = EA500 bathymetry, EK = EK60 biological echosounder, TO = Topas sub bottom profiler, AD = ADCP Acoustic Doppler Current Profiler.

& Check ADCP setup file CX1,3 Bottom tracking mode off

As yet, no method has been created to run the ADCP within the core box survey. However, it should be possible within the new group setting of EM EA&EK&AD TO. There will likely have to be a compromise from the physicists regarding bottom pinging (not necessarily compatible with the SSU), but a dedicated time is required onboard the ship to really establish compatible instruments and correct settings. A recommendation would be to use the ships trials after refit to undertake on-shelf/off-shelf transects in a dedicated time allocation.

General narrative:

The Western Core Box (WCB) acoustic survey was run in the normal west to east direction. W1.1 was started at 08:57 GMT 13 October 2006 at the southern end, all XBTs were successfully undertaken. The sea was calm (!) and there was little dropout on transect W1.1 or W1.2. Immediately after the end of W1.2 transect 3 RMT8 net hauls were undertaken. The first (Event 9), was fished returning back off shelf along the transect W1.2 on small marks between 130 and 150 m. The catch consisted predominantly of salps. The second net (Event 10) was undertaken near the beginning of transect W1.1 on a strong deep scattering layer that was present at the beginning of the WCB survey. The net was fished at a depth of ~265 m and returned with 6 myctophid fish and a few euphausiids – predominantly *Euphausia triacantha*. Unfortunately this sample was disposed of before further investigation could be made. The third net undertaken on the first WCB day (Event 11) was close to the surface between 0 and 20 m, unfortunately the mark originally expected to be fished had disappeared. This net event brought up only a few euphausiids and was not kept. A shallow and a deep CTD were undertaken overnight before the second transect commenced at 09:00 14 October 2006. The weather deteriorated rapidly over the period of W2.1 and W2.2 (far more in keeping with typical WCB weather!) and neither nets or CTDs were undertaken after the transects had finished. At this point, with the weather forecast in hand, it was decided to abort the WCB and run for shelter.

EK60 settings and operation:

Software versions, hardware

Simrad ER60 v. 2.0
Sonardata Echolog 60 v 4.05
Sonardata Echoview v 4.0.75.6342 Live viewing and processing

HASP Dongle BAS3 licensed for base, bathymetry, analysis export, live viewing, school detection and virtual echogram was used to run the echolog and echoview in live viewing mode. It was intended to use the analogue BAS1 HASP, however it appears that the dongle is slightly damaged and the connection is intermittent. Therefore processing of the WCB data was undertaken using the BAS1 dongle (screwed tightly into a parallel port to get it to work!).

The echosounder pc AP10 and the EK60 workstation 2 are integrated into the ship's LAN. ER60 .raw data files were logged to a Sun workstation jrua, using a Samba connection, which is backed up at regular intervals. Echolog was run on workstation 2 and wrote compressed files also directly to the Sun workstation via a Samba connection.

Echolog compression settings

Final compression settings used in Echolog for all frequencies:

6) Power data only (angle data is still available from the raw files)
7) From 0 to 300 m data only (data from deeper is available from the raw files)
8) Average samples where both Sv below -100 and TS below -20
9) Maximum number of samples to average: 50
10) DO NOT use average samples below echosounder detected bottom unless sure of bottom detection

Data processing

Data processing utilised the WCBtemp.ev template that is on the Echoview workstation. Dropout and interference was removed, data were averaged into 100 sec intervals horizontally and 3 m vertical bins. Krill biomass estimates were calculated assuming a TS of -39 dB per Kg for Antarctic krill (NOTE – this value was not calculated using in situ length data and may be subject to validation). The average biomass for the two transects was calculated to be 25 gm^{-2}.

EK60 (ER60) settings

Variable	38 kHz	120 kHz	200 kHz
Ping interval (per sec)	2	2	2
Salinity (PSU)	34	34	34
Temperature (°C)	1	1	1
Sound velocity (m/s)	1453	1453	1453
Mode	Active	Active	Active
Transducer type	ES38	ES120-7	ES200-7
Transceiver Serial no.	009072033fa5	00907203422d	009072033f91
Transducer depth (m)	0	0	0
Absorption coef. (dB/km)	10.07	26.27	39.8
Pulse length (ms)	1.024	1.024	1.024
Max Power (W)	2000	500	300
2-way beam angle (dB)	-20.70	-20.70	-19.60
Sv transducer gain (dB)	24.07	21.38	22.03
Sa correction (dB)	-0.63	-0.39	-0.31
Angle sensitivity along	22	21	23
Angle sensitivity athwart	22	21	23
3 dB Beam along	-0.02	-0.12	0.17

3 dB Beam athwart	0	-0.07	-0.24
Along offset	6.96	7.48	6.44
Athwart offset	6.88	7.48	6.43

CTD operations

The CTD was successfully deployed at 2 stations.

Problems:

During the transect from Stanley to South Georgia the EK60 38 kHz signal was extremely noisy. This feature was also noted during cruise JR129 and was discovered to have been solve by replacing the 38 kHz GPT (Serial No. 00907203400b). This process was undertaken during this cruise also. The serial number of the 38 kz GPT being used during this season is 009072033fa5

Echolog appeared to be extremely temperamental this trip and stalled regularly if used to compress files in real time, although live viewing could be run permanently if no compression was used. Ultimately, Jeremy discovered that there was a problem with new Samba software Ver. 3.0.23c loaded onto the Sun server. Reloading the older version (Ver. 2.2.12) fixed the problem and normal Echolog saving could resume.

Both the EK60 main processor and the EK60 workstation computers were networked differently this cruise – onto a more secure network. There were some teething problems after this that were fixed by Jeremy Robst actually.

A comcontainer.exe error arose on several occasions with the ER60 software, crashing the EK60 echosounder. This seems to arise when there is a conflict between the SSU and the EK60 and requires the power cycling of the EK60 and turning the trigger off on the SSU.

Calibration:

An acoustic calibration was carried out in Stromness Harbour, South Georgia between the 13 and 14th October 2006. Standard EK60 calibration procedures were undertaken for a calibration of each transducer as documented for previous cruises on the 13 October 2006. Each frequency was calibrated (with the other frequencies switched off) with standard copper spheres and a pulse duration of 1.024 ms. All unnecessary ships noise was turned off and ships discharge over the side was ceased. A CTD was conducted prior to the start of the calibration and sound velocity calculated using Francois and Garrison (1989) for the depth of the target (Temperature = 1°C, Salinity = 33.75, Sound velocity = 1453). Slightly different from previous calibrations was the requirement to undertake at least 300 points per calibration (this was to examine the controls on a good calibration). The 120 kHz target appeared to have some noise above it as viewed in the echogram and it was decided to repeat this calibration during the next set of calibrations.

On the 14th October a second calibration was undertaken, in a similar manner, but on this occasion all frequencies were left on during calibration (except for the 120 kHz repeat). At a first look it appears that there is little difference between calibration values and that it may be possible to undertake future calibrations within conditions more similar to survey conditions (i.e. noise left on as well as all transducers left on). During the 38 kHz calibration a tungsten carbide sphere was also hung under the transducers (below the copper sphere). The EK60 settings after calibration are given above, these were implemented on the 14th October 2006.

Calibration details are as follows for each frequency. The following filenames were uploaded as the calibration constants. Cal38khz_061006_mod, cal_07100_120khzalone_mod, cal200khz_20061006_cal

38 kHz calibration

```
#  Calibration  Version   1.0.0.9
#
#  Date:  2006-10-06
#
#  Comments:
#
#
#  Reference Target:
#    TS                  -33.80 dB       Min. Distance         22.00
m
#    TS Deviation           3.0 dB       Max. Distance         28.00
m
#
#  Transducer:  ES38  Serial No.   0090720335
#    Frequency             38000 Hz       Beamtype
Split
#    Gain                  24.24 dB       Two Way Beam Angle   -20.7
dB
#    Athw. Angle Sens.       22.00        Along. Angle Sens.
22.00
#    Athw. Beam Angle     6.91 deg       Along. Beam Angle    6.94
deg
#    Athw. Offset Angle   0.03 deg       Along. Offset Angle -0.03
deg
#    SaCorrection         -0.64 dB       Depth                 0.00
m
#
#  Transceiver:  GPT  38 kHz 009072033fa5 1 ES38
#    Pulse Duration       1.024 ms       Sample Interval     0.186
m
#    Power                 2000  W       Receiver Bandwidth   2.43
kHz
#
#  Sounder Type:
#    EK60 Version   ComSounder
#
#  TS Detection:
#    Min. Value           -50.0 dB
#    Max. Beam Comp.        6.0 dB       Min. Echolength         80
%
#    Max. Phase Dev.          8.0       Max. Echolength        180
%
#
#  Environment:
#    Absorption Coeff.  10.1 dB/km       Sound Velocity     1453.0
m/s
#
#  Beam Model results:
```

```
#    Transducer Gain    = 24.07 dB       SaCorrection       = -0.63
dB
#    Athw. Beam Angle   = 6.88 deg       Along. Beam Angle  = 6.96
deg
#    Athw. Offset Angle = 0.00 deg       Along. Offset Angle=-0.02
deg
#
#  Data deviation from beam model:
#    RMS =    0.14 dB
#    Max =    0.47 dB  No. =   129  Athw. = -2.9 deg  Along =  0.2
deg
#    Min =   -0.44 dB  No. =   147  Athw. =  0.5 deg  Along = -4.8
deg
#
#  Data deviation from polynomial model:
#    RMS =    0.10 dB
#    Max =    0.42 dB  No. =   129  Athw. = -2.9 deg  Along =  0.2
deg
#    Min =   -0.24 dB  No. =   229  Athw. =  1.4 deg  Along =  2.7
deg
#
#  Data:
#  No.    Time    Distance  TS-c    TS-u      Athw.    Along     Sa
#                  [m]      [dB]    [dB]      [deg]    [deg]
[m2/nm2]
#
   1  19:25:12.35  24.85   -34.22  -34.24     0.03     0.16      3088
   2  19:25:49.35  24.85   -34.14  -34.17    -0.03     0.22      3078
   3  19:26:02.35  24.85   -34.09  -34.20    -0.22     0.35      3093
   4  19:27:33.37  24.86   -34.50  -34.52     0.23    -0.10      2922
   5  19:27:37.38  24.87   -34.56  -34.64     0.35    -0.29      2864
   6  19:27:45.37  24.93   -34.65  -35.08     0.74    -0.61      2679
   7  19:27:47.37  24.94   -34.57  -35.12     0.80    -0.74      2619
   8  19:27:50.38  24.95   -34.49  -35.48     1.06    -0.99      2382
   9  19:27:51.38  24.96   -34.62  -35.66     1.06    -1.06      2275
  10  19:27:58.38  24.98   -34.15  -36.30     1.50    -1.50      1936
  11  19:28:02.38  24.98   -34.14  -36.19     1.50    -1.44      1980
  12  19:28:07.37  25.00   -34.12  -37.62     1.89    -1.95      1403
  13  19:28:15.37  25.02   -34.10  -39.23     2.27    -2.40       958
  14  19:28:16.38  25.03   -34.08  -39.47     2.34    -2.46       902
  15  19:28:25.38  25.04   -34.22  -41.87     2.78    -2.97       530
  16  19:28:30.38  25.03   -33.90  -40.46     2.59    -2.72       717
  17  19:28:47.39  25.01   -34.45  -43.27     3.17    -3.04       379
  18  19:29:11.38  25.17   -34.31  -40.56     2.21    -2.91       708
  19  19:29:22.39  25.14   -34.36  -38.65     1.82    -2.40      1120
  20  19:29:25.38  25.13   -34.63  -38.53     1.76    -2.27      1156
  21  19:29:30.38  25.17   -34.29  -37.64     1.38    -2.27      1387
  22  19:29:36.41  25.22   -33.87  -36.68     0.99    -2.21      1685
  23  19:29:42.40  25.31   -34.61  -36.93     0.48    -2.14      1682
  24  19:29:46.40  25.35   -34.61  -36.71     0.16    -2.08      1712
  25  19:29:50.40  25.38   -34.18  -36.18    -0.22    -2.02      1891
  26  19:29:57.41  25.43   -34.15  -36.48    -0.67    -2.08      1791
  27  19:30:03.40  25.53   -34.14  -36.55    -1.05    -1.95      1757
  28  19:30:09.40  25.58   -33.74  -36.82    -1.50    -2.02      1588
  29  19:30:14.40  25.62   -33.97  -37.79    -1.95    -2.02      1311
  30  19:30:24.40  25.71   -33.97  -38.37    -2.33    -1.89      1141
  31  19:30:25.41  25.72   -33.97  -38.40    -2.40    -1.82      1120
  32  19:30:29.40  25.76   -33.60  -38.92    -2.71    -1.89       966
  33  19:30:35.40  25.80   -33.76  -40.46    -3.23    -1.82       698
  34  19:30:39.40  25.88   -34.04  -41.66    -3.48    -1.89       531
  35  19:30:41.40  25.91   -33.94  -41.91    -3.61    -1.82       490
```

36	19:30:50.41	25.92	-33.65	-42.79	-3.99	-1.63	395
37	19:30:52.41	25.92	-33.62	-43.05	-4.12	-1.44	373
38	19:30:56.40	25.90	-34.09	-44.31	-4.38	-1.12	282
39	19:30:57.41	25.90	-34.25	-44.66	-4.44	-0.99	262
40	19:31:04.41	25.88	-34.40	-46.37	-4.82	-0.55	181
41	19:31:10.40	25.80	-34.65	-46.30	-4.76	-0.48	185
42	19:31:17.40	25.76	-34.04	-43.63	-4.31	-0.48	326
43	19:31:23.40	25.71	-34.23	-42.21	-3.93	-0.48	472
44	19:31:29.40	25.61	-33.74	-40.10	-3.48	-0.61	761
45	19:31:35.40	25.57	-33.52	-38.60	-3.10	-0.61	1062
46	19:31:38.40	25.54	-33.83	-38.17	-2.84	-0.67	1204
47	19:31:42.40	25.50	-34.12	-37.73	-2.59	-0.61	1373
48	19:31:43.40	25.44	-34.16	-37.63	-2.52	-0.67	1437
49	19:31:47.41	25.42	-34.10	-36.99	-2.27	-0.74	1565
50	19:31:53.41	25.38	-33.97	-35.86	-1.76	-0.80	2053
51	19:31:58.41	25.33	-34.36	-35.64	-1.37	-0.80	2237
52	19:32:04.41	25.23	-34.18	-34.99	-0.99	-0.80	2524
53	19:32:11.41	25.18	-34.41	-34.96	-0.61	-0.86	2568
54	19:32:16.41	25.13	-34.28	-34.59	-0.16	-0.80	2909
55	19:32:27.41	25.06	-34.42	-34.95	0.10	-1.06	2653
56	19:32:34.41	25.03	-34.00	-35.09	-0.03	-1.50	2479
57	19:32:47.41	24.96	-34.14	-36.81	-0.16	-2.34	1750
58	19:32:50.42	24.93	-34.25	-37.56	-0.22	-2.59	1501
59	19:32:51.41	24.88	-34.21	-37.85	-0.22	-2.72	1421
60	19:32:58.42	24.85	-33.84	-38.80	-0.29	-3.17	1081
61	19:33:06.41	24.81	-33.85	-40.38	-0.48	-3.61	756
62	19:33:12.41	24.75	-34.23	-41.44	-0.86	-3.74	621
63	19:33:14.41	24.75	-34.43	-42.57	-0.80	-4.00	478
64	19:33:16.42	24.75	-34.58	-44.19	-0.61	-4.38	327
65	19:33:18.42	24.69	-34.44	-44.64	-0.67	-4.51	299
66	19:33:39.42	24.63	-34.34	-44.95	-0.16	-4.64	263
67	19:33:45.42	24.58	-34.84	-45.46	0.23	-4.64	241
68	19:33:56.43	24.49	-34.18	-43.38	0.16	-4.32	393
69	19:34:00.44	24.47	-33.95	-41.33	-0.16	-3.87	616
70	19:34:18.43	24.49	-33.56	-38.70	-0.16	-3.23	1161
71	19:34:28.43	24.56	-34.10	-40.78	0.29	-3.68	729
72	19:34:33.44	24.58	-34.08	-42.05	0.55	-4.00	531
73	19:34:36.43	24.60	-34.55	-43.38	0.74	-4.19	387
74	19:34:38.43	24.61	-34.41	-44.12	0.86	-4.38	323
75	19:34:40.44	24.62	-34.18	-44.87	1.06	-4.57	270
76	19:34:47.44	24.66	-34.42	-44.20	1.31	-4.32	313
77	19:34:53.43	24.68	-34.28	-42.43	1.44	-3.87	494
78	19:34:57.43	24.75	-34.37	-41.67	1.50	-3.61	578
79	19:34:58.44	24.76	-34.42	-41.29	1.50	-3.49	627
80	19:35:04.43	24.80	-34.18	-39.92	1.57	-3.10	839
81	19:35:35.44	24.87	-34.02	-36.37	1.44	-1.70	1926
82	19:35:54.44	24.97	-34.40	-35.38	1.31	-0.61	2416
83	19:36:00.44	25.01	-34.54	-35.45	1.38	-0.16	2315
84	19:36:11.45	25.00	-34.15	-34.85	1.18	0.22	2678
* 85	19:36:20.44	24.94	-35.19	-36.44	1.57	0.29	1943
* 86	19:36:25.45	24.86	-33.24	-35.03	1.89	0.29	2590
87	19:36:31.45	24.82	-34.36	-37.09	2.34	0.29	1618
88	19:36:39.45	24.75	-34.23	-37.90	2.72	0.22	1407
89	19:36:40.45	24.69	-34.31	-38.33	2.85	0.16	1293
90	19:36:43.44	24.68	-33.80	-38.77	3.17	0.16	1120
91	19:36:45.45	24.66	-33.71	-39.11	3.29	0.22	1013
92	19:36:49.44	24.64	-34.09	-40.36	3.55	0.16	771
93	19:36:54.45	24.59	-34.54	-41.52	3.74	0.29	608
94	19:36:57.44	24.56	-34.43	-42.65	4.06	0.22	474
95	19:36:58.44	24.55	-34.62	-43.34	4.19	0.09	409
96	19:37:00.45	24.50	-34.48	-44.03	4.38	0.03	344

97	19:37:41.46	24.47	-34.45	-42.92	4.12	-0.23	427
98	19:37:46.46	24.44	-34.07	-41.79	3.93	-0.35	563
99	19:37:50.45	24.41	-34.69	-42.29	3.87	-0.67	510
100	19:37:56.46	24.32	-34.62	-42.21	3.81	-1.06	539
101	19:38:01.46	24.32	-34.37	-42.93	4.00	-1.31	460
102	19:38:30.47	24.38	-34.79	-43.56	4.00	-1.50	390
103	19:38:58.47	24.31	-34.11	-40.42	3.49	-0.86	790
104	19:39:08.46	24.30	-34.07	-39.58	3.29	-0.61	950
105	19:39:12.48	24.29	-33.76	-38.57	3.10	-0.35	1177
106	19:39:25.47	24.25	-33.96	-36.86	2.34	0.67	1805
107	19:39:26.48	24.25	-33.91	-36.57	2.21	0.73	1927
108	19:39:46.47	24.28	-33.89	-35.78	1.76	0.86	2250
109	19:39:51.47	24.31	-34.24	-35.55	1.38	0.86	2429
110	19:39:57.47	24.41	-34.05	-34.91	0.99	0.86	2821
111	19:40:01.48	24.45	-34.23	-34.95	0.55	1.05	2732
112	19:40:02.47	24.45	-34.14	-34.76	0.48	0.99	2835
113	19:40:07.47	24.49	-34.45	-35.05	0.16	1.05	2668
114	19:40:12.47	24.58	-34.17	-34.81	-0.29	1.05	2895
115	19:40:14.47	24.60	-34.18	-34.79	-0.41	0.99	2854
116	19:40:18.48	24.64	-33.87	-34.81	-0.73	1.12	2773
117	19:40:22.48	24.67	-33.94	-35.24	-1.05	1.18	2443
118	19:40:30.48	24.76	-34.27	-36.16	-1.50	1.18	2083
119	19:40:34.48	24.81	-33.97	-36.51	-1.88	1.18	1864
120	19:40:40.48	24.85	-34.10	-37.65	-2.33	1.24	1403
121	19:40:46.48	24.95	-34.15	-38.75	-2.71	1.31	1128
122	19:40:52.47	25.01	-33.80	-40.05	-3.23	1.44	800
123	19:40:53.48	25.02	-33.96	-40.50	-3.29	1.50	716
124	19:40:56.48	25.04	-34.16	-41.56	-3.55	1.50	563
125	19:41:04.48	25.05	-33.74	-41.27	-3.61	1.44	605
126	19:41:10.48	25.06	-33.84	-39.63	-3.23	0.99	902
127	19:41:12.47	25.06	-34.11	-39.38	-3.10	0.86	974
128	19:41:15.48	25.12	-34.22	-38.56	-2.84	0.61	1180
129	19:41:48.49	25.05	-33.05	-37.42	-2.91	0.16	1486
130	19:41:58.49	25.03	-33.98	-37.45	-2.59	0.16	1425
131	19:42:03.49	24.99	-34.05	-36.74	-2.27	0.16	1745
132	19:42:10.49	24.88	-33.92	-35.65	-1.82	0.09	2306
133	19:42:14.50	24.85	-33.97	-35.05	-1.44	0.03	2511
134	19:42:20.50	24.81	-34.54	-35.07	-0.99	-0.03	2603
*135	19:42:25.65	24.70	-34.95	-35.15	-0.61	-0.03	2689
136	19:42:44.65	24.64	-34.48	-34.50	-0.03	-0.23	2972
137	19:42:51.65	24.59	-34.44	-34.64	-0.22	-0.61	2960
138	19:42:59.65	24.49	-34.40	-35.02	-0.41	-1.06	2670
139	19:43:04.65	24.46	-34.00	-34.98	-0.67	-1.25	2694
140	19:43:09.64	24.43	-34.28	-35.65	-0.73	-1.50	2354
141	19:43:13.65	24.38	-33.90	-35.63	-1.12	-1.50	2450
142	19:43:28.61	24.27	-33.97	-37.46	-1.31	-2.34	1527
143	19:43:31.61	24.26	-33.90	-38.25	-1.24	-2.72	1290
144	19:43:40.61	24.25	-33.96	-39.38	-1.05	-3.17	995
145	19:43:42.61	24.26	-33.92	-39.49	-0.99	-3.23	970
146	19:44:00.61	24.29	-34.21	-42.13	-0.35	-4.00	516
147	19:44:13.61	24.36	-35.17	-46.75	0.48	-4.83	189
148	19:44:47.58	24.23	-33.68	-38.35	-1.50	-2.72	1282
149	19:44:49.58	24.23	-33.88	-38.38	-1.50	-2.65	1273
150	19:45:08.58	24.12	-33.74	-40.12	-1.82	-3.17	862
151	19:45:09.58	24.12	-33.47	-40.15	-1.88	-3.23	847
152	19:45:18.58	24.13	-33.88	-41.20	-1.63	-3.55	676
153	19:45:21.58	24.18	-34.02	-41.77	-1.44	-3.74	608
154	19:45:31.58	24.25	-33.88	-42.80	-1.63	-4.00	453
155	19:45:34.59	24.27	-33.74	-42.65	-1.95	-3.87	461
156	19:45:45.55	24.27	-33.50	-41.58	-2.33	-3.42	592
157	19:45:51.55	24.25	-34.01	-41.66	-2.65	-3.04	588

158	19:45:52.55	24.24	-33.97	-41.62	-2.71	-2.97	594
159	19:45:57.54	24.23	-33.77	-41.29	-2.97	-2.65	651
160	19:46:00.55	24.22	-33.77	-41.16	-3.16	-2.34	679
161	19:46:19.55	24.26	-33.36	-39.35	-3.16	-1.44	996
162	19:46:21.55	24.27	-33.49	-39.06	-3.10	-1.25	1049
163	19:46:50.51	24.47	-33.69	-37.53	-2.65	0.67	1472
164	19:46:51.51	24.46	-33.81	-37.28	-2.52	0.61	1565
165	19:46:55.51	24.43	-34.31	-37.16	-2.27	0.61	1660
166	19:47:02.51	24.32	-34.07	-35.95	-1.82	0.54	2240
167	19:47:11.51	24.31	-34.14	-35.65	-1.56	0.67	2386
168	19:47:22.51	24.44	-34.07	-36.37	-1.50	1.50	1973
169	19:47:23.51	24.45	-33.88	-36.29	-1.44	1.63	2002
170	19:47:27.50	24.47	-33.65	-36.42	-1.37	1.88	1904
171	19:47:33.50	24.50	-34.03	-37.64	-1.31	2.33	1496
172	19:47:40.51	24.60	-33.89	-38.59	-1.12	2.84	1190
173	19:47:45.47	24.64	-33.75	-39.55	-1.05	3.23	928
174	19:47:46.48	24.65	-33.78	-39.73	-0.99	3.29	883
175	19:47:53.48	24.65	-33.78	-41.06	-1.24	3.61	652
176	19:47:56.47	24.64	-33.78	-42.29	-1.50	3.87	495
177	19:48:00.48	24.63	-33.77	-42.92	-1.63	3.99	428
178	19:48:04.47	24.62	-33.95	-44.71	-1.88	4.31	287
179	19:48:05.47	24.62	-33.95	-45.06	-1.95	4.38	263
180	19:48:16.47	24.58	-34.16	-43.60	-2.01	3.93	380
181	19:48:27.47	24.50	-33.94	-43.93	-2.33	3.93	352
182	19:48:28.48	24.49	-33.97	-44.31	-2.40	3.99	318
183	19:48:36.47	24.57	-34.27	-45.24	-2.71	3.99	263
184	19:49:04.44	24.31	-33.74	-41.49	-0.99	3.80	616
185	19:49:10.45	24.27	-33.82	-41.32	-0.61	3.80	636
186	19:49:18.44	24.23	-33.88	-40.12	-0.41	3.48	859
187	19:49:24.45	24.13	-33.97	-39.00	-0.54	3.10	1150
188	19:49:27.44	24.12	-33.81	-38.15	-0.67	2.84	1349
189	19:49:30.45	24.10	-33.69	-37.50	-0.67	2.65	1528
190	19:49:36.45	24.06	-34.15	-36.96	-0.80	2.20	1792
191	19:49:50.45	24.10	-33.68	-37.12	-1.50	2.14	1660
192	19:49:55.41	24.14	-34.05	-38.39	-1.88	2.27	1335
193	19:50:03.41	24.27	-33.76	-39.13	-2.40	2.27	1046
194	19:50:07.40	24.30	-33.85	-40.16	-2.78	2.27	832
195	19:50:08.40	24.30	-33.72	-40.32	-2.84	2.33	803
196	19:50:23.41	24.32	-34.31	-38.49	-2.33	1.69	1266
197	19:50:24.41	24.38	-34.22	-38.05	-2.27	1.56	1407
198	19:50:40.41	24.31	-33.90	-41.93	-3.16	2.59	560
199	19:50:42.40	24.31	-33.64	-42.16	-3.23	2.71	532
200	19:50:53.41	24.32	-33.97	-44.21	-3.55	3.03	339
201	19:51:06.37	24.28	-33.80	-42.07	-3.03	2.84	532
202	19:51:12.37	24.22	-33.83	-40.82	-2.59	2.78	731
203	19:51:16.37	24.13	-34.09	-40.22	-2.27	2.71	864
204	19:51:22.37	24.09	-34.02	-39.32	-1.82	2.71	1015
205	19:51:25.37	24.07	-34.16	-38.90	-1.56	2.65	1138
206	19:51:38.37	23.91	-34.11	-37.52	-0.54	2.52	1549
207	19:51:50.37	23.91	-34.00	-36.66	-0.22	2.27	1885
208	19:51:52.37	23.92	-33.88	-36.11	-0.16	2.08	2143
209	19:51:57.37	23.93	-33.87	-35.59	0.23	1.82	2450
210	19:52:04.35	23.94	-34.24	-35.34	0.67	1.31	2655
211	19:52:40.34	24.20	-34.24	-36.19	0.55	1.88	2188
212	19:52:43.34	24.22	-33.80	-36.35	0.67	2.14	2064
213	19:52:46.35	24.24	-33.96	-36.93	0.67	2.33	1778
214	19:52:51.35	24.28	-33.67	-37.62	0.67	2.71	1486
215	19:52:57.34	24.31	-34.08	-39.43	0.80	3.16	1003
216	19:53:02.34	24.40	-33.70	-40.43	0.93	3.55	801
217	19:53:07.30	24.44	-33.57	-41.57	1.06	3.87	598
218	19:53:09.30	24.45	-33.56	-42.05	1.06	3.99	531

219	19:53:13.31	24.48	-33.31	-43.61	1.31	4.38	372
220	19:53:21.30	24.46	-33.67	-44.15	1.50	4.38	327
221	19:53:22.30	24.45	-33.84	-44.13	1.57	4.31	330
222	19:53:26.31	24.42	-33.82	-44.77	1.89	4.38	290
223	19:53:31.30	24.39	-33.91	-44.59	1.89	4.31	308
224	19:53:36.30	24.31	-33.60	-42.77	1.89	3.93	468
225	19:53:38.30	24.30	-34.00	-42.60	1.82	3.80	479
226	19:53:43.30	24.27	-33.78	-40.79	1.63	3.42	720
227	19:53:48.31	24.23	-33.71	-39.35	1.50	3.03	1029
228	19:53:49.30	24.22	-33.97	-39.53	1.44	3.03	993
229	19:53:54.31	24.13	-34.31	-38.72	1.38	2.65	1226
230	19:54:07.27	24.09	-34.10	-37.75	1.50	2.27	1471
231	19:54:12.27	24.10	-33.81	-37.52	1.89	2.01	1536
232	19:54:15.27	24.10	-33.90	-37.39	2.02	1.76	1573
233	19:54:19.27	24.11	-33.82	-37.57	2.34	1.50	1540
234	19:54:20.27	24.12	-34.16	-37.75	2.34	1.37	1478
235	19:54:27.27	24.11	-34.11	-38.42	2.72	1.18	1239
236	19:54:33.27	24.06	-34.14	-39.72	3.17	1.18	949
237	19:54:38.26	24.02	-34.55	-41.33	3.55	1.12	669
238	19:54:45.26	23.92	-33.97	-42.61	4.06	1.05	480
239	19:54:49.27	23.90	-33.91	-41.86	3.74	1.56	577
240	19:54:53.27	23.92	-34.30	-43.40	4.19	0.99	398
241	19:54:59.27	23.93	-34.41	-44.17	4.38	0.73	344
242	19:55:00.27	23.93	-34.52	-44.75	4.51	0.54	300
243	19:55:14.23	23.88	-34.49	-44.05	4.38	-0.23	350
244	19:55:20.23	23.83	-34.77	-44.25	4.32	-0.80	344
245	19:55:22.23	23.83	-34.72	-44.45	4.38	-0.74	329
246	19:55:43.23	23.74	-34.01	-39.58	3.29	0.67	973
247	19:55:45.23	23.73	-34.21	-39.26	3.10	0.80	1051
248	19:56:03.23	23.74	-33.72	-38.95	2.65	1.95	1153
249	19:56:07.24	23.76	-34.04	-39.78	2.72	2.14	980
250	19:56:10.23	23.83	-34.23	-40.50	2.72	2.40	838
251	19:56:13.23	23.85	-33.88	-41.19	2.78	2.78	702
252	19:56:19.20	23.90	-33.60	-42.39	2.97	3.16	512
253	19:56:26.20	23.92	-33.65	-42.78	3.17	3.10	472
254	19:56:31.20	23.91	-33.60	-43.81	3.74	2.84	365
255	19:56:33.20	23.91	-34.05	-44.15	3.87	2.59	339
256	19:56:40.20	23.83	-34.22	-44.52	4.06	2.33	329
257	19:56:41.21	23.84	-34.05	-43.43	3.87	2.20	415
258	19:56:44.20	23.73	-34.07	-45.64	4.51	2.01	243
259	19:56:46.20	23.73	-34.16	-43.57	4.12	1.56	392
260	19:56:48.21	23.66	-34.65	-45.73	4.51	1.63	248
261	19:56:52.20	23.64	-34.52	-44.93	4.44	1.24	302
262	19:57:01.20	23.65	-34.47	-41.92	3.81	0.80	602
263	19:58:01.16	24.27	-33.91	-35.22	-0.22	1.56	2610
264	19:58:02.17	24.27	-34.04	-35.23	-0.16	1.50	2590
265	19:58:27.12	24.24	-34.27	-34.95	-0.73	0.86	2812
266	19:58:43.13	24.13	-34.08	-34.34	-0.16	0.67	3280
267	19:58:54.13	24.05	-34.34	-34.75	0.67	0.61	2999
268	19:59:08.13	24.03	-34.48	-35.77	1.63	-0.03	2391
269	19:59:10.12	24.06	-34.44	-35.65	1.57	-0.23	2420
270	19:59:13.13	24.02	-34.48	-36.78	2.14	-0.35	1912
271	19:59:21.13	23.95	-34.50	-37.28	2.34	-0.48	1754
272	19:59:26.13	23.92	-34.36	-38.02	2.65	-0.67	1381
273	20:00:04.11	23.63	-35.31	-47.19	4.83	-0.93	179
274	20:00:10.11	23.57	-34.78	-46.44	4.76	-1.06	214
275	20:00:30.10	23.74	-34.44	-40.46	3.36	-1.06	812
276	20:00:35.07	23.82	-34.48	-38.97	2.91	-0.86	1182
277	20:00:41.06	23.76	-34.25	-39.33	3.04	-1.12	1094
278	20:00:46.07	23.74	-34.25	-39.30	2.85	-1.57	1063
279	20:00:53.06	23.75	-33.98	-38.79	2.65	-1.76	1203

280	20:00:56.07	23.76	-34.22	-38.63	2.40	-1.89	1299
281	20:01:06.07	23.84	-34.45	-40.22	2.72	-2.21	871
282	20:01:08.06	23.85	-34.14	-40.65	2.91	-2.34	780
283	20:01:30.06	23.89	-34.32	-41.07	3.17	-2.08	696
284	20:01:52.03	23.84	-34.71	-42.76	3.81	-1.50	480
285	20:02:06.03	23.87	-34.69	-44.27	4.06	-1.95	333
286	20:02:13.03	23.80	-35.01	-43.61	3.74	-2.08	411
287	20:02:15.03	23.81	-35.08	-45.17	3.93	-2.53	285
288	20:02:16.03	23.76	-34.79	-45.35	4.00	-2.65	275
289	20:02:19.03	23.74	-34.56	-44.59	3.81	-2.72	316
290	20:02:23.02	23.74	-34.78	-46.02	4.00	-2.97	226
291	20:02:31.02	23.87	-35.01	-45.25	3.55	-3.17	265
292	20:02:32.03	23.88	-34.57	-44.63	3.49	-3.17	305
293	20:02:41.00	24.02	-35.22	-46.69	3.49	-3.68	190
294	20:02:43.00	24.02	-34.91	-44.26	3.04	-3.36	334
295	20:02:45.00	24.06	-34.44	-44.05	2.91	-3.55	344
296	20:02:48.00	24.09	-34.58	-46.57	3.29	-4.00	190
297	20:03:00.00	24.08	-34.00	-42.30	2.59	-3.36	510
298	20:03:25.99	23.94	-34.31	-35.70	0.93	-1.44	2425
299	20:03:45.97	24.05	-34.43	-34.90	0.99	-0.16	2885
300	20:04:04.96	24.09	-33.96	-35.28	1.25	1.05	2578
301	20:04:10.96	24.08	-34.00	-35.45	0.80	1.50	2508
302	20:04:19.97	24.08	-33.75	-36.54	-0.03	2.33	1947
303	20:04:58.92	24.28	-33.72	-40.02	-1.50	3.23	848
304	20:05:01.93	24.30	-33.88	-40.93	-1.88	3.29	697
305	20:05:46.92	24.42	-34.10	-43.52	-1.44	4.12	386
306	20:06:01.90	24.32	-33.96	-42.92	-0.92	4.12	462
307	20:06:02.90	24.23	-34.04	-43.54	-0.41	4.31	389
308	20:06:04.90	24.24	-34.00	-42.63	-0.16	4.12	482
309	20:06:11.90	24.24	-34.18	-43.97	-0.41	4.38	353
310	20:06:13.90	24.27	-34.23	-45.41	-0.92	4.63	247
311	20:06:24.90	24.19	-34.31	-44.60	-0.16	4.50	317
312	20:06:36.90	24.24	-34.10	-45.88	-0.03	4.82	226
313	20:06:49.90	24.19	-34.47	-46.30	0.42	4.82	215
314	20:07:00.86	24.13	-34.30	-45.54	0.48	4.70	254
315	20:07:07.86	24.09	-33.94	-43.40	0.35	4.31	398
316	20:07:12.86	24.09	-33.90	-42.41	0.67	4.06	501
317	20:07:15.86	24.11	-33.60	-41.53	0.55	3.93	620
318	20:07:23.86	24.07	-33.82	-39.80	0.35	3.42	928
319	20:07:26.86	24.05	-34.07	-39.05	0.48	3.10	1114
320	20:07:36.86	24.08	-34.03	-38.72	0.03	3.03	1183
321	20:07:46.86	24.12	-34.01	-37.29	0.23	2.52	1644
322	20:08:14.82	23.92	-34.54	-34.71	0.35	0.48	3001
323	20:10:06.76	23.90	-34.10	-35.55	-0.54	-1.63	2455
324	20:13:45.65	24.31	-33.97	-39.28	-0.09	3.23	1051
325	20:14:34.62	24.13	-33.84	-41.43	-0.03	3.87	654
326	20:15:03.62	24.37	-34.38	-45.00	-1.56	4.38	284
327	20:15:17.62	24.47	-34.03	-45.99	-2.33	4.44	210
328	20:16:30.55	24.66	-34.17	-44.54	-2.84	3.74	289
329	20:16:34.54	24.65	-33.76	-42.60	-2.52	3.48	453
330	20:16:57.55	24.76	-34.15	-36.36	-0.99	1.82	1997
331	20:18:27.52	25.01	-34.08	-34.36	-0.67	0.22	2979
332	20:18:39.48	25.00	-34.42	-34.84	-0.86	-0.23	2692
333	20:25:20.28	24.57	-34.71	-35.09	0.61	-0.67	2716

120 kHz calibration

```
#  Calibration  Version   1.0.0.9
#
#  Date:  2006-10-07
#
#  Comments:
```

```
#    just 120 kHz
#
#  Reference Target:
#    TS                  -40.40 dB       Min. Distance         24.00
m
#    TS Deviation           3.0 dB       Max. Distance         28.00
m
#
#  Transducer:  ES120-7  Serial No.   907203422
#    Frequency           120000 Hz       Beamtype
Split
#    Gain                 20.24 dB       Two Way Beam Angle   -20.7
dB
#    Athw. Angle Sens.       21.00       Along. Angle Sens.
21.00
#    Athw. Beam Angle     7.73 deg       Along. Beam Angle    7.71
deg
#    Athw. Offset Angle  -0.04 deg       Along. Offset Angle -0.17
deg
#    SaCorrection         -0.38 dB       Depth                 0.00
m
#
#  Transceiver:  GPT 120 kHz 00907203422d 1 ES120-7
#    Pulse Duration       1.024 ms       Sample Interval     0.186
m
#    Power                  500  W       Receiver Bandwidth   3.03
kHz
#
#  Sounder Type:
#    EK60 Version   ComSounder
#
#  TS Detection:
#    Min. Value           -50.0 dB
#    Max. Beam Comp.        6.0 dB       Min. Echolength          80
%
#    Max. Phase Dev.          8.0       Max. Echolength         180
%
#
#  Environment:
#    Absorption Coeff.  26.3 dB/km       Sound Velocity     1453.0
m/s
#
#  Beam Model results:
#    Transducer Gain    = 21.38 dB       SaCorrection       = -0.39
dB
#    Athw. Beam Angle   = 7.48 deg       Along. Beam Angle  = 7.48
deg
#    Athw. Offset Angle =-0.07 deg       Along. Offset Angle=-0.12
deg
#
#  Data deviation from beam model:
#    RMS =    0.19 dB
#    Max =    0.50 dB  No. =   220  Athw. = -1.3 deg  Along = -3.0
deg
#    Min =   -0.73 dB  No. =   228  Athw. = -0.6 deg  Along = -5.3
deg
#
#  Data deviation from polynomial model:
#    RMS =    0.15 dB
#    Max =    0.37 dB  No. =    83  Athw. =  4.4 deg  Along = -2.8
deg
```

```
#    Min =   -0.45 dB  No. =   248  Athw. =  0.2 deg  Along = -2.4
deg
#
#  Data:
#  No.    Time     Distance  TS-c    TS-u      Athw.    Along     Sa
#                   [m]      [dB]    [dB]      [deg]    [deg]
[m2/nm2]
#
   1  12:15:23.74  25.21   -38.20  -38.30    -0.29     0.24      1171
   2  12:15:25.73  25.21   -37.90  -37.98    -0.23     0.24      1259
   3  12:15:54.77  25.21   -38.05  -38.11    -0.23     0.17      1223
*  4  12:15:55.77  25.21   -37.82  -37.89    -0.29     0.17      1289
   5  12:16:26.77  25.26   -38.12  -38.45    -0.23     0.71      1129
   6  12:16:30.77  25.28   -38.32  -39.15    -0.23     1.24       957
   7  12:16:35.81  25.30   -38.56  -39.99    -0.09     1.71       793
   8  12:16:40.82  25.32   -38.15  -40.25    -0.03     2.11       750
   9  12:16:47.81  25.35   -38.13  -41.20    -0.09     2.58       611
  10  12:16:52.81  25.37   -38.05  -42.26    -0.16     3.05       478
  11  12:16:58.81  25.39   -37.56  -43.27    -0.09     3.59       376
  12  12:17:12.81  25.42   -37.73  -46.40    -0.03     4.46       182
  13  12:17:24.81  25.49   -37.65  -47.89     0.11     4.86       127
  14  12:17:36.86  25.41   -37.64  -47.37     0.24     4.72       146
  15  12:17:44.86  25.36   -37.44  -47.40     0.91     4.72       144
  16  12:17:46.86  25.38   -37.46  -47.33     1.18     4.66       144
  17  12:17:52.86  25.32   -37.76  -46.58     1.11     4.39       174
  18  12:17:59.86  25.29   -37.41  -44.61     1.11     3.92       275
  19  12:18:03.86  25.23   -37.42  -43.18     1.11     3.45       390
  20  12:18:10.87  25.21   -38.09  -42.20     1.04     2.85       486
  21  12:18:15.86  25.20   -38.31  -41.62     0.98     2.51       562
  22  12:18:22.86  25.17   -38.04  -40.47     1.04     2.05       730
  23  12:18:28.86  25.14   -38.51  -40.20     1.04     1.58       769
* 24  12:18:34.86  25.12   -37.46  -38.24     0.91     0.84      1180
  25  12:18:37.86  25.11   -38.26  -38.84     0.84     0.64      1026
  26  12:18:42.90  25.08   -38.01  -38.37     0.84     0.17      1160
  27  12:18:49.90  25.03   -38.59  -39.20     1.18     0.04       969
  28  12:18:54.90  24.99   -38.79  -39.97     1.65     0.10       821
  29  12:19:00.89  24.99   -38.28  -39.51     1.65     0.30       911
  30  12:19:05.90  25.01   -38.55  -40.09     1.71     0.71       807
  31  12:19:09.90  25.02   -38.35  -40.37     1.71     1.24       754
  32  12:19:15.90  25.04   -37.73  -40.54     1.78     1.78       727
  33  12:19:19.90  25.09   -38.26  -41.53     1.71     2.11       575
  34  12:19:25.90  25.12   -38.13  -42.41     1.78     2.58       462
  35  12:19:31.90  25.19   -37.66  -43.20     1.78     3.12       382
  36  12:19:40.90  25.18   -37.45  -45.25     1.91     3.85       242
  37  12:19:45.94  25.20   -37.49  -46.52     1.85     4.25       181
  38  12:19:48.93  25.21   -38.02  -47.82     1.91     4.46       130
  39  12:19:54.94  25.22   -37.85  -47.67     2.12     4.39       138
  40  12:20:01.94  25.31   -37.73  -46.64     2.65     3.85       171
  41  12:20:13.94  25.24   -37.43  -44.77     2.79     3.18       270
  42  12:20:15.94  25.23   -37.49  -44.08     2.65     2.98       314
  43  12:20:22.94  25.22   -37.77  -43.36     2.65     2.51       366
  44  12:20:27.94  25.21   -38.09  -42.71     2.65     1.98       435
  45  12:20:32.94  25.19   -38.08  -41.85     2.52     1.58       531
  46  12:20:34.94  25.18   -38.23  -41.81     2.58     1.31       537
  47  12:20:36.94  25.17   -38.35  -41.59     2.52     1.11       567
  48  12:20:38.93  25.16   -37.61  -41.13     2.65     1.11       624
  49  12:20:42.94  25.15   -38.56  -41.40     2.52     0.57       585
  50  12:20:45.93  25.14   -37.84  -40.87     2.65     0.37       653
  51  12:20:47.94  25.12   -38.63  -41.31     2.52     0.17       599
  52  12:20:48.98  25.12   -38.62  -41.42     2.58     0.10       586
  53  12:20:56.98  25.16   -38.80  -42.33     2.92    -0.23       473
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54	12:20:58.97	25.17	-38.59	-42.46	3.05	-0.37	461
55	12:21:02.98	25.20	-38.97	-43.63	3.32	-0.70	350
56	12:21:12.97	25.22	-38.40	-43.33	3.46	-0.10	376
57	12:21:16.98	25.27	-38.16	-43.34	3.52	0.30	371
58	12:21:19.97	25.29	-38.24	-43.36	3.46	0.57	366
59	12:21:20.97	25.29	-37.97	-43.34	3.52	0.71	367
60	12:21:26.97	25.36	-38.20	-44.19	3.59	1.24	298
61	12:21:30.98	25.37	-38.30	-44.73	3.59	1.64	264
62	12:21:35.97	25.36	-37.59	-44.67	3.59	2.11	273
63	12:21:41.97	25.38	-37.79	-45.68	3.59	2.58	216
64	12:21:46.98	25.40	-37.98	-47.14	3.66	3.12	153
65	12:21:53.03	25.41	-37.72	-48.16	3.72	3.59	121
66	12:22:05.02	25.49	-37.90	-48.94	4.12	3.38	100
67	12:22:10.02	25.53	-38.08	-49.41	4.46	3.05	90
68	12:22:11.02	25.54	-38.26	-49.55	4.53	2.92	86
69	12:22:18.02	25.52	-38.20	-49.02	4.59	2.51	98
70	12:22:23.02	25.50	-38.51	-48.18	4.46	2.05	119
71	12:22:28.03	25.48	-38.57	-47.89	4.53	1.58	127
72	12:22:32.02	25.42	-38.46	-47.12	4.46	1.11	153
73	12:22:34.03	25.41	-38.45	-46.78	4.39	0.97	167
74	12:22:38.02	25.41	-38.04	-46.17	4.39	0.64	190
75	12:22:43.02	25.42	-38.03	-45.97	4.39	0.10	200
76	12:22:47.02	25.40	-38.30	-45.98	4.33	-0.23	200
77	12:22:52.02	25.39	-38.76	-46.53	4.33	-0.70	174
78	12:22:57.06	25.38	-38.80	-46.80	4.33	-1.17	163
79	12:23:03.06	25.31	-38.70	-46.82	4.26	-1.64	164
80	12:23:06.06	25.30	-38.24	-47.47	4.46	-2.04	141
81	12:23:08.06	25.30	-38.80	-47.21	4.19	-2.11	149
82	12:23:10.06	25.29	-38.64	-48.38	4.46	-2.44	115
83	12:23:14.06	25.27	-38.23	-48.25	4.39	-2.78	120
84	12:23:19.06	25.22	-39.30	-49.47	4.26	-3.11	91
85	12:23:25.06	25.27	-39.10	-50.55	4.46	-3.45	70
86	12:23:42.06	25.35	-39.95	-51.89	4.86	-2.98	51
87	12:23:44.06	25.36	-39.45	-51.33	4.93	-2.78	58
88	12:23:51.06	25.38	-39.44	-50.46	4.93	-2.11	71
89	12:23:55.06	25.42	-38.88	-49.55	4.93	-1.77	87
90	12:23:57.06	25.40	-38.84	-49.29	4.93	-1.50	92
91	12:23:58.06	25.40	-38.96	-49.11	4.86	-1.44	96
92	12:24:01.11	25.41	-38.82	-48.75	4.86	-1.10	106
93	12:24:02.11	25.41	-38.83	-49.02	4.93	-1.10	99
94	12:24:06.11	25.46	-39.92	-49.93	4.93	-0.63	80
95	12:24:12.11	25.55	-39.58	-50.07	5.06	-0.16	74
96	12:24:16.11	25.51	-39.03	-49.29	5.00	0.24	91
97	12:24:21.10	25.54	-38.46	-49.16	5.06	0.71	94
98	12:24:26.11	25.56	-39.59	-50.59	5.06	1.17	69
99	12:24:31.11	25.57	-39.05	-51.00	5.20	1.64	63
100	12:24:46.11	25.69	-38.58	-47.67	4.39	1.78	131
101	12:24:58.11	25.82	-37.96	-44.11	3.46	1.71	300
102	12:25:09.14	25.93	-37.73	-41.46	2.45	1.64	549
103	12:25:24.14	25.85	-37.58	-41.53	1.51	2.58	538
104	12:25:36.15	25.75	-37.64	-42.67	0.51	3.32	422
105	12:25:38.14	25.74	-37.44	-43.21	0.37	3.59	372
106	12:25:45.14	25.73	-38.04	-45.28	-0.23	4.05	225
107	12:25:46.14	25.68	-38.12	-45.85	-0.36	4.19	200
108	12:25:51.14	25.65	-37.45	-46.25	-0.70	4.46	184
109	12:26:03.15	25.61	-38.29	-48.73	-0.90	4.86	104
110	12:26:50.18	25.75	-38.31	-50.29	-1.57	5.13	72
111	12:26:53.19	25.75	-38.38	-49.87	-1.63	4.99	80
112	12:26:57.18	25.73	-37.98	-48.41	-1.63	4.72	112
113	12:26:59.19	25.72	-37.76	-47.37	-1.57	4.52	142
114	12:27:00.18	25.71	-38.25	-47.44	-1.63	4.39	140

115	12:27:01.18	25.71	-37.82	-46.71	-1.57	4.32	165
116	12:27:08.18	25.68	-37.51	-44.68	-1.63	3.79	263
117	12:27:09.18	25.67	-37.46	-44.57	-1.57	3.79	270
118	12:27:13.23	25.65	-37.90	-44.07	-1.63	3.45	304
119	12:27:15.22	25.60	-37.89	-43.44	-1.57	3.25	357
120	12:27:20.23	25.59	-37.53	-42.38	-1.70	2.92	455
121	12:27:24.22	25.58	-37.72	-41.65	-1.70	2.51	538
122	12:27:30.22	25.56	-38.23	-41.26	-1.70	2.05	597
123	12:27:36.23	25.54	-38.26	-40.74	-1.84	1.58	668
124	12:27:41.23	25.52	-38.70	-40.63	-1.84	1.11	681
125	12:27:47.22	25.49	-38.08	-39.79	-1.97	0.57	816
126	12:27:52.22	25.47	-37.76	-39.20	-1.90	0.17	932
127	12:27:57.22	25.41	-38.29	-39.79	-1.97	-0.30	834
128	12:28:02.23	25.43	-38.23	-39.95	-2.04	-0.70	799
129	12:28:07.22	25.38	-38.32	-40.26	-1.97	-1.24	756
130	12:28:12.22	25.37	-38.40	-40.73	-1.97	-1.64	679
131	12:28:17.27	25.35	-38.28	-41.33	-2.04	-2.11	587
132	12:28:19.27	25.34	-38.22	-41.47	-2.10	-2.17	565
133	12:28:24.27	25.32	-38.63	-42.46	-2.04	-2.58	445
134	12:28:25.31	25.32	-38.53	-42.60	-2.10	-2.64	434
135	12:28:30.28	25.30	-38.80	-43.70	-2.10	-3.04	337
136	12:28:31.27	25.29	-38.89	-43.83	-2.04	-3.11	326
137	12:28:36.27	25.28	-38.68	-44.86	-2.10	-3.58	260
138	12:28:42.27	25.22	-39.06	-46.57	-2.10	-4.05	176
139	12:28:48.27	25.21	-39.53	-48.56	-2.30	-4.45	111
140	12:28:52.27	25.20	-39.26	-49.99	-2.37	-4.92	80
141	12:29:02.27	25.22	-39.73	-51.19	-2.71	-4.99	61
142	12:29:06.27	25.31	-39.40	-51.18	-3.04	-4.92	59
143	12:29:07.27	25.33	-39.19	-50.86	-3.11	-4.85	65
144	12:29:13.27	25.38	-39.10	-49.47	-3.31	-4.32	88
145	12:29:18.27	25.39	-38.62	-47.73	-3.24	-3.91	132
146	12:29:23.31	25.41	-38.69	-46.33	-3.11	-3.45	183
147	12:29:28.31	25.41	-38.37	-44.86	-3.11	-2.91	258
148	12:29:34.31	25.48	-38.18	-43.67	-3.04	-2.44	335
149	12:29:36.31	25.49	-38.56	-43.58	-2.97	-2.24	341
150	12:29:39.31	25.50	-38.40	-43.05	-2.97	-1.97	385
151	12:29:44.31	25.52	-38.39	-42.43	-2.91	-1.57	449
152	12:29:49.31	25.54	-38.62	-42.25	-2.91	-1.10	468
153	12:29:54.30	25.55	-38.49	-41.72	-2.84	-0.63	533
154	12:30:00.31	25.57	-38.69	-41.85	-2.84	-0.10	517
155	12:30:05.31	25.59	-38.60	-41.56	-2.71	0.30	544
156	12:30:10.31	25.60	-38.48	-41.67	-2.71	0.77	535
157	12:30:15.30	25.61	-38.04	-41.64	-2.71	1.24	539
158	12:30:20.31	25.68	-37.88	-41.96	-2.71	1.64	491
159	12:30:26.35	25.70	-38.02	-42.67	-2.64	2.11	418
160	12:30:30.34	25.72	-37.64	-43.18	-2.64	2.58	372
161	12:30:37.34	25.75	-37.51	-44.08	-2.64	3.05	303
162	12:30:44.34	25.80	-37.84	-45.51	-2.57	3.52	212
163	12:30:45.35	25.81	-37.70	-45.44	-2.50	3.59	214
164	12:30:46.35	25.77	-37.58	-47.06	-2.71	4.05	149
165	12:30:54.35	25.79	-38.06	-48.54	-2.50	4.46	108
166	12:30:55.35	25.80	-37.85	-49.00	-2.64	4.59	97
167	12:31:33.39	25.97	-38.64	-50.60	-3.91	4.05	66
168	12:31:35.40	25.96	-38.65	-50.08	-3.84	3.92	73
169	12:31:37.40	25.96	-38.33	-49.92	-3.98	3.85	77
170	12:31:40.39	25.94	-38.35	-48.56	-3.84	3.45	105
171	12:31:46.39	25.93	-38.18	-47.34	-3.84	2.98	140
172	12:31:52.40	25.90	-37.95	-46.26	-3.91	2.45	179
173	12:31:57.40	25.88	-37.63	-45.40	-3.98	1.98	218
174	12:32:00.39	25.86	-38.59	-45.80	-3.91	1.71	199
175	12:32:02.39	25.85	-38.39	-45.37	-3.91	1.51	221

176	12:32:04.40	25.85	-38.01	-44.98	-3.98	1.31	243
177	12:32:07.39	25.79	-38.13	-44.92	-3.98	1.11	247
178	12:32:12.40	25.78	-38.45	-44.71	-3.91	0.64	261
179	12:32:13.40	25.78	-38.37	-44.77	-3.98	0.50	252
180	12:32:18.40	25.76	-38.19	-44.48	-3.98	0.17	274
181	12:32:26.40	25.75	-38.02	-44.27	-3.98	-0.23	291
182	12:32:31.40	25.73	-38.36	-44.92	-4.04	-0.70	249
183	12:32:35.43	25.71	-38.58	-45.37	-4.04	-1.17	223
184	12:32:41.44	25.69	-38.52	-46.19	-4.18	-1.70	184
185	12:32:46.44	25.67	-38.38	-46.71	-4.25	-2.11	164
186	12:32:52.43	25.60	-38.91	-47.88	-4.25	-2.58	126
187	12:32:56.43	25.60	-38.68	-48.65	-4.31	-3.04	105
188	12:33:04.43	25.60	-38.57	-49.33	-4.45	-3.25	90
189	12:33:34.43	25.68	-39.56	-51.47	-5.32	-1.77	55
190	12:33:38.47	25.70	-39.25	-50.95	-5.32	-1.50	62
191	12:33:42.47	25.71	-39.55	-50.73	-5.25	-1.10	65
192	12:33:48.47	25.74	-39.33	-50.03	-5.18	-0.57	77
193	12:33:54.47	25.75	-38.96	-49.62	-5.18	-0.16	84
194	12:33:57.47	25.76	-39.57	-50.28	-5.18	0.24	72
195	12:34:03.47	25.78	-39.13	-49.76	-5.12	0.77	82
196	12:34:07.47	25.79	-39.82	-50.70	-5.12	1.17	66
197	12:34:12.47	25.85	-39.64	-51.01	-5.12	1.71	60
198	12:34:26.47	25.87	-39.18	-51.02	-5.12	2.11	60
199	12:34:36.47	25.80	-38.75	-49.87	-4.85	2.31	80
200	12:34:43.51	25.76	-38.30	-47.82	-4.38	2.31	128
201	12:34:55.51	25.60	-38.22	-44.86	-3.38	2.31	255
202	12:35:06.51	25.51	-37.77	-42.53	-2.50	2.31	435
203	12:35:18.51	25.37	-38.03	-41.39	-1.57	2.31	586
204	12:35:24.51	25.30	-38.69	-41.73	-1.10	2.38	534
205	12:35:47.56	25.27	-38.62	-40.93	-0.96	2.05	651
206	12:35:50.55	25.26	-37.65	-39.17	-0.90	1.58	948
207	12:35:55.56	25.21	-38.59	-40.15	-1.17	1.44	784
208	12:35:57.55	25.20	-37.95	-38.88	-0.96	1.04	1028
209	12:36:03.55	25.21	-38.26	-39.04	-1.17	0.64	995
210	12:36:04.55	25.18	-38.42	-38.96	-1.03	0.44	1012
211	12:36:07.56	25.17	-37.90	-38.35	-1.03	0.17	1161
212	12:36:12.55	25.15	-38.37	-38.77	-1.03	-0.30	1042
*213	12:36:18.55	25.12	-37.99	-38.56	-1.10	-0.70	1098
*214	12:36:19.56	25.12	-37.89	-38.57	-1.17	-0.83	1096
215	12:36:23.56	25.10	-38.12	-38.97	-1.10	-1.17	998
216	12:36:29.56	25.08	-38.17	-39.65	-1.10	-1.77	866
217	12:36:32.55	25.03	-38.45	-40.42	-1.23	-2.04	746
218	12:36:33.56	25.03	-38.79	-40.86	-1.23	-2.11	675
219	12:36:38.55	25.02	-38.28	-41.22	-1.30	-2.58	620
220	12:36:44.55	25.00	-37.90	-41.83	-1.30	-3.04	541
221	12:36:50.60	24.98	-38.76	-43.84	-1.30	-3.51	338
222	12:37:04.60	24.99	-38.45	-44.83	-0.96	-4.05	267
223	12:37:08.59	25.01	-39.28	-45.86	-0.50	-4.18	212
224	12:37:15.59	25.02	-39.46	-46.98	-0.56	-4.45	164
225	12:37:21.59	25.01	-39.19	-48.41	-0.56	-4.92	117
226	12:37:22.59	25.00	-39.50	-49.02	-0.70	-4.99	101
227	12:37:25.60	24.99	-40.59	-51.46	-0.70	-5.32	58
228	12:37:26.59	24.99	-41.20	-52.03	-0.56	-5.32	51
229	12:37:34.59	24.96	-40.45	-51.21	-0.23	-5.32	61
230	12:37:37.60	24.92	-40.73	-51.21	0.04	-5.25	61
231	12:37:42.59	24.89	-40.33	-51.10	0.24	-5.32	64
232	12:37:48.59	24.85	-40.09	-50.59	0.31	-5.25	71
233	12:37:53.64	24.90	-39.44	-48.39	0.44	-4.85	118
234	12:37:59.63	24.92	-39.39	-46.41	0.37	-4.32	186
235	12:38:04.63	24.94	-38.92	-44.68	0.44	-3.91	276
236	12:38:11.63	24.97	-38.73	-43.01	0.51	-3.38	409

237	12:38:19.63	24.98	-39.45	-42.58	0.44	-2.91	453
238	12:38:25.63	25.00	-38.68	-41.00	0.51	-2.51	651
239	12:38:30.63	25.02	-38.29	-39.82	0.51	-2.04	847
240	12:38:35.64	25.06	-38.52	-39.46	0.58	-1.57	903
241	12:38:41.64	25.08	-38.59	-39.13	0.64	-1.10	984
242	12:38:44.63	25.09	-38.56	-38.96	0.71	-0.83	1015
243	12:38:46.63	25.10	-38.82	-39.09	0.64	-0.63	978
244	12:38:48.64	25.11	-38.09	-38.33	0.71	-0.37	1155
*245	12:39:01.68	25.17	-38.44	-38.48	0.17	-0.37	1125
*246	12:39:32.68	25.19	-37.89	-38.20	0.31	0.64	1208
*247	12:39:42.68	25.17	-38.32	-38.44	0.37	0.17	1136
248	12:40:14.72	25.02	-39.52	-41.51	0.17	-2.37	577
249	12:40:19.73	25.03	-38.30	-40.66	0.17	-2.58	691
250	12:40:23.72	25.09	-38.42	-40.92	-0.29	-2.64	648
251	12:40:26.73	25.13	-39.28	-41.59	-0.56	-2.51	555
252	12:40:29.72	25.16	-38.09	-40.72	-0.70	-2.64	678
253	12:40:47.73	25.14	-38.93	-42.47	-0.76	-3.04	453
254	12:40:52.72	25.12	-38.72	-43.47	-0.83	-3.51	358
255	12:41:08.76	25.04	-38.98	-46.64	-0.90	-4.45	175
256	12:41:25.76	24.97	-39.95	-48.84	-0.16	-4.85	106
257	12:41:35.76	24.84	-40.04	-49.08	0.71	-4.85	101
258	12:41:36.76	24.84	-39.67	-49.05	0.84	-4.92	101
259	12:41:42.76	24.79	-40.29	-49.71	1.31	-4.85	88
260	12:41:44.76	24.79	-40.38	-50.16	1.45	-4.92	79
261	12:41:56.76	24.80	-39.53	-47.31	1.31	-4.38	153
262	12:42:03.76	24.83	-39.23	-45.32	1.31	-3.85	244
263	12:42:09.81	24.84	-38.97	-43.92	1.45	-3.38	333
264	12:42:14.81	24.85	-39.17	-43.10	1.38	-2.98	406
265	12:42:20.80	24.90	-38.69	-41.73	1.45	-2.51	551
266	12:42:26.80	24.93	-38.37	-40.64	1.45	-2.04	695
267	12:42:31.81	24.99	-37.92	-39.59	1.51	-1.50	862
268	12:42:36.81	24.97	-37.91	-39.10	1.45	-1.04	982
269	12:42:41.81	24.99	-38.33	-39.39	1.51	-0.63	931
*270	12:42:51.81	25.02	-37.56	-38.53	1.45	0.30	1129
271	12:43:37.84	24.74	-38.15	-42.87	3.25	-1.17	424
272	12:43:43.84	24.71	-38.62	-43.92	3.32	-1.64	336
273	12:43:53.85	24.66	-38.65	-44.18	3.19	-2.11	317
274	12:43:57.84	24.65	-38.65	-44.90	3.19	-2.58	271
275	12:44:03.84	24.63	-38.88	-46.00	3.19	-3.04	209
276	12:44:08.85	24.62	-38.89	-47.05	3.19	-3.51	163
277	12:44:14.85	24.60	-39.28	-48.80	3.19	-4.05	110
278	12:44:24.88	24.58	-39.56	-50.39	3.25	-4.45	75
279	12:44:36.89	24.61	-39.80	-50.73	2.99	-4.65	70
280	12:44:40.88	24.64	-39.78	-49.69	2.52	-4.58	90
281	12:44:52.88	24.73	-39.72	-48.65	1.98	-4.52	112
282	12:44:58.89	24.74	-39.37	-47.86	1.98	-4.38	135
283	12:45:04.89	24.76	-38.86	-45.91	1.98	-3.91	209
284	12:45:09.88	24.78	-38.89	-44.48	1.85	-3.45	293
285	12:45:19.89	24.77	-38.52	-43.86	2.12	-3.18	337
286	12:45:51.92	24.71	-38.63	-44.77	2.58	-3.18	277
287	12:45:57.92	24.72	-38.91	-44.74	2.65	-2.98	278
288	12:46:03.92	24.74	-38.78	-43.61	2.65	-2.44	357
289	12:46:07.92	24.76	-38.83	-43.18	2.72	-2.04	395
290	12:46:13.92	24.78	-38.62	-42.40	2.72	-1.57	476
291	12:46:20.92	24.77	-38.26	-41.50	2.52	-1.44	586
292	12:46:24.92	24.73	-38.84	-41.07	2.18	-0.97	647
293	12:46:27.97	24.67	-38.60	-40.36	1.98	-0.70	778
294	12:46:28.97	24.67	-38.72	-40.35	1.91	-0.63	784
295	12:47:06.97	24.61	-38.37	-38.42	-0.36	-0.30	1197
*296	12:47:16.97	24.61	-38.06	-38.26	-0.50	-0.70	1243
297	12:47:21.97	24.59	-38.33	-38.82	-0.50	-1.17	1084

298	12:47:28.97	24.57	-38.35	-39.38	-0.50	-1.70	948
299	12:47:46.00	24.48	-38.05	-41.52	-0.63	-3.04	602
300	12:47:53.01	24.46	-39.08	-43.70	-0.56	-3.51	363
301	12:48:21.00	24.56	-38.56	-41.00	-0.83	-2.51	660
302	12:48:40.05	24.78	-38.57	-39.38	-0.23	-1.57	926
303	12:48:45.05	24.79	-38.44	-38.79	-0.09	-1.10	1075

200 kHz calibration

```
#  Calibration  Version   1.0.0.9
#
#  Date:  2006-10-06
#
#  Comments:
#
#
#  Reference Target:
#    TS                  -44.80 dB       Min. Distance         23.00
m
#    TS Deviation           4.5 dB       Max. Distance         28.00
m
#
#  Transducer:  ES200-7  Serial No.   9072033191
#    Frequency           200000 Hz       Beamtype
Split
#    Gain                 24.01 dB       Two Way Beam Angle   -19.6
dB
#    Athw. Angle Sens.       23.00       Along. Angle Sens.
23.00
#    Athw. Beam Angle     6.32 deg       Along. Beam Angle    6.22
deg
#    Athw. Offset Angle  -0.16 deg       Along. Offset Angle  0.14
deg
#    SaCorrection         -0.28 dB       Depth                 0.00
m
#
#  Transceiver:  GPT 200 kHz 009072033f91 1 ES200-7
#    Pulse Duration       1.024 ms       Sample Interval     0.186
m
#    Power                  300  W       Receiver Bandwidth   3.09
kHz
#
#  Sounder Type:
#    EK60 Version   ComSounder
#
#  TS Detection:
#    Min. Value           -50.0 dB
#    Max. Beam Comp.        6.0 dB       Min. Echolength         80
%
#    Max. Phase Dev.           8.0       Max. Echolength        180
%
#
#  Environment:
#    Absorption Coeff.  39.8 dB/km       Sound Velocity     1453.0
m/s
#
#  Beam Model results:
#    Transducer Gain    = 22.03 dB       SaCorrection       = -0.31
dB
#    Athw. Beam Angle   = 6.43 deg       Along. Beam Angle  = 6.44
deg
```

```
#    Athw. Offset Angle =-0.24 deg       Along. Offset Angle= 0.17
deg
#
#  Data deviation from beam model:
#    RMS =    0.26 dB
#    Max =    1.00 dB  No. =   237  Athw. =  2.9 deg  Along = -0.8
deg
#    Min =   -0.83 dB  No. =   279  Athw. =  2.7 deg  Along = -3.3
deg
#
#  Data deviation from polynomial model:
#    RMS =    0.23 dB
#    Max =    0.87 dB  No. =   237  Athw. =  2.9 deg  Along = -0.8
deg
#    Min =   -0.68 dB  No. =   241  Athw. =  3.0 deg  Along = -1.8
deg
#
#  Data:
#  No.    Time     Distance  TS-c    TS-u      Athw.    Along     Sa
#                   [m]      [dB]    [dB]      [deg]    [deg]
[m2/nm2]
#
```

#	No.	Time	Distance [m]	TS-c [dB]	TS-u [dB]	Athw. [deg]	Along [deg]	Sa [m2/nm2]
	1	23:37:27.65	25.79	-49.01	-49.09	-0.02	-0.20	70
	2	23:37:28.66	25.91	-48.22	-48.36	-0.27	-0.32	82
	3	23:37:30.66	25.83	-48.53	-48.64	0.16	-0.14	78
*	4	23:37:35.66	25.75	-49.22	-49.39	0.22	-0.20	69
	5	23:37:45.66	25.77	-48.52	-48.66	0.22	-0.14	83
	6	23:37:48.65	25.77	-48.41	-48.87	0.22	-0.63	79
	7	23:37:53.66	25.74	-48.75	-49.25	0.16	-0.69	71
	8	23:37:59.66	25.75	-48.29	-49.19	0.59	-0.81	70
	9	23:38:01.65	25.75	-48.19	-49.22	0.47	-1.00	70
	10	23:38:07.62	25.67	-46.99	-48.21	0.59	-1.06	85
	11	23:38:08.62	25.71	-48.25	-50.41	0.53	-1.61	50
	12	23:38:20.62	25.73	-48.61	-49.86	0.16	-1.24	56
	13	23:38:32.62	25.73	-48.07	-49.49	0.04	-1.36	69
	14	23:38:39.62	25.76	-48.56	-49.13	-0.21	-0.81	71
	15	23:38:40.62	25.75	-47.84	-48.65	-0.27	-1.00	81
	16	23:39:09.60	25.88	-48.66	-50.09	-0.39	-1.36	57
	17	23:39:10.59	25.80	-48.84	-51.05	-0.39	-1.73	45
	18	23:39:20.59	25.75	-48.45	-51.86	-0.63	-2.16	41
	19	23:39:22.59	25.79	-49.15	-51.72	-0.57	-1.85	41
	20	23:39:23.60	25.78	-47.73	-50.92	-0.51	-2.10	50
	21	23:39:26.59	25.76	-48.14	-52.42	-0.51	-2.46	36
	22	23:39:32.59	25.76	-47.55	-53.39	-0.63	-2.89	28
	23	23:39:33.59	25.62	-47.95	-53.74	-0.51	-2.89	26
	24	23:39:34.59	25.76	-47.95	-53.19	-0.76	-2.71	30
	25	23:39:37.60	25.74	-47.33	-54.30	-0.45	-3.20	21
	26	23:39:40.59	25.76	-47.14	-56.16	-0.82	-3.63	14
	27	23:39:41.59	25.72	-47.21	-54.87	-0.82	-3.32	20
	28	23:39:47.59	25.60	-46.99	-58.01	-0.57	-4.05	9
	29	23:39:53.59	25.70	-46.89	-56.33	-0.39	-3.75	14
	30	23:40:18.56	25.77	-47.40	-54.00	-1.06	-3.01	24
	31	23:40:19.56	25.78	-47.87	-53.61	-1.12	-2.77	26
	32	23:40:24.56	25.79	-47.78	-54.93	-1.37	-3.07	19
	33	23:40:29.55	25.94	-47.00	-55.28	-1.98	-3.14	17
	34	23:40:30.56	25.88	-48.53	-54.08	-1.49	-2.59	23
	35	23:40:31.56	25.89	-47.20	-54.97	-2.29	-2.83	19
	36	23:40:36.55	25.89	-48.09	-54.73	-1.92	-2.71	19
	37	23:40:50.55	26.07	-47.82	-55.26	-2.22	-2.77	17
	38	23:40:51.56	25.95	-49.00	-54.20	-1.86	-2.28	22
	39	23:40:54.56	25.97	-48.26	-56.85	-2.47	-2.95	12

40	23:40:56.55	26.07	-46.73	-57.24	-2.90	-3.20	11
41	23:40:57.55	25.99	-47.02	-57.10	-2.90	-3.07	11
* 42	23:40:59.56	26.10	-46.81	-54.55	-2.53	-2.65	19
43	23:41:06.56	26.13	-47.92	-55.40	-2.71	-2.40	16
44	23:41:11.55	26.13	-48.12	-54.00	-2.47	-2.04	23
45	23:41:14.56	26.13	-49.13	-53.87	-2.35	-1.67	24
46	23:41:19.52	26.13	-48.81	-53.90	-2.53	-1.61	24
47	23:41:24.52	26.14	-48.61	-55.14	-2.90	-1.79	18
48	23:41:28.52	26.28	-48.42	-55.09	-3.02	-1.67	17
49	23:41:31.52	26.16	-49.20	-57.05	-3.26	-1.85	11
50	23:41:36.51	26.19	-47.53	-57.82	-3.81	-2.04	10
51	23:41:37.52	26.17	-48.87	-57.89	-3.45	-2.10	9
52	23:41:45.52	26.14	-48.94	-56.88	-3.45	-1.55	11
53	23:41:53.52	26.13	-48.40	-55.28	-3.26	-1.30	17
54	23:42:03.52	26.24	-48.64	-57.92	-3.88	-1.30	8
55	23:42:04.51	26.32	-49.05	-54.68	-2.90	-1.30	18
56	23:42:05.52	26.17	-48.00	-57.24	-3.75	-1.61	10
57	23:42:28.48	26.11	-48.44	-52.87	-2.16	-1.73	25
58	23:42:29.48	25.97	-47.89	-51.81	-1.92	-1.73	38
59	23:42:30.48	26.10	-48.92	-52.70	-1.98	-1.61	30
* 60	23:42:36.48	25.93	-47.37	-50.70	-1.67	-1.67	51
61	23:42:37.48	25.93	-48.49	-51.90	-1.55	-1.79	38
62	23:42:42.48	25.94	-48.66	-51.23	-1.25	-1.61	46
* 63	23:42:46.48	25.91	-47.45	-50.50	-1.31	-1.79	54
64	23:42:59.48	25.98	-48.48	-50.70	-1.43	-1.30	51
65	23:43:02.48	25.95	-48.93	-50.61	-1.25	-1.12	52
66	23:43:07.48	26.10	-48.99	-50.43	-1.43	-0.75	48
67	23:43:10.48	26.09	-48.95	-50.33	-1.55	-0.45	51
68	23:43:11.48	26.09	-48.82	-49.98	-1.31	-0.63	55
69	23:43:20.48	26.12	-48.78	-50.62	-1.74	-0.63	50
70	23:43:23.48	26.10	-49.12	-51.32	-1.98	-0.45	43
71	23:43:29.45	26.27	-48.92	-52.20	-2.41	-0.51	33
72	23:43:30.45	26.14	-48.75	-52.47	-2.59	-0.38	32
73	23:43:31.46	26.20	-49.11	-52.60	-2.47	-0.57	31
74	23:43:38.46	26.32	-49.26	-54.29	-2.96	-0.63	21
75	23:43:39.46	26.32	-49.26	-54.41	-3.02	-0.51	21
76	23:43:48.46	26.29	-49.08	-55.63	-3.45	-0.14	17
77	23:43:49.45	26.35	-49.15	-56.50	-3.57	-0.69	13
78	23:43:51.45	26.46	-48.81	-57.92	-4.00	-0.57	9
79	23:43:57.45	26.31	-48.59	-56.31	-3.69	-0.51	13
80	23:44:02.45	26.51	-48.55	-58.49	-4.18	-0.51	7
81	23:44:03.45	26.35	-49.03	-57.10	-3.75	-0.63	10
82	23:44:04.45	26.35	-48.88	-55.97	-3.57	-0.26	13
83	23:44:16.45	26.46	-48.99	-58.62	-4.12	0.78	7
84	23:44:25.45	26.46	-49.22	-57.82	-3.94	0.17	9
85	23:44:26.45	26.47	-48.87	-58.04	-4.06	0.29	9
86	23:44:32.41	26.35	-49.20	-56.48	-3.63	0.29	13
87	23:44:33.42	26.41	-48.59	-55.36	-3.51	0.29	16
88	23:44:38.41	26.36	-49.19	-58.10	-4.00	-0.14	9
89	23:44:55.42	26.30	-48.73	-53.06	-2.84	0.29	28
90	23:45:00.41	26.34	-49.29	-54.02	-2.96	0.23	23
91	23:45:16.42	26.16	-48.82	-51.73	-2.35	0.35	38
92	23:45:26.41	26.16	-48.38	-50.39	-1.98	0.29	52
93	23:45:35.38	26.19	-49.02	-50.89	-1.92	0.17	46
94	23:45:37.38	26.15	-49.28	-51.70	-2.16	0.17	37
95	23:45:47.37	26.13	-49.13	-50.41	-1.61	0.29	53
96	23:45:58.38	25.99	-49.14	-49.86	-1.25	0.10	59
97	23:46:03.38	26.11	-49.28	-50.11	-1.31	0.35	56
98	23:46:21.38	26.02	-48.95	-49.27	-0.88	0.10	66
99	23:46:22.37	25.96	-49.08	-49.35	-0.82	0.23	67
100	23:46:48.36	25.90	-49.07	-49.07	-0.21	0.10	73

*101	23:46:58.35	25.90	-49.28	-49.29	-0.21	0.23	69
102	23:47:13.35	26.09	-49.00	-49.42	-0.08	0.96	65
103	23:47:19.35	25.93	-49.06	-49.85	-0.21	1.27	56
104	23:47:20.35	25.98	-48.78	-49.66	-0.27	1.33	62
105	23:47:32.35	25.98	-48.96	-49.96	-0.76	1.27	58
106	23:47:39.35	26.10	-49.28	-50.29	-0.63	1.33	52
107	23:48:18.32	26.13	-49.18	-50.66	-1.25	1.27	50
108	23:48:19.31	26.16	-49.26	-51.27	-1.49	1.39	45
109	23:48:28.31	26.29	-49.27	-51.88	-1.92	1.27	35
110	23:48:37.31	26.32	-49.14	-53.16	-2.53	1.21	28
111	23:48:43.31	26.40	-49.07	-55.24	-3.14	1.39	17
112	23:48:44.28	26.46	-48.73	-55.18	-3.26	1.27	16
113	23:48:50.28	26.50	-49.09	-56.40	-3.45	1.39	13
114	23:49:19.28	26.63	-49.14	-60.50	-4.24	1.88	5
115	23:49:29.27	26.50	-48.45	-56.47	-3.63	1.39	12
116	23:49:33.28	26.62	-48.84	-57.47	-3.63	1.82	10
117	23:49:41.28	26.47	-49.29	-56.13	-3.20	1.69	14
118	23:49:53.25	26.47	-48.92	-53.90	-2.35	2.06	21
119	23:49:58.25	26.47	-49.11	-53.55	-2.29	1.88	23
120	23:50:01.25	26.47	-48.92	-53.95	-2.47	1.94	22
121	23:50:10.26	26.31	-48.81	-52.59	-1.86	2.00	31
122	23:50:28.25	26.10	-49.29	-51.27	-0.57	1.88	44
123	23:50:31.26	26.06	-49.01	-51.23	-0.51	2.00	42
124	23:50:42.25	26.08	-49.07	-51.38	-0.27	2.06	41
125	23:50:43.25	25.96	-48.82	-50.83	-0.15	1.94	47
126	23:50:45.25	25.97	-49.29	-51.26	0.22	1.88	44
127	23:50:50.25	25.95	-48.16	-50.93	-0.08	2.24	45
128	23:50:55.21	26.10	-48.93	-52.55	-0.02	2.55	31
129	23:50:58.22	26.06	-48.59	-53.40	-0.02	2.92	25
130	23:51:09.21	25.97	-49.09	-53.49	-0.33	2.79	25
131	23:51:10.21	25.97	-48.79	-54.03	-0.33	3.04	22
132	23:51:11.21	25.97	-48.09	-54.29	-0.45	3.28	21
133	23:51:19.22	25.92	-48.44	-55.50	-0.76	3.47	15
134	23:51:20.22	25.94	-49.07	-57.25	-0.88	3.71	11
135	23:51:21.21	25.97	-48.36	-57.56	-1.12	3.90	10
136	23:51:25.21	25.96	-48.67	-59.52	-1.61	4.14	7
137	23:51:28.21	25.79	-49.27	-58.71	-1.61	3.83	8
138	23:51:34.21	25.92	-48.40	-57.98	-1.25	3.96	9
139	23:51:36.21	25.93	-48.81	-56.73	-1.43	3.53	11
140	23:51:38.21	25.92	-49.09	-55.67	-1.49	3.16	15
141	23:51:39.21	25.91	-48.95	-56.60	-1.19	3.53	12
142	23:51:46.21	25.76	-48.80	-53.76	-1.37	2.73	24
143	23:51:47.22	25.80	-49.09	-53.90	-1.25	2.73	25
144	23:51:57.17	25.80	-48.64	-54.42	-1.80	2.79	21
145	23:52:11.17	25.96	-48.86	-57.01	-2.77	2.86	10
146	23:52:19.18	25.97	-48.45	-57.65	-3.08	2.92	9
147	23:52:21.18	25.94	-48.32	-56.45	-2.84	2.79	12
148	23:52:44.17	26.10	-49.12	-60.14	-3.02	3.53	6
149	23:52:53.17	26.26	-49.08	-56.49	-2.41	2.92	12
150	23:52:59.17	26.29	-48.86	-53.48	-1.92	2.31	24
151	23:53:25.14	26.23	-49.13	-53.06	-1.61	2.24	27
152	23:53:32.14	26.14	-49.00	-52.66	-1.19	2.37	32
153	23:53:40.14	26.13	-49.21	-52.21	-0.82	2.24	34
154	23:54:03.14	25.93	-49.03	-52.20	0.22	2.37	36
155	23:54:11.11	25.85	-48.65	-52.43	0.40	2.55	32
156	23:54:30.11	25.78	-48.80	-53.56	0.40	2.86	27
157	23:54:36.11	25.74	-48.72	-54.64	-0.02	3.22	21
158	23:54:45.11	25.74	-48.54	-54.55	0.28	3.22	20
159	23:54:54.11	25.73	-47.89	-56.02	0.47	3.71	14
160	23:55:00.11	25.71	-48.64	-56.62	0.16	3.71	13
161	23:55:03.11	25.61	-48.53	-57.28	0.59	3.83	11

162	23:55:10.07	25.56	-48.99	-55.51	0.71	3.28	14
163	23:55:13.07	25.58	-47.91	-57.02	1.02	3.83	12
164	23:55:15.08	25.61	-48.91	-56.68	1.20	3.47	13
165	23:55:20.07	25.58	-48.65	-58.61	1.02	4.02	9
166	23:55:21.08	25.54	-48.75	-58.05	1.38	3.77	10
167	23:55:25.07	25.62	-47.89	-57.58	0.71	4.02	10
168	23:55:38.07	25.54	-48.20	-53.59	1.08	2.86	27
169	23:55:40.07	25.59	-49.03	-55.04	0.65	3.16	19
170	23:55:45.07	25.57	-48.88	-53.79	0.83	2.79	26
171	23:55:52.07	25.56	-48.75	-53.37	1.08	2.61	27
172	23:56:01.07	25.56	-48.80	-53.56	1.51	2.43	28
173	23:56:04.08	25.56	-48.95	-53.52	1.57	2.31	27
174	23:56:05.08	25.61	-48.44	-53.06	1.75	2.18	30
175	23:56:09.07	25.58	-49.11	-53.19	1.69	2.00	28
176	23:56:28.03	25.60	-48.12	-51.25	1.63	1.57	45
177	23:56:37.04	25.58	-49.06	-51.28	1.44	1.21	46
178	23:56:39.04	25.55	-48.49	-50.34	1.44	0.84	57
179	23:56:50.04	25.57	-48.33	-51.01	1.87	0.72	50
180	23:56:52.04	25.58	-48.86	-51.56	1.93	0.47	43
181	23:56:54.03	25.59	-49.22	-52.56	2.18	0.41	33
182	23:56:58.04	25.64	-48.22	-52.06	2.36	0.04	37
183	23:56:59.04	25.71	-48.01	-52.43	2.54	-0.02	33
184	23:57:10.04	25.57	-48.75	-54.90	3.03	0.04	20
185	23:57:17.01	25.55	-47.67	-54.81	3.28	0.04	21
186	23:57:24.01	25.43	-47.07	-55.81	3.65	0.04	16
187	23:57:28.01	25.41	-48.22	-56.96	3.65	0.23	12
188	23:57:29.00	25.41	-48.64	-56.82	3.52	0.23	12
189	23:57:34.01	25.40	-48.24	-55.18	3.22	0.53	18
190	23:57:35.01	25.40	-48.74	-55.00	3.03	0.59	20
191	23:57:39.01	25.40	-48.78	-54.02	2.73	0.78	25
192	23:57:42.01	25.35	-48.68	-54.13	2.73	1.02	24
193	23:57:44.01	25.36	-48.94	-53.44	2.42	1.08	29
194	23:57:45.01	25.36	-47.61	-52.41	2.42	1.33	35
195	23:57:50.00	25.24	-48.26	-52.28	2.06	1.51	36
196	23:57:52.01	25.21	-47.62	-51.62	1.87	1.76	38
197	23:58:07.01	25.36	-48.87	-54.24	1.81	2.43	22
198	23:58:13.01	25.38	-48.94	-55.75	1.81	2.92	17
199	23:58:15.01	25.36	-48.71	-55.27	1.69	2.92	19
200	23:58:16.01	25.37	-47.98	-56.16	1.87	3.28	15
201	23:58:24.05	25.38	-48.89	-56.74	1.57	3.35	13
202	23:58:34.06	25.40	-48.02	-56.14	2.30	2.98	14
203	23:58:35.06	25.53	-48.26	-55.47	2.30	2.67	16
204	23:58:39.06	25.43	-49.18	-56.23	2.48	2.43	14
205	23:58:40.06	25.44	-48.59	-55.68	2.54	2.37	16
206	23:58:43.05	25.57	-48.91	-57.02	2.91	2.31	12
207	23:58:46.06	25.55	-48.18	-56.42	3.16	1.94	14
208	23:58:47.06	25.55	-48.34	-56.95	3.28	1.88	12
209	23:58:52.06	25.61	-48.69	-57.57	3.46	1.57	11
210	23:58:54.06	25.61	-47.53	-57.48	3.71	1.57	10
211	23:58:55.06	25.64	-48.01	-57.05	3.58	1.27	11
212	23:58:57.05	25.72	-49.07	-59.51	3.89	1.27	6
213	23:58:59.06	25.73	-47.73	-58.76	4.01	1.27	8
214	23:59:00.06	25.61	-48.18	-58.62	3.95	0.90	8
215	23:59:02.06	25.74	-48.88	-60.24	4.13	0.90	5
216	23:59:14.06	25.76	-48.26	-56.60	3.52	0.72	14
217	23:59:19.05	25.78	-48.74	-55.95	3.22	0.96	15
218	23:59:29.02	25.92	-48.82	-53.07	2.42	0.78	30
219	23:59:49.02	26.08	-49.13	-50.86	1.32	0.96	47
220	00:00:00.01	26.07	-49.12	-50.48	1.20	0.78	52
221	00:00:06.01	25.96	-48.88	-50.25	1.32	0.41	56
222	00:00:07.01	25.94	-48.51	-49.95	1.38	0.29	61

223	00:00:13.01	25.94	-48.65	-49.40	0.83	0.65	66
224	00:00:20.01	25.91	-48.86	-49.72	0.47	1.14	60
225	00:00:24.02	25.78	-49.19	-50.18	0.04	1.39	55
226	00:00:33.98	25.73	-49.28	-50.75	0.22	1.63	50
227	00:00:36.98	25.74	-48.86	-50.46	0.59	1.57	53
228	00:00:44.98	25.71	-48.28	-50.45	1.08	1.57	53
229	00:00:57.98	25.58	-49.15	-51.83	1.20	1.76	41
230	00:01:24.98	25.74	-47.99	-53.20	2.30	1.82	29
231	00:01:34.98	25.72	-48.58	-54.50	2.54	1.82	20
232	00:01:35.96	25.72	-48.54	-54.66	2.73	1.57	19
233	00:01:38.95	25.71	-49.11	-56.16	2.97	1.63	13
234	00:02:06.95	25.57	-49.08	-57.92	2.18	3.28	10
235	00:03:11.92	25.58	-49.21	-54.46	2.79	0.23	21
236	00:03:15.91	25.57	-49.11	-54.66	2.85	-0.26	21
237	00:03:21.91	25.55	-46.15	-52.32	2.91	-0.81	35
238	00:03:25.92	25.55	-48.16	-55.20	3.09	-1.00	18
239	00:03:27.91	25.58	-48.68	-54.33	2.73	-0.93	23
240	00:03:34.91	25.58	-47.93	-54.88	2.91	-1.42	18
241	00:03:37.92	25.52	-49.12	-56.95	2.97	-1.79	12
242	00:03:42.91	25.55	-47.96	-55.29	2.79	-1.85	17
243	00:03:44.88	25.55	-48.56	-56.98	2.91	-2.16	12
244	00:03:47.88	25.42	-47.41	-57.01	3.03	-2.46	11
245	00:03:55.88	25.54	-46.98	-55.61	2.79	-2.40	16
246	00:03:57.88	25.55	-47.01	-55.09	2.48	-2.52	18
247	00:03:59.88	25.52	-48.93	-56.49	2.42	-2.40	13
248	00:04:02.88	25.57	-47.94	-55.20	2.24	-2.46	18
249	00:04:05.88	25.56	-47.49	-53.57	1.81	-2.40	27
250	00:04:06.88	25.59	-47.37	-54.08	1.93	-2.52	24
251	00:04:11.88	25.60	-47.29	-53.39	1.63	-2.52	27
252	00:04:13.88	25.60	-48.80	-54.56	1.32	-2.59	20
253	00:04:17.88	25.74	-47.15	-52.25	1.26	-2.40	34
254	00:04:25.88	25.71	-48.07	-51.79	0.89	-2.10	38
255	00:04:26.88	25.59	-47.51	-50.70	0.71	-1.97	50
256	00:04:34.88	25.70	-48.07	-50.66	0.53	-1.79	52
257	00:04:35.88	25.59	-49.00	-51.35	0.59	-1.67	45
258	00:04:55.85	25.60	-49.11	-50.29	1.02	-0.63	56
259	00:05:08.85	25.57	-47.01	-48.98	1.44	-0.69	79
260	00:05:16.85	25.72	-47.25	-50.83	1.87	-1.24	45
261	00:05:18.85	25.70	-46.99	-49.80	1.69	-1.00	59
262	00:05:19.85	25.72	-48.48	-52.73	2.06	-1.36	28
263	00:05:20.85	25.61	-48.39	-53.73	2.30	-1.61	25
264	00:05:23.85	25.71	-48.20	-54.37	2.54	-1.67	22
265	00:05:26.85	25.70	-47.46	-53.40	2.42	-1.73	27
266	00:05:36.85	25.72	-47.26	-57.57	3.40	-2.22	10
267	00:05:43.85	25.59	-46.54	-58.40	3.65	-2.46	9
268	00:05:44.85	25.72	-48.45	-57.51	3.28	-1.85	10
269	00:05:47.85	25.73	-48.14	-56.76	3.28	-1.61	12
270	00:05:56.81	25.70	-48.00	-56.30	3.34	-1.24	14
271	00:05:58.82	25.63	-47.64	-55.27	3.28	-0.87	18
272	00:06:01.81	25.69	-46.85	-56.73	3.71	-1.24	12
273	00:06:08.81	25.57	-46.46	-58.44	4.13	-1.30	9
274	00:06:15.81	25.62	-47.72	-59.55	4.07	-1.42	7
275	00:06:18.82	25.60	-47.66	-58.83	3.95	-1.36	8
276	00:06:28.81	25.62	-46.72	-58.29	3.83	-1.97	9
277	00:07:18.78	25.62	-48.84	-60.44	3.03	-3.14	5
278	00:07:20.78	25.64	-48.76	-60.24	2.85	-3.26	5
279	00:07:21.78	25.66	-49.29	-60.43	2.73	-3.26	5
280	00:07:25.78	25.59	-48.71	-58.23	2.36	-3.07	8
281	00:07:26.78	25.60	-47.94	-58.57	2.24	-3.44	8
282	00:07:32.78	25.60	-49.26	-58.29	1.81	-3.26	8
283	00:07:33.78	25.61	-47.99	-57.03	2.06	-3.14	12

284	00:07:40.78	25.75	-49.08	-56.62	1.63	-2.95	13
285	00:07:47.78	25.77	-48.87	-56.36	1.14	-3.14	14
286	00:07:50.78	25.76	-48.42	-53.62	0.89	-2.59	26
287	00:08:02.75	25.75	-47.91	-53.89	0.83	-2.83	23
288	00:08:06.75	25.73	-48.51	-55.17	0.53	-3.07	16
289	00:08:07.75	25.61	-48.52	-56.04	0.95	-3.20	14
290	00:08:08.75	25.59	-48.68	-56.85	0.83	-3.38	12
291	00:08:11.74	25.67	-48.01	-57.61	0.89	-3.69	9
292	00:08:15.75	25.60	-48.12	-58.70	0.65	-3.93	8
293	00:08:16.75	25.57	-48.19	-58.14	0.95	-3.75	7
294	00:08:38.75	25.61	-48.88	-53.91	0.47	-2.65	23
295	00:10:29.68	25.22	-48.92	-49.42	0.71	-0.14	68
296	00:12:17.61	25.21	-48.87	-50.79	-1.00	1.69	52
297	00:12:22.62	25.21	-49.19	-50.58	-1.00	1.39	55
298	00:12:28.62	25.16	-48.82	-49.45	-0.82	0.90	72
299	00:12:34.61	25.07	-49.26	-49.85	-1.00	0.65	66
300	00:12:56.62	24.94	-49.11	-49.20	0.22	0.23	74

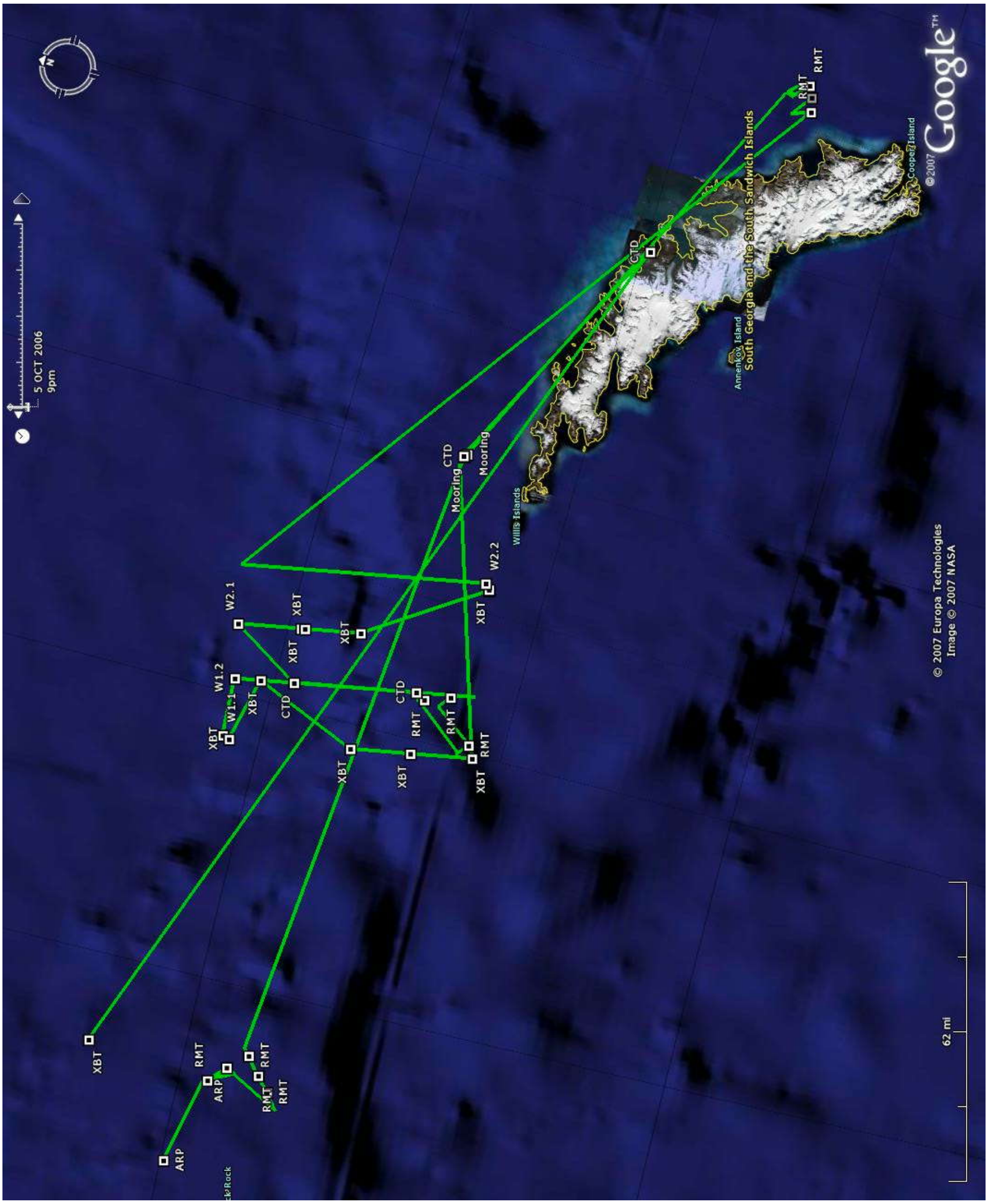
Event Log

Time	*Event*	*Lat*	*Lon*	*Comment*
05/10/2006 20:48	**1**	-53.15117	-41.21994	Test XBT deployed
06/10/2006 17:57	**1**	-54.15887	-36.69725	Test CTD deployed for calibration
06/10/2006 18:07	**2**	-54.15886	-36.69726	CTD recovered
12/10/2006 20:08	**3**	-53.79976	-37.93687	Vessel On DP 300m north of shallow mooring
12/10/2006 20:11	**3**	-53.79977	-37.93686	Buoy Released
12/10/2006 20:13	**3**	-53.79976	-37.93688	Buoy on the surface and sighted, transponder recovered
12/10/2006 20:25	**3**	-53.80318	-37.93741	mooring grapnelled
12/10/2006 20:45	**3**	-53.80118	-37.94591	Mooring release hook recovered
12/10/2006 20:51	**3**	-53.80042	-37.94759	Mooring recovered to deck
12/10/2006 21:38	**3**	-53.78827	-37.94339	deck secure moving off station
13/10/2006 08:57	**4**	-54.05599	-39.39183	XBT Deployed. Commence Western Core Box @ W1.1S
13/10/2006 10:04	**5**	-53.87647	-39.44557	XBT Deployed
13/10/2006 11:11	**6**	-53.70197	-39.49702	XBT Deployed
13/10/2006 12:17	**7**	-53.39572	-39.28019	XBT Deployed
13/10/2006 13:20	**8**	-53.3486	-39.60116	XBT Deployed
13/10/2006 13:30		-53.32765	-39.59055	Transect 1.1 Complete
13/10/2006 14:38		-53.32043	-39.30306	Commence Transect 1.2
13/10/2006 18:55		-54.02219	-39.0894	End of transect 1.2 - A/C to run back up transect for RMT target fishing
13/10/2006 19:30	**9**	-53.95644	-39.10923	Slowing for RMT deployment
13/10/2006 19:33	**9**	-53.95288	-39.11344	Bridge ready to deploy
13/10/2006 19:41	**9**	-53.94956	-39.12328	Deploying RMT
13/10/2006 19:43	**9**	-53.94847	-39.12596	RMT Deployed
13/10/2006 19:59	**9**	-53.92261	-39.18206	RMT @ 346m
13/10/2006 20:23	**9**	-53.9225	-39.18216	RMT @ Surface
13/10/2006 20:27	**9**	-53.92413	-39.17934	RMT Recovered
13/10/2006 20:37	**9**	-53.92174	-39.18251	Moving off station
13/10/2006 22:00	**10**	-54.04002	-39.33141	Slowing for RMT deployment
13/10/2006 22:02	**10**	-54.03667	-39.3317	Bridge ready to deploy
13/10/2006 22:03	**10**	-54.03629	-39.33313	Deploying RMT
13/10/2006 22:05	**10**	-54.03554	-39.33548	RMT Deployed
13/10/2006 22:28	**10**	-54.00776	-39.39238	RMT @ 505m

13/10/2006 22:53	**10**	-54.00703	-39.39399	RMT @ Surface
13/10/2006 22:58	**10**	-54.01252	-39.38231	RMT Recovered
14/10/2006 00:42	**11**	-53.86781	-39.18566	Slowing for RMT deployment
14/10/2006 01:03	**11**	-53.86717	-39.18652	Clear to deploy RMT
14/10/2006 01:06	**11**	-53.87632	-39.16812	RMT Deployed
14/10/2006 01:17	**11**	-53.8655	-39.18818	Commence Recovery of RMT
14/10/2006 01:18	**11**	-53.86426	-39.18871	RMT @ Surface
14/10/2006 01:23	**11**	-53.86382	-39.18838	RMT Recovered
14/10/2006 01:29	**11**	-53.86354	-39.18785	Moving off station
14/10/2006 01:50	**12**	-53.84789	-39.1417	Slowing for CTD Deployment
14/10/2006 02:05	**12**	-53.84789	-39.14169	On Station
14/10/2006 02:21	**12**	-53.84788	-39.14169	Clear to deploy CTD
14/10/2006 02:23	**12**	-53.84791	-39.14168	CTD deployed
14/10/2006 02:41	**12**	-53.8479	-39.14169	CTD recovered
14/10/2006 02:51		-53.84479	-39.14473	Vessel moving off station
14/10/2006 05:00	**13**	-53.50529	-39.24487	commence slowing for CTD station
14/10/2006 05:02	**13**	-53.50101	-39.24712	Bow thruster problem
14/10/2006 05:20	**13**	-53.49321	-39.25096	bow thruster problem resolved
14/10/2006 05:24	**13**	-53.49283	-39.25065	V/L on station for CTD deployment
14/10/2006 05:28	**13**	-53.49282	-39.25068	CTD 1.2N deployed
14/10/2006 05:49	**13**	-53.4928	-39.25073	CTD @ depth 1000m
14/10/2006 06:07	**13**	-53.49278	-39.25105	CTD recovered
14/10/2006 06:19		-53.49237	-39.25119	vessel off station, proceeding to start of 2.1
14/10/2006 09:00	**14**	-53.28905	-39.03752	Commence Transect W2.1N @ 10.0kts
14/10/2006 10:02	**15**	-53.48366	-38.97845	XBT Deployed
14/10/2006 10:03	**15**	-53.48442	-38.97817	XBT Aborted
14/10/2006 10:05	**16**	-53.47248	-38.982	XBT Deployed
14/10/2006 11:07	**17**	-53.64552	-38.92816	XBT Deployed
14/10/2006 12:10	**18**	-53.97699	-38.55799	XBT Deployed
14/10/2006 13:14	**19**	-53.97613	-38.5523	XBT Deployed
14/10/2006 14:25		-53.96219	-38.52707	Commence Transect W2.2N@ 10kt
14/10/2006 19:36		-53.25461	-38.75209	Complete Transect W2.2N, Proceeding to Royal Bay due to Adverse weather conditions
15/10/2006 09:30	**20**	-54.49797	-35.75695	Slowing for RMT deployment
15/10/2006 09:36	**20**	-54.49792	-35.76329	Bridge ready to deploy
15/10/2006 09:42	**20**	-54.4932	-35.76705	Deploying RMT
15/10/2006 09:53	**20**	-54.48405	-35.77417	RMT @ 65m
15/10/2006 10:38	**20**	-54.44842	-35.7999	RMT @ Surface
15/10/2006 10:42	**20**	-54.44562	-35.80215	RMT Recovered
15/10/2006 10:50	**20**	-54.43965	-35.80737	deck secure moving off station
15/10/2006 11:33	**21**	-54.48486	-35.69377	Clear to deploy RMT
15/10/2006 11:36	**21**	-54.48264	-35.69473	RMT Deployed
15/10/2006 12:23	**21**	-54.40784	-35.70721	RMT at Depth
15/10/2006 12:53	**21**	-54.42908	-35.71777	Commence Recovery of RMT
15/10/2006 12:56	**21**	-54.42684	-35.71877	RMT Recovered
15/10/2006 13:46	**21**	-54.47255	-35.63159	V/L head to wind and 2Kts through the water
15/10/2006 13:56	**21**	-54.46627	-35.63808	RMT Deployed
15/10/2006 14:41	**21**	-54.43736	-35.65938	Commence Recovery of RMT
15/10/2006 14:45	**21**	-54.43488	-35.6608	RMT Recovered
15/10/2006 15:10	**21**	-54.40784	-35.70721	

16/10/2006 17:09		-53.81139	-37.92998	V/L on station 0.5nm downwind of mooring site. Evaluating suitability of conditions for deployment
16/10/2006 18:47		-53.80924	-37.92898	Commence deployment of shallow water mooring – Commence moving ahead at 1 knot
16/10/2006 18:50	**22**	-53.80848	-37.92997	Buoy deployed
16/10/2006 18:52		-53.80809	-37.9306	Releases deployed
16/10/2006 19:19	**22**	-53.80242	-37.93854	Mooring Released, water depth 319m
16/10/2006 19:33	**23**	-53.79953	-37.94261	Vessel on DP 500m upwind of mooring reday to deploy ctd
16/10/2006 19:43	**23**	-53.79951	-37.94274	CTD deployed
16/10/2006 19:50	**23**	-53.7995	-37.94272	CTD stopped @ 303m
16/10/2006 19:59	**23**	-53.79953	-37.94271	CTD recovered
16/10/2006 20:13	**24**	-53.79946	-37.94272	commence deployment of Whale Listening buoy
16/10/2006 20:15	**24**	-53.79949	-37.94273	Whale Listening buoy deployed in 318m
16/10/2006 20:40	**25**	-53.80283	-37.9376	Vessel on DP over Shallow mooring site
16/10/2006 21:21	**25**	-53.8028	-37.93765	Vessel moving off station
17/10/2006 09:00	**26**	-53.60921	-41.07897	Vessel head to wind @ 2.5 Kts, assessing weather for RMT deployment
17/10/2006 09:28	**26**	-53.62231	-41.10645	Deploying RMT
17/10/2006 09:35	**26**	-53.62529	-41.11308	RMT Deployed
17/10/2006 09:43	**26**	-53.62965	-41.12149	RMT @ 32m
17/10/2006 10:11	**26**	-53.64213	-41.14929	RMT @ 43m
17/10/2006 10:40	**26**	-53.65464	-41.17896	recovering RMT
17/10/2006 10:43	**26**	-53.65621	-41.18192	RMT @ Surface
17/10/2006 10:49	**26**	-53.65962	-41.18791	RMT Recovered
17/10/2006 10:58	**27**	-53.66381	-41.1962	Deploying RMT
17/10/2006 11:02	**27**	-53.6658	-41.19996	RMT Deployed
17/10/2006 12:06	**27**	-53.69624	-41.25914	Commence Recovery of RMT
17/10/2006 12:14	**27**	-53.69927	-41.26579	RMT on deck
17/10/2006 12:22	**28**	-53.70205	-41.27225	RMT Deployed
17/10/2006 13:39	**28**	-53.73552	-41.34646	Commence Recovery of RMT
17/10/2006 13:45	**28**	-53.73875	-41.35231	RMT on deck
17/10/2006 15:04		-53.56922	-41.19658	V/L on DP awaiting deployement of whale listening buoy
17/10/2006 15:18	**29**	-53.56921	-41.19653	Whale Listening buoy deployed in 199m
17/10/2006 15:25	**30**	-53.59849	-41.21632	V/L off DP preparing for RMT
17/10/2006 15:28	**30**	-53.57068	-41.19738	Commence deployment of RMT
17/10/2006 15:32	**30**	-53.52185	-41.28156	RMT deployed
17/10/2006 15:36	**30**	-53.57726	-41.20164	Stop veering 80m cable out
17/10/2006 15:48	**30**	-53.58761	-41.2088	Commence recovery of RMT
17/10/2006 15:53	**30**	-53.5921	-41.21197	RMT @ Surface
17/10/2006 15:57	**30**	-53.5954	-41.2144	RMT Recovered
17/10/2006 16:00		-53.59822	-41.21615	Fishing postponed till further notice due to deteriorating sea conditions
17/10/2006 16:10		-53.51094	-41.28652	Decision make to proceed 20Nm NW to next whale buoy location
17/10/2006 19:53	**31**	-53.44581	-41.72734	Vessel stopped on D.P. in 193m water
17/10/2006 20:09	**31**	-53.44578	-41.72723	Whale Listening buoy deployed, ready to deploy whale listening buoy

Cruise track



Appendix 6: Western Core Box Protocol

General description

The Western Core Box (WCB) acoustic survey has been undertaken since 1994 and provides a time series of krill biomass estimation as part of the Long Term Monitoring Series. The WCB is composed of 8 semi-randomly spaced transects orientated in a north-south direction, just north of Bird Island and South Georgia (Figure 1).

General protocols

1) **The preferred direction of survey is from west to east**, against the prevailing currents. In some cases the Captain may ask you if it can be run in the other direction. It can, but this compromises the data as you potentially sample the same water more than once. It does not matter whether you start from the north or the south end of transect 1.1

2) **The WCB lasts for 4 days, once it has started you have to insist not to break off unless there is a really good reason to split it**. The survey is supposed to be synoptic (i.e. a camera snapshot), it seriously compromises the data quality and usefulness if it is broken up.

3) **The acoustic data must be collected within certain instrument settings. The ping interval must be 2 seconds, data must be stored to at least 300 m and the correct setup of the SSU should be undertaken to minimise interference.** This will enable the data collected to be directly comparable with previous years – the whole point of a time series!

For reference, the ping interval is the most important consideration in the WCB acoustics – then minimising interference.

EK60 Operation and settings

The core of EK60 operations is undertaken using the two computers in the UIC, labelled EK60 Main Processor (APC10) and EK60 Workstation (JCR-EK60WS-D1). The EK60 Main Processor runs the EK60 itself and it is important that this computer is not used for anything else. The EK60 Workstation is creating the backup log files and likewise should not be used unnecessarily.

Step 1

Set up the file structure on the drive that the EK60 will be logging to in both the U:\data\EK60 raw data\JR$$$\WCB Transect W1.1 etc. folder and also U:\data\Echolog\JR$$$\WCB Transect W1.1 etc. An example of the file structure to be used (which can be copied across) is given in c:\WCB acoustic survey\example file structure to copy and paste\ on the EK60 workstation

EK60 operation

Switch the EK60 GPTs on using the switch (labelled EK60 remote on/off switch) on the wall to the left of the EK60 Main Processor PC.
Switch on the EK60 by turning on the EK60 Main Processor (unscrew the plate on the front of the blue machine to the bottom left of the EK60 Main Processor monitor).
Run the **ER60** software (icon on desktop), choose last recent settings, and the main ER60 screen (empty) should come up.

Step 2

Check settings of the EK60 and record on excel spreadsheet found on EK60 Workstation

a) Operation – Normal – check the following and when the same as below - ok

You should see the following settings – if not please change to the following settings

Channel	**Mode**	**Pulse duration/Sample interval/Bandwidth**	**Power**	**Depth (m)**
GPT 38 kHz 009072033fa5* 1 ES38	Active	1024us / 256us / 2425Hz	2000 W	0.00
GPT 120 kHz 00907203422d* 1 ES120-7	Active	1024us / 256us / 3026Hz	500 W	0.00
GPT 200 kHz 009072033f91* 1 ES200-7	Active	1024us / 256us / 3088Hz	300 W	0.00

* these are the serial numbers of the installed GPTs – please note these in the excel spreadsheet. If you have to change a GPT please note the time and date of the change in the event log and the new serial number.

On clicking ok 3 windows should appear – although they may not show anything depending on whether the EK60 is actively pinging.

b) Install – environment – check and record the settings - ok

The conditions should be Seawater. Please record the temperature, salinity and sound speed that are being used (you do not need to click any buttons for this – just record) in the excel spreadsheet.

c) Operation – ping control – view/change settings - close

Operation should show only the start or stop option, Set ping mode to interval (2.00) and, for the moment, make sure the incoming and outgoing trigger boxes are empty. The EK60 should now commence displaying data.

****

CHECK THE FORMAT THE RAW DATA AND WHERE IT IS SAVED

****

d) Output – file -

Directory - Use browse to choose the correct folder to log the data to

Raw data - File name prefix should be JR$$$ ($$$ = cruise no.)

Range (m) = 500

File size

Max vessel distance (nmi) = 0

Max file size (Mb) = 25

TICK Save raw data

Processed data – leave un-ticked

The following will show if all is working correctly. See below for picture accompaniment.

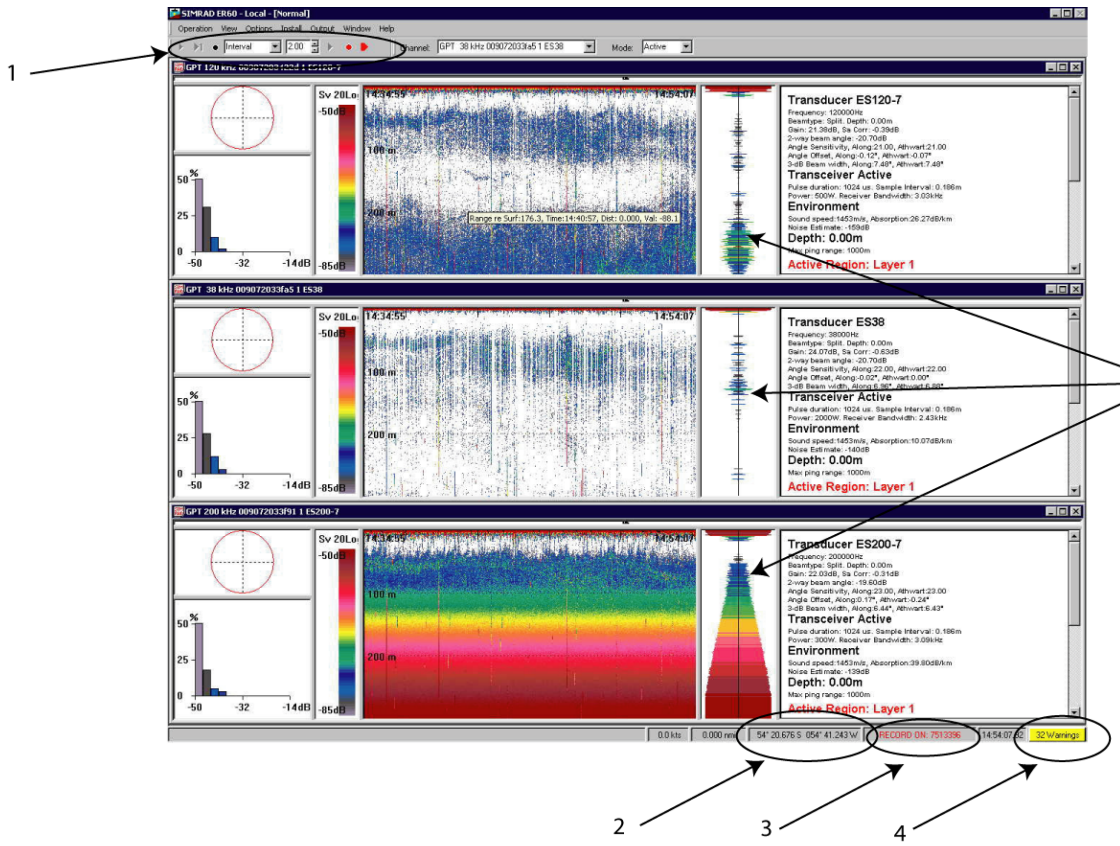
1) Ping control area (on/off) - the dot (stop) should be black, the play and pause should be grey (equals echosounder pinging and on). Interval = 2.00. The red buttons are the record control. The little play button (on the left of the three) is greyed out, the dot (stop) should be red, and the big play button should be red.

2) These are lat/long positions and should be changing as you move! If not there may be a problem with the GPS system and you need to call the IT support person.

3) This is the file name being recorded and should be in red when recording. If not recording it will be in black – this is bad if happening when doing the survey!

4) These are EK60 warnings, such as losing contact with the transducers. Do not be concerned if there are a number of warnings during the whole survey (e.g. 0 – 150), but if tens of warnings occur in a few minutes then rebooting the system might be necessary or there may be a network problem.

5) Single ping display. This panel shows the results from each single ping. It should change every two seconds (since that is the desired ping rate), and is a good indication that the echosounder is working.



Finally record the Gain, Sa correction, 2-way beam angle, Angle sensitivity along and athwart, Angle offset along and athwart, 3-dB beamwidth along and athwart and the absorption coefficient for each frequency in the excel spreadsheet provided.

Echolog setup

Echolog runs on the EK60 Workstation

Start – programs – Sonardata 4 – Echolog 60

Right click on top left corner (Echoview icon) for options (there are no obvious menu options) – go to:

Settings

EK60 survey folder = U:\data\EK60 raw data\JR$$$ i.e. the folder that the ER60 software is saving to.
Folder check interval (ms) = 250
Echodepth broadcast interval (ms) = 500
Live viewing broadcast interval (seconds) = 10
Warn when hard disk has less than (MB) = 50
Warn when hard disk has less than (minutes) = 60
Equipment name = JCR-EK60WS-D1
Warn if no activity (minutes) is un-ticked

Data compression:

Tick enable
Delete original files after compression is **UN-TICKED**
Suspend when hard disk has less than (MB) = 10

Write compressed files to folder = U:\data\Echolog\JR$$$\ i.e. the folder that mirrors where the data is saved in the EK60 raw data folder

Click Compression settings

Compression settings need to be set for each of the three transducers – that is Transducer 1, Transducer 2 and Transducer 3. The following are therefore the compression settings for all frequencies.

1) Tick store power data
   Start range (m) = 0
   End range (m) = 300
   Reduced data resolution:
      Average samples where both Sv below (dB) = -80 and TS below (dB) = 20.
      Average samples below sounder detected bottom + offset is UN-TICKED.
      Maximum number of samples to average = 50.
2) Split beam data is UN-TICKED
      All the boxes should then be greyed out
3) Sounder detected bottom
      Ignore bottom detection if range less than (m) = 10
4) Click OK - Click OK again

If the echosounder is working Echolog should now indicate that a file is being written. The data throughput is displayed in the top-left of the menu bar. It is typically between 16 and 25 KB/s. To check that the ER60 software and the Echolog software are working correctly, file names (that are time stamped) can be viewed in the file manager window.

SSU setup

1) Make sure the EM120 (Swath bathymetry system) is turned OFF

2) Phone bridge and ask them to switch the EA600 to active mode and on external trigger

3) Make sure SSU mode is EM EA&EK TO ADCP

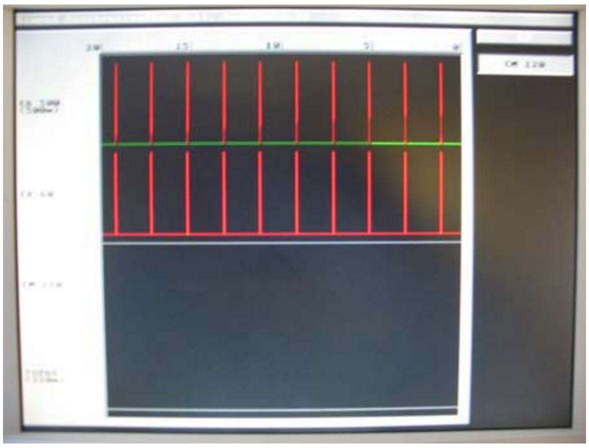
Group	Sub-group	Trigger	Time usage
EM	EM120	OFF	
EA/EK	EA600	ON	TX pulse
EA/EK	EK60	ON	Calculated
TO	Topas	OFF	
AD	ADCP	OFF	

4) Now go to the EK60:

   Click operation – ping control
   Make sure ping rate is 2 seconds
   TICK box for triggering ingoing

It should now read GPT auxiliary port.

The SSU should now look like this:



SSU monitor:

EA (top) + EK (below) must ping at the **same time**

EA + EK must show a **red (active)** signal

EA must show a **green line (waiting)** between pings

Topas must show a **grey line (system off)**

General Guidance

If you have to slow down due to icebergs, fog or weather, no problem, just make a note in the eventlog and carry on (same for a detour, due to an iceberg).

The CTDs during the nights will not take all night. If there is bad weather sit and wait to do the CTD until you have to break off to make sure you arrive in the morning at the start of the next transect.

If the EK60 falls over, close the ER 60 software, switch off the GPTs, reboot the computer (APC10), wait 30 seconds, switch on the GPTs and start the ER60 software again – MAKE SURE IT IS LOGGING AGAIN. Please make a note of this in the event log.

If you are not sure then ring either Peter Enderlein or Sophie Fielding. Their phone numbers are in this document.

Appendix 7: Cruise Report Guidelines

The science part of the cruise will soon be finished and now is the time to start thinking about cruise report and intranet web page. This needs to be finished while on the ship; trying to think about what we did on this cruise once we are back does not bear thinking about.

The aims are a) to show each other where samples/data/experiments were done so that we can cross-reference analysis and b) to show what went wrong and how it could be fixed. It also shows others what we did, but we are the main users so it needs to be useful. It would be great if we can show some results as well, but don't spend lots of time trying to work up data. A few sentences about values being low/high/regional trends is fine. It's a reference document, not flag waving. The scientific value of a cruise is only known 10 years later when its papers/reports start being quoted.

The reports for JR70, JR82, etc outlines the format, (see JCR intranet site under bioscience under other pages).

Please place all the information for JR116 on q:\JR116_Shared\Cruise_Report. Please create a directory with a meaningful name to place your material for the cruise report in. My life will be much easier if the follow formats are used when creating your contribution: WORD, RTF, EXCEL, ACCESS, PDF, HTML plus JPEG images.

To avoid loads of "table 1" etc, please cite tables and figures prefixed by first 4 letters of section name, e.g. "table ceta1"

A suggested format for the report is in the table below. Please modify to suite.

A general format within each section (or in some cases subsections) is:

Introduction
Aim
Method/system specification (main bit)
Data coverage (main bit)

Preliminary results (if any)

Problems encountered (if any)
References (if unavoidable)

Most people did same basic measurements at South Georgia, so no need to split these continually (I will give an overview of the Western Core Box "protocol").

Lift relevant chunks from previous cruise reports to save time.

Nathan Cunningham
9th January 2005

Section	Subsection
Introduction	
Aims	
Cruise overview	
Timetable	
Oceanography	Navigation
	CTD and XBT transects
	ADCP
	Oceanlogger
Moorings	
Optics Rig	AC9
	Hydroscat
	Seabird CTD
Nutrients and Primary Production	Nutrients
	Chlorophyll distribution
	Microplankton sampling
	Primary production
	FRRF
Mesozooplankton	Horiz/vertical distribution
	Copepod condition factor
	Copepod rate processes
	Larval krill
Macroplankton	Larval icefish age structure
	Krill target fishing
	Growth rates of krill
	Krill moult stage analysis
	RMT8 sampling in WCB
Acoustics	Settup/calibration
	Acoustic transects
Cetaceans and seals	Visual observations
	Acoustic observations
Technical	Gear
	ETS support
	ITS support
	Data management
Acknowledgements	
Appendices	