

1 Introduction

Jon Watkins

1.1 Rationale

Jr228 is a combined science and logistics leg of the 2009-10 voyage of the RRS James Clark Ross to the Antarctic. All of the science team had participated in the previous JR230 cruise in and around Marguerite Bay on the west Antarctic Peninsula (see separate JR230 cruise report). As a result mobilization for the cruise had mainly taken place at Rothera as part of the JR230 cruise. As part of the logistics element of JR228, the ship undertook base reliefs at Signy (South Orkney Islands) and at Bird Island and King Edward Point (South Georgia). During the science part of the cruise we undertook the Western Core Box survey to determine the distribution and biomass of krill northwest of South Georgia, and refurbished the 3 biological moorings in the South Georgia region. In addition we undertook an abbreviated acoustic survey on the shelf to the south west of South Georgia and deployed a Continuous Plankton Recorder (CPR) on the long run between Signy and South Georgia. The cruise leg terminated in Stanley.

1.2 Western Core Box Summary

Since 1981 BAS have undertaken cruises to determine krill biomass as part of the ongoing assessment of the status of the marine ecosystem in the region of South Georgia. This unique time series, known as the Western Core Box, is part of the Ecosystems Programme contribution to BAS national capability. It comprises an acoustic grid survey of 8 transects each of 80 km in length, together with associated net and oceanographic sampling and the calibration of acoustic instrumentation.

In addition to the acoustic survey, which covers a wide area but has limited temporal coverage, there are three moorings (one on the shelf in the Western Core Box, and two in deep water to the southwest and northwest of South Georgia) to provide a temporal, year-round set of observations. These moorings are recovered during the cruise, refurbished and data downloaded, and then redeployed later in the cruise. The shallow WCB mooring has been in position more or less continuously since 2003.

1.3 Cruise narrative

(Note all times on ship refer to ship-time which is GMT-3)

Friday 11 December 2009 – afternoon finds us off Sally Cove, Horseshoe Island where we undertake calibration for benthic-pelagic coupling. Some of science team get chance to go ashore to see the old BAS base (station Y).

Saturday 12 December 2009 – a busy day working cargo at Rothera, everything completed by dinner and we leave Rothera just before 19:00 and head towards The Gullet, the narrow passage between Adelaide Island and mainland. Views from Monkey Island spectacular as we pass through a growler-strewn channel. This is only the second time in 12 years that the Mate has been through this passage. The low sun, ice and mountains make for very atmospheric photographs.

Sunday 13 December 2009 – low visibility, big swell and snow for much of day. We steam outside of Lemaire and Neumayer and see very little of Bransfield Strait.

Monday 14 December 2009 – afternoon RMT reconfigured so that it is just an RMT8 rather than an RMT8+1. Still some snow on deck so possible to have a snowball fight and make a snowman. By late afternoon, we arrive off Cummings Cove, Signy to check if possible to input a generator. Strong breeze and cold viewing from on Monkey Island. Once around at Borge Bay, after an early dinner (18:00), two humbers and cargo tender used to transfer Mike Dunn, Andy Webb and Gerry Hattingh ashore and pick up Jessica Royles, Bruce Maltman and William Purvis. All the science team get the opportunity to put their feet on dry land for literally a few minutes.

Tuesday 15 December 2009 – finally clear of the bands of sea-ice north of Signy by 01:00 and CPR launched. Now on route to pick up Southern mooring. After breakfast, Science team met to discuss order and timing of events over remaining cruise time. After lunch, went through cruise timings with Captain. Seawater nontoxic supply has been switched off because bolt corroded where pump attached, hoping that can be fixed at KEP. Christmas decorations gone up in saloon and lounge.

Wednesday 16 December 2009 – on route to pick up Southern mooring (P3 site). Early morning finds us towing the CPR over a gentle beam swell. As we get closer to the mooring site the visibility starts to drop and by the time we arrive, at 08:00 it is down to a couple of 100 m. After some discussion we decide to go ahead and recover mooring, which in spite of the mist we sight without too much problem. Retrieving the large buoy, sediment trap and release gear goes according to plan and everything is on board by 11:00. We carry out a CTD to 1000 m and then a series of bongo and N70 nets at the P3 site before heading off towards South Georgia and a quick call at Bird Island.

Thursday 17 December 2009 - Bird Island call takes place at 04:00 and we then proceed down the north side of South Georgia with low cloud preventing us from seeing anything above 100 m. We arrive off Cumberland Bay at 10:30 and the clouds have lifted and we are presented with stunning views of the fjords and mountain peaks peaking through the clouds. We tie up at the jetty at KEP and after a quick lunch scientists disappear off for various walks in brilliant sunshine. With every one suitably refreshed after time ashore we depart at 18:30 with the addition of Iain Staniland and Tom Walker who we will drop off at King Haakon Bay tomorrow.

Friday 18 December 2009 – at first light we are approaching King Haakon Bay. Sun, clouds and mountain vistas reward the early photographers once again. The ship feels its way into the bay slowly while the beaches are scanned for suitable fur seal colonies. Having navigated to the head of the bay but found little sign of breeding female seals we return to Cheapman Bay and send a party ashore to assess the area. Insufficient females for a scientific study forces us to adopt plan B and we head around to Wilson Harbour. Here in a steady rain and low cloud the field party is established and we finally depart at 17:50 to head up to recover the northern mooring.

Saturday 19 December 2009 – at 07:30 we are on station ready to recover the northern mooring. Although the weather is due to deteriorate later in the day we decide to go ahead with the retrieval. The retrieval is made more difficult as the wind increases and we are faced with 40 knot gusts and a building swell coming over the stern quarter. By the time we get to the sediment trap the mooring line is almost horizontal as the Captain uses all his skill to keep the ship as stationary as possible in the confused sea conditions. By midday the releases are finally on board and everything is being

lashed down. A successful retrieval in trying conditions due to the sterling efforts and skills of both the deck team (crew and scientists) and the Captain. Conditions deteriorate further for the afternoon and the ship heaves-to awaiting an improvement in conditions. By 21:00 we return to the mooring site and start to plan for a CTD. The CTD is in the water by 21:30 and is then followed a bongo series for Pete W.

Sunday 20 December 2009 – at 05:00 we start the first pair of acoustic transects for the Western Core Box survey. The transects run smoothly and are completed by 15:00. We then head towards the first CTD station while looking for targets to fish. An RMT8 haul on targets is undertaken before we move into the station sampling sequence of CTD, bongo sequence, RMT at station 1.2N followed by RMT and CTD at 1.2S.

Monday 21 December 2009 – second day of the core box survey again started at 05:00. After finishing the acoustic transects we search for targets but not finding anything suitable we start the first station (2.2S) CTD followed by bongos and station RMT.

Tuesday 22 December 2009 - After the RMT and CTD at station 2.2N we arrive at the start of the third acoustic transect pair early. Core box transects 3.1 and 3.2 completed according to schedule we move straight into station based work through the night.

Wednesday 23 December 2009 – the day starts with the final CTD of the WCB, just a quick dip as the water depth is only 120 m. Having seen a variety of tempting acoustic targets during the CTD and bongos we look for targets to fish prior to starting the final day of the WCB acoustic transects. After dawn we find a couple of small targets and try our luck with the RMT. The second net successfully catches a few kgs of small krill. The final transects are started 15 min early. Ten hours later we finish the acoustics and head northwest to recover the WCB shallow mooring. With sea mist periodically reducing visibility to less than 100 m, we send the release codes but eventually realize that the range to the releases is not changing. We confirm the position of the rig by acoustic triangulation and then steam over the mooring. Detecting the complete mooring string at its deployed depth on the ek60 shows that we have not been able to release the mooring despite repeated signals to both release units. We have no other option but to try and dredge up the rig. Using the coring wire with weights attached we manoeuvre the ship so that two circles of wire are laid around the mooring. We then move away and start hauling. A little later the mooring pops to the surface. We recover the equipment to find that the Kevlar rope had parted between the acoustic releases and the trimsin buoys. While it is unfortunate to have lost the two releases we are exceedingly relieved to have recovered the main mooring buoy complete with all instrumentation and data. So what was originally planned as a quick recovery ends up taking just under 5 hours – such is science at sea! By 21:00L we are heading off towards P3 to deploy the northern mooring, hoping that the weather will remain reasonable for long enough to deploy the 3,800 m deep mooring.

Thursday 24 December 2009 – early morning (06:30L) finds the mooring crew already to go for the deployment of the Northern Mooring at station P3. Sea relatively flat with 20-25 knots of wind, fog and intermittent drizzle. The lengthy deployment was enlivened by a clap of thunder and the appearance of 3 humpback whales that swam around the ship for at least half an hour. By 10:00L the mooring has been deployed and the new position ($52^{\circ} 43.4668'S$ $40^{\circ} 09.5185'W$) determined by triangulation using the mooring release pinger to indicate distance between the ship and the

mooring. A CTD to 1000 m rounds off the activities at this station and we then head for our acoustic calibration site in Stromness.

Friday 25 December 2009 - we arrive at our Stromness anchorage by 01:00. The CTD for determining the environmental constants for the calibration is underway by 06:00 but by the time we have the lines rigged for the first sphere the wind is blowing strongly. The ship yaws constantly in the strengthening wind even with the use of DP. We abandon any attempts to calibrate shortly after breakfast. For the rest of our Christmas Day we enjoy our enforced rest as the winds gust up to 88 knots in the afternoon. While the science party are able to relax, the Captain and Mate have to use engines and thrusters constantly through the day to maintain our position. During the day both anchors had dragged over 200 m.

Saturday 26 December 2009 - the calibration team started preparations at 04:00 to take advantage of the calm morning. By 05:10 the 38 kHz calibration was underway and proceeded quickly and so effectively that all three frequencies had been calibrated by 07:50. A quick test of the spare mooring release gear took place using the CTD prior to recovering the anchors. This turned out to be a marathon undertaking as both anchors were twisted together and fouled with old discarded cables. Nearly 6 hours work was required to clear both anchors and we finally left Stromness at 15:00 in the afternoon. Six hours later we are at the WCB shallow mooring site and getting ready to deploy the refurbished buoy. The total deployment takes under an hour and is followed by a CTD just off the mooring. With heavy fog we leave at 22:30 to steam around to the south of the island to start the hotspot transects.

Sunday 27 December 2009 – with wind expected to increase through the day we investigate the best transect orientation prior to starting the first transect at 04:00. Best quality of acoustic data occurs with the original 209° - 019° transect direction. First transect proceeds according to plan although problems with the XBT launcher prevent collection of XBT data at the start of the run. On the return transect, heading into the building sea, data quality are extremely poor and we are only able to make 5-6 knots. We effectively abandon this transect at 11:00 and just continue steaming so that we will be able to collect some more reasonable data on the next downwind transect. The weather deteriorates more and even running with the swell the data quality is such that the 38 kHz is not receiving any returns and the 120 kHz is severely compromised. At 16:00 we decide that continuing the transect is pointless and we assume a course to get us to the deep mooring site for around midday tomorrow.

Monday 28 December 2009 – by midday we are at the mooring site and the swell and wind have dropped as predicted. Preparations commence after lunch to deploy the final mooring. A text book mooring deployment is followed by triangulation of the mooring position. The final CTD is completed by just after 17:00 and then the CPR is deployed as we head for Stanley which is 640 miles away.

Tuesday 29 December 2009 – ship on passage to Stanley, the sea is flat and we are steaming at over 14 knots which puts our arrival in Stanley at around 15:00 on 30 December. Science team busy packing and report writing.

1.5 Cruise personnel

Table 1. JR228 Scientific Personnel

| JR228 Scientific Personnel | | |
|-----------------------------------|-------------|----------------------------|
| Jon Watkins | BAS | PSO, Acoustics |
| Vsevolod Afanasyev | BAS | AME |
| Peter Enderlein | BAS | Equipment Engineer |
| Natalie Ensor | BAS | Gear and Equipment |
| Sophie Fielding | BAS | Acoustics |
| Maria Luisa Avila Jimenez | UNIS | Microbiology |
| Rebecca Korb | BAS | Phytoplankton |
| Jeremy Robst | BAS | ITS |
| Gabi Stowasser | BAS | Macro-zooplankton and fish |
| Peter Ward | BAS | Meso-zooplankton |
| Signy staff input | | |
| Mike Dunn | BAS | Predator biologist |
| Gerhard Hattingh | BAS | Electrician |
| Andrew Webb | BAS | Facilities Engineer |
| Signy staff homeward bound | | |
| Bruce Maltman | BAS | Field Assistant |
| William Purvis | NHM, London | Lichen Physiology |
| Jessica Royles | BAS | Biogeochemistry |
| King Haakon field party | | |
| Thomas Marshall | BAS | KEP BC |
| Iain Staniland | BAS | Seal Ecologist |

Table 2. JR228 Officers and Crew

| JCR Officers and Crew | | | |
|------------------------------|-------------------------|------------------|--------------------------|
| Graham Chapman | Master | Derek Forward | Chief Engineer |
| Robert Patterson | Chief Officer | Glynn Collard | 2 nd Engineer |
| Krishnakant Dalvi | 2 nd Officer | James Ditchfield | 3 rd Engineer |
| Benjamin du Feu | 3 rd Officer | Steven Eadie | 4 th Engineer |
| Charles Waddicor | ETO Comms | Nicholas Dunbar | ETO |
| John Summers | Deck Officer | Simon Wright | Deck Engineer |
| George Stewart | Bosun | Gareth Wale | Deck Engineer |
| Derek Jenkins | Bosun's Mate | Carl Moore | MG1 |
| Andrew Campbell | SG1 | Mark Robinshaw | MG1 |
| Colin Leggett | SG1 | Glen Ballard | 2 nd Cook |
| James McIlhatton | SG1 | Keith Weston | Senior Steward |
| Clifford Mullaney | SG1 | Derek Lee | Steward |
| James Gibson | Purser | Colin Motte | Steward |
| Keith Walker | Chief Cook | James Newell | Steward |
| Joanna Gregory | Doctor | Jake Boswell | Cadet |

1.6 Acknowledgements

This cruise is part of a long term commitment to investigate the ecology of the Scotia Sea ecosystem and understand the variability and change occurring in the region by the scientists in the Discovery 2010 Programme and the new Ecosystems Programme. The cruise was undertaken by a small team of scientists and support staff who carried out their own work and also all the general cruise tasks with great enthusiasm and dedication. As always a successful science cruise is dependent on the full involvement of the ship's officers and crew, and we are grateful to all of them for ensuring that the cruise was both successful and enjoyable.

2 Physical Oceanography

Sophie Fielding

2.1 Underway Oceanlogger and Meteorological Data

2.1.1 Instrumentation and Data Collection

Surface ocean and meteorological data were logged continuously throughout the cruise. Ocean data were collected from the ship's uncontaminated seawater supply, whilst the meteorological data were measured by instruments on the forward mast. Both surface ocean and meteorological data were collected at 5 second intervals. Instruments were as follows:

2.1.1.1 Oceanlogger

SeaBird Electronics SBE45 CTD

Turner Designs 10-AU Fluorometer

2.1.1.2 Meteorological Data

Photosynthetically Active Radiation (PAR) 1, Parlite Quantum Sensor, Kipp & Zonen

Photosynthetically Active Radiation (PAR) 2, Parlite Quantum Sensor, Kipp & Zonen

Solar Radiation 1, Proto1 SPLite, Kipp & Zonen

Solar Radiation 2, Proto1 SPLite, Kipp & Zonen

Air temperature/humidity 1, Chilled Mirror Hygrometer MBW, PM-20251/1, Temperature Sensor Pt100, PM-20252/1

Anemometer (this logs wind speed relative to the ship. At this time there is no datastream for true wind, but this can be calculated from relative wind and navigational data, if required).

2.1.2 Processing

Initial processing was carried out in Unix, which generated files that could be further processed in Matlab.

Unix

get_underway Calls the scripts *get_oceanlog*, *get_anemom* and *get_truwind*, which invoke the *listit* command to retrieve 24 hours of underway data. Output files are *oceanlog.NNN*, *anemom.NNN* and *truwind.NNN*, where NNN is the jday.

Matlab

loadunderway Calls functions *loadoceanlog* and *loadanemom* to read *oceanlog.NNN* and *anemom.NNN*. Data are stored in structure arrays and saved as *oceanlogNNN.mat* and *anemomNNN.mat*. The program then calls the

function *cleanoceanlog*, which sets unrealistic values to NaNs, uses *dspike* to remove large spikes in conductivity, housing (CTD) temperature and remote (hull) temperature. Linear interpolation is used to fill data gaps. Data from periods of flow >1.5 l/min or <0.4 l/min are also set to NaNs, as are data from 5 minutes after a drop in flow to allow variables to return to normal. Surface ocean data are further cleaned using an interactive editor, which allows manual removal of spikes and flier points. Salinity is then calculated using *ds_salt* and the interactive editor is used to remove spikes and flier points. The output is *oceanlogNNNclean.mat*.

plot_oceanlog_daily Loads *oceanlogNNNclean.mat* and *seatexNNN.mat*, calculates 1 minute averages and plots maps of sea surface temperature, salinity and fluorescence. Bathymetry data from GEBCO are included in the plots. Output files are *oceanlog_navNNN.mat* and *oceanlog_navNNN_1minave.mat*.

plot_oceanlog_all Loads *oceanlog_navNNN_1minave.mat* for all jdays and plots sea surface temperature, salinity and fluorescence for the entire cruise track. Bathymetry data from GEBCO are included in the plots.

2.2 Underway Navigational Data

2.2.1 Instrumentation and data collection

Navigational data were collected continuously throughout the cruise. Instrumentation was as follows:

Ashtec ADU2 GPS: antenna 1 used to determine the ship's position; antennae 2-4 used to determine pitch, roll and yaw.

Ashtec GLONASS GG24 (accurate to ≈15m)

Sperry Mk 37 Model D Gyrocompass

Seatex GPS (Seapath 200)

GPS NMEA

Navigational data were collected every second, whilst the bathymetric data were logged every 10 seconds.

2.2.2 Processing

Navigational data were processed in Unix and Matlab using modified versions of programs developed by Mike Meredith. Data were initially read into the Unix system, then transferred to Matlab, where the bulk of the processing was carried out.

Unix

get_nav Calls the scripts *get_gyro*, *get_bestnav*, *get_gpsash*, *get_gpsglos*, *get_gpsnmea*, *get_seatex* and *get_tsshrrp*, which invoke the *listit* command to retrieve 24 hours of gyrocompass, bestnav, Ashtec (ADU2), Ashtec Glonass (GG24), GPS NMEA, Seatex and tsshrrp (heave, pitch and roll) data. Data are saved in subdirectories 'gyro', 'bestnav', 'gpsash', 'gpsglos', 'gpsnmea', 'seatex', and 'tsshrrp' as *gyro.NNN*, *bestnav.NNN*, *gpsash.NNN*, *gpsglos.NNN*, *gpsnmea.NNN*, *seatex.NNN* and *tsshrrp.NNN*, where NNN is the jday.

Matlab

load_daily.m Reads in navigation files output by the Unix processing (above) by calling the following functions:

- *load_daily_bestnav*: reads in text file *bestnav.NNN* and writes data to a Matlab structure array. Data are flagged, such that any variable with flag $\neq 50$ are poor, and thus discarded. Output is *bestnav/bestnavNNN.mat*.
- *load_daily_gpsash*: reads in text file *gpsash.NNN* and writes data to Matlab structure array. Data are flagged, such that any variable with flag $\neq 50$ are poor, and thus discarded. Output is *gpsash/gpsashNNN.mat*.
- *load_daily_gpsglos*: reads in text file *gpsglos.NNN* and writes data to Matlab structure array. Data are flagged, such that any variable with flag $\neq 50$ are poor, and thus discarded. Output is *gpsglos/gpsglosNNN.mat*.
- *load_daily_gpsnmea*: reads in text file *gpsnmea.NNN* and writes data to Matlab structure array. Data are flagged, such that any variable with flag $\neq 50$ are poor, and thus discarded. Output is *gpsnmea/gpsnmeaNNN.mat*.
- *load_daily_gyro*: reads in text file *gyro.NNN* and writes data to Matlab structure array. Data are flagged, such that any variable with flag $\neq 50$ are poor, and thus discarded. Output is *gyro/gyroNNN.mat*.
- *load_daily_seatex*: reads in text file *seatex.NNN* and writes data to Matlab structure array. Data are flagged, such that any variable with flag $\neq 50$ are poor, and thus discarded. Output is *seatex/seatexNNN.mat*.
- *load_daily_tsshrrp*: reads in text file *tsshrrp.NNN* and writes data to Matlab structure array. Data are flagged, such that any variable with flag $\neq 50$ are poor, and thus discarded. Output is *tsshrrp/tsshrrpNNN.mat*.

For a quick visual check, the program then plots bestnav, gpsash, gpsglos, gpsnmea and seatex data over one another (after plotting each dataset the user must hit return to continue), gyrocompass heading, and pitch and roll.

plot_seatex_all Plots entire cruise track. Loads *seatexNNN.mat* for all jdays and GEBCO bathymetry data.

2.3 Problems Encountered

TSHRP was not recording for the duration of the cruise.

3 Acoustics

3.1 Introduction

JR228 ran from Rothera to Stanley, including the Western Core Box routine annual survey as well as 3 transects for “hotspots” and the recovery and deployment of 3 moorings. The EK60 was run pretty much continuously throughout except for periods of mooring recovery. The overall aims of the acoustic work were to

- (i) collect acoustic data to accompany all transects, acoustic surveys, and net tows.
- (ii) backup and post process the acoustic data

3.2 Western Core Box survey

The Western Core Box (WCB) survey was conducted between 20th and 23rd of December 2009. The acoustic survey was run from west to east starting at the northern end of Transect 1.1 at 08:00 GMT on the 20th. Transect times are given in Table 3. The weather was reasonable throughout the whole survey, the XBTs worked each time and 2 CTDs and some RMT8 stratified and target hauls were undertaken each night. Data quality was good, particularly because the ship’s Doppler logger was switched off.

Table 3. Transect start and end times for JR228 Western Core Box Survey

| Transect | Date | Start Time | End Time |
|----------|------------|------------|----------|
| 1.1 | 20/12/2009 | 08:00 | 12:37 |
| 1.2 | 20/12/2009 | 13:42 | 17:59 |
| 2.1 | 21/12/2009 | 07:58 | 12:38 |
| 2.2 | 21/12/2009 | 13:45 | 18:02 |
| 3.1 | 22/12/2009 | 07:46 | 12:17 |
| 3.2 | 22/12/2009 | 13:21 | 17:47 |
| 4.1 | 23/12/2009 | 07:40 | 12:13 |
| 4.2 | 23/12/2009 | 12:59 | 17:38 |

3.3 Hotspots survey

Three transects (S2.2, S2.1, S1.2) were undertaken to the South west of South Georgia to investigate the distribution of prey available to tagged fur seals from Wilson harbour. These transects were attempted on the 27th December in increasingly heavy seas. As a result of poor data quality only the first transect (S2.2) was run for its entire length (50 nm), transect S2.1 was shortened due to poor headway and transect S1.2 was eventually abandoned after 1 hour due to very poor data quality. Transect times are given in Table 4. The original plan was to deploy XBTs at the start and end of each

transect, however the XBT gun appeared to malfunction and XBTs were collecting data despite not having been deployed. Only one XBT (event 204) was eventually undertaken during the survey.

Table 4. Transect start and end times for JR228 Hotspots Survey

| Transect | Date | Start Time | End Time |
|----------|------------|------------|----------|
| 2.2 | 27/12/2009 | 07:28 | 12:45 |
| 2.1 | 27/12/2009 | 14:00 | 18:17 |
| 1.2 | 27/12/2009 | 19:05 | 20:13 |

3.4 Methods/System Specification

3.4.1 Software versions

Simrad ER60 v. 2.0,10.07.2003

Sonardata Echolog 60 v 4.10.1.6230

Sonardata Echoview v 4.20.59.8698 Live viewing

Sonardata Echoview v 4.280.43.15788 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. 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. All raw data were collected to 700 m. Echolog was run on workstation 2 and wrote compressed files also directly to the Sun workstation via a Samba connection.

3.4.2 Echolog compression settings

Final compression settings used in Echolog for all frequencies were:

- (i) Power data only (angle data is still available from the raw files)
- (ii) From 0 - 500 m (38 kHz), 0 – 500 (120 kHz) and 0 – 500 (200 kHz) data only (data from greater depths are available from the raw files)
- (iii) Average samples where both Sv below –100 dB and TS below –20 dB
- (iv) Maximum number of samples to average: 50

DO NOT use average samples below echosounder detected bottom unless sure of bottom detection

3.4.3 File locations

All raw data were saved in a general folder JR230, all echolog data were saved in the folder JR230\ek60 files. All files were prefixed with JR228. Calibration data were saved to the calibration folder.

3.4.4 EK60 (ER60) settings

Table 5. Settings used for EK60 during cruise JR228

| Variable | 38 kHz | 120 kHz | 200 kHz |
|---------------------------|---------------|--------------|--------------|
| Ping interval (per sec) | 2.25 | 2.25 | 2.25 |
| Salinity (PSU) | 33 | 33 | 33 |
| Temperature (°C) | 1 | 1 | 1 |
| Sound velocity (m/s) | 1446 | 1446 | 1446 |
| 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) | 9.97 | 26.08 | 39.60 |
| 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 (26.00) | 21.38 | 22.03 |
| Sa correction (dB) | -0.63 (-0.52) | -0.39 | -0.31 |
| Angle sensitivity along | 22 | 21 | 23 |
| Angle sensitivity athwart | 22 | 21 | 23 |
| 3 dB Beam along | 7.03 | 7.48 | 6.44 |
| 3 dB Beam athwart | 7.00 | 7.48 | 6.43 |
| Along offset | -0.06 | -0.12 | 0.17 |
| Athwart offset | -0.06 | -0.07 | -0.24 |

The EK60 was calibrated at Horseshore Island (Marguerite Bay) on 9 December 2009 and then at Stromness just after the WCB survey. Prior to the Stromness calibration the EK60 was run with settings post JR230 as in Table 5. After the Stromness calibration the transducer gain for the 38 kHz transducer was updated and the hotspots transects were run with the new settings. However, due to a software crash during the calibration the environment settings were not updated as previously thought. The changed 38 kHz settings are in brackets in Table 5. At the end of the cruise the environment settings were updated to 2°C and 33 PSU with a sound speed of 1458 m/s to leave the EK60 ready for next year.

The EK60 was controlled through the SSU, under a group **EK60 and ADCP**, the swath system was in a different group **EM120 and EA600**. The EK60 was the master, with a ping rate set to 2.25 seconds. The ADCP was run in water column mode (as a slave with an external trigger). Within this setup the ADCP only pings every other trigger, therefore its resolution is slightly reduced at 1 ping every 4 seconds. From Rothera to South Georgia and from South Georgia to Stanley, on the long transects the EK60 was run on internal trigger – allowing the swath system to get the highest resolution.

3.4.5 SSU settings

EM120 external trigger Fixed time (750ms)

EA600 external trigger Tx pulse

EK60 external trigger Fixed time (2000ms) (Set to 2 seconds in ER60 software)

ADCP external trigger Tx pulse (this setting only works if the bottom tracking mode is off)

3.5 EK60 Calibration

Stromness Bay. 08:58 (GMT) 25/12/2009 and recommenced at 08:06 (GMT) 26/12/2009.

An acoustic calibration was attempted in Stromness Bay, South Georgia, on 25/12/2009. Winches were deployed and the 38 kHz ball swung under the ship. As winds increased to gusts of 80 knots it was apparent that the calibration was not possible in such conditions. Later that day the ship went to two anchors and still slipped.

A complete acoustic calibration was undertaken in Stromness Bay, South Georgia, on 26/12/2009. The ship was anchored (2 anchors), its movement balanced by minimal DP usage. The EK60 was synchronised with the EA600 (a bridge requirement) and set to a 1 second ping rate. All other acoustic instruments (including the Doppler logger) were switched off. Each transducer was calibrated in turn, although all transducers were operating at the time. Standard ER60 calibration procedures were used as documented for previous cruises (the relevant copper sphere was moved through all quadrants of each transducer). In addition the sphere was held on-axis for extra periods of time to enable calibration variables to be determined in Echoview.

A CTD (event 200) was undertaken on the 25/12/2009 immediately prior to the first attempt. Temperature and salinity were averaged from 5 (depth of the transducers) to 30 m (depth of the calibration sphere) and were 2.325°C and 33.7145 PSU resulting in a speed of sound constant of 1458 m/s (Francois and Garrison, 1982). These values were used to update the environmental

constants on the EK60, although due to a crash this only occurred during the 38 kHz calibration. The 120 and 200 kHz calibrations were undertaken at the JR230 settings, the 200 kHz transducer parameters were also updated.

Parameters following two different procedures for calibrating are given in Table 6 and Table 7.

Table 6. Echoview calibration

| Parameter | 38 kHz | 120 kHz | 200 kHz |
|---------------------|---------------|----------------|----------------|
| Alpha (dB/km) | 10.40 | 24.85 | 38.70 |
| Theoretical TS (dB) | -33.70 | -40.45 | -44.85 |
| TS gain | 25.89 | 21.82 | 23.88 |
| Sa correction | 0.20 | 0.03 | 0.07 |

Table 7. Calibration

| Variable | 38 kHz | 120 kHz | 200kHz |
|--------------------------------|------------------|------------------|------------------|
| Date | 26/12/2009 | 26/12/2009 | 26/12/2009 |
| Location | Stromness Bay | Stromness Bay | Stromness Bay |
| Time (GMT) | 08:04 | 09:05 | 09:53 |
| Transducer serial no | 23080 | | 24574 |
| GPT serial no | 009072033fa5 | 00907203422d | 9072033191 |
| Comments | EA600 synched in | EA600 synched in | EA600 synched in |
| Water temperature (°C) | 2.325 | 2.325 | 2.325 |
| Salinity (PSU) | 33.7145 | 33.7145 | 33.7145 |
| Sound velocity (m/s) | 1458 | 1446 | 1446 |
| Absorption coefficient (dB/km) | 10.40 | 24.85 | 38.70 |
| Ping rate | 1 | 1 | 1 |
| Transmit power | 2000 | 500 | 300 |
| Sample interval | 0.186 | 0.186 | 0.186 |

| | | | |
|--------------------------|--------|--------|--------|
| Original gain | 24.07 | 21.38 | 22.03 |
| Original Sa correction | -0.63 | -0.39 | -0.31 |
| Theoretical TS of sphere | -33.70 | -40.45 | -44.85 |
| TS deviation allowed | 6 | 6 | 6 |
| Depth of target | 26.0 | 25.6 | 26.5 |
| Min distance layer | 24 | 24.5 | 25 |
| Max distance layer | 28 | 29 | 28.5 |
| New TS gain | 26.0 | 21.7 | 23.95 |
| New Sa correction | -0.52 | -0.44 | -0.26 |
| Athw Beam angle | 7.00 | 7.56 | 6.55 |
| Along Beam angle | 7.03 | 7.61 | 6.55 |
| Athw offset angle | -0.06 | -0.06 | -0.11 |
| Along offset angle | -0.06 | -0.10 | 0.14 |
| Calibration applied | Yes | No | Yes |

The calibration values for the 120 and 200 kHz are relatively consistent with previous calibrations. The TS gain for the 38 kHz is significantly different from the calibrations in previous years. A 2 dB change in TS gain is the greatest variation since the transducers were installed. Note, however, that this Stromness value is very similar to a calibration performed at Horseshoe Island, near Rothera, on 9 December 2009. Conversation with ship and AME engineers identified that the 38 kHz transducer protective cover (and oil filling) on the hull had been replaced during the last refit (due to a crack). This is considered to be the likely cause of the large change in TS gain.

3.6 Data processing in echoview

Post-processing was undertaken in Echoview. A template EV file was set up. The following virtual variables were created, where Freq represents both 38 and 120 kHz data (Table 8).

Table 8. Echoview virtual variables created for acoustic data processing

| Variable name | Operator | Operand1 | Operand2 |
|------------------------|-------------------------------|---------------------------|---------------------|
| Freq resampled even | Resample by number of pings | Fileset1: Sv raw pings T? | |
| Freq bad data | Region bitmap | Freq resampled even | |
| Freq surface bottom | Line bitmap | Freq resampled even | |
| Freq all bad | And | Freq bad data | Freq surface bottom |
| Freq bad masked | Mask | Freq resampled even | Freq all bad |
| Freq resample 1ping | Resample by number of pings | Freq bad masked | |
| Freq resample original | Resample by number of pings | Freq resample 1ping | |
| Freq dropout range | Data range bitmap | Freq resample original | |
| Freq no dropout | Mask | Freq bad masked | Freq dropout range |
| Freq noise | Data generator | Freq no dropout | |
| Freq-noise | Linear minus | Freq no dropout | Freq noise |
| Freq convolute | 3x3 convolution | Freq-noise | |
| Freq spike detect | Minus | Freq-noise | Freq convolute |
| Freq spike mask | Data range bitmap | Freq spike detect | |
| Freq-noise-spike | Mask | Freq-noise | Freq spike mask |
| Freq-500m | Resample by distance interval | Freq-noise-spike | |

3.7 Problems encountered

The EK60 crashed on several occasions, typically associated with the order in which it had been synchronised with the SSU (set SSU to trigger on then set trigger on EK60) and once during the calibration for no obvious reason. On the whole the system was stable, the only issue was the ping rate attainable through the SSU. The EK60 could not ping at a 2 second ping rate and collect data to 700m – surprising since previous cruises have been able to do this. First assumption is that the sound speed constant affected this. This has now been updated to 1458 m/s.

4 Mooring cruise report JR 228

Peter Enderlein, Natalie Ensor & Sophie Fielding

4.1 Deep water sediment trap moorings:

During JR228 both deep sediment trap moorings were successfully recovered and redeployed. After the recovery, both moorings were refurbished and redeployed. Both moorings were deployed buoy first as was done on the previous cruise. Due to deploying the moorings buoy first there is the difficulty with the pendulum effect of the mooring. This means that the exact position of the mooring rig is difficult to determine, therefore a triangulation was done after each deployment to determine the position of the moorings.

4.1.1 3200m sediment trap mooring @ P2

The 3200m mooring was recovered on the **16.12.09** @ 11:52 GMT and sighted @ 12:01GMT in marginal conditions. It was foggy and the wind was gusting 30-40 kn. During the recovery the wind picked up further and it was gusting with over 40kn with strong currents and high waves. The vessel had to steam at 4 kn to keep steering possible and was pitching quite heavily in the swell. The mooring was successfully recovered @14:01 GMT. It was redeployed on **28.12.09**, the buoy entered the water @ 16:30 GMT and the main weight was cut @ 18:02 GMT in 3130m of water at 55.20635S and 41.13360W. To release the main weights a sacrificial rope was used.

Because of the pendulum effect having deployed the mooring buoy first, the mooring was pinged after the deployment to determine its position by triangulation. The ship moved from its position approx. ½ nm first W and then again ½ nm NE and then again ½ nm NW. The positions, water depth, acoustic distance and the calculated radius are shown in Table 9.

Table 9. Triangulation data for position of P2 mooring

| Position | Time | Triangulation | | Latitude | Longitude |
|----------|-------|---------------|------|----------|-----------|
| P1 | 18:15 | Depth | 3130 | 55.20630 | 41.13400 |
| | | Ping distance | 3089 | | |
| | | Radius | | | |
| P2 (W) | 18:39 | Depth | 3121 | 55.20695 | 41.14731 |
| | | Ping distance | 3274 | | |
| | | Radius | | | |
| P3 (NE) | 19:03 | Depth | 3107 | 55.20062 | 41.12158 |
| | | Radius | 3183 | | |
| | | Ping distance | | | |

| | | | | | |
|---------|-------|---------------|------|----------|----------|
| P4 (NW) | 19:18 | Depth | 3150 | 55.19681 | 41.13295 |
| | | Ping distance | 3253 | | |
| | | Radius | | | |

This gave the following triangulation, with a relative position of **55° 12.3023 S and 41° 07.7919 W** where we believe the 3200m mooring is sitting:

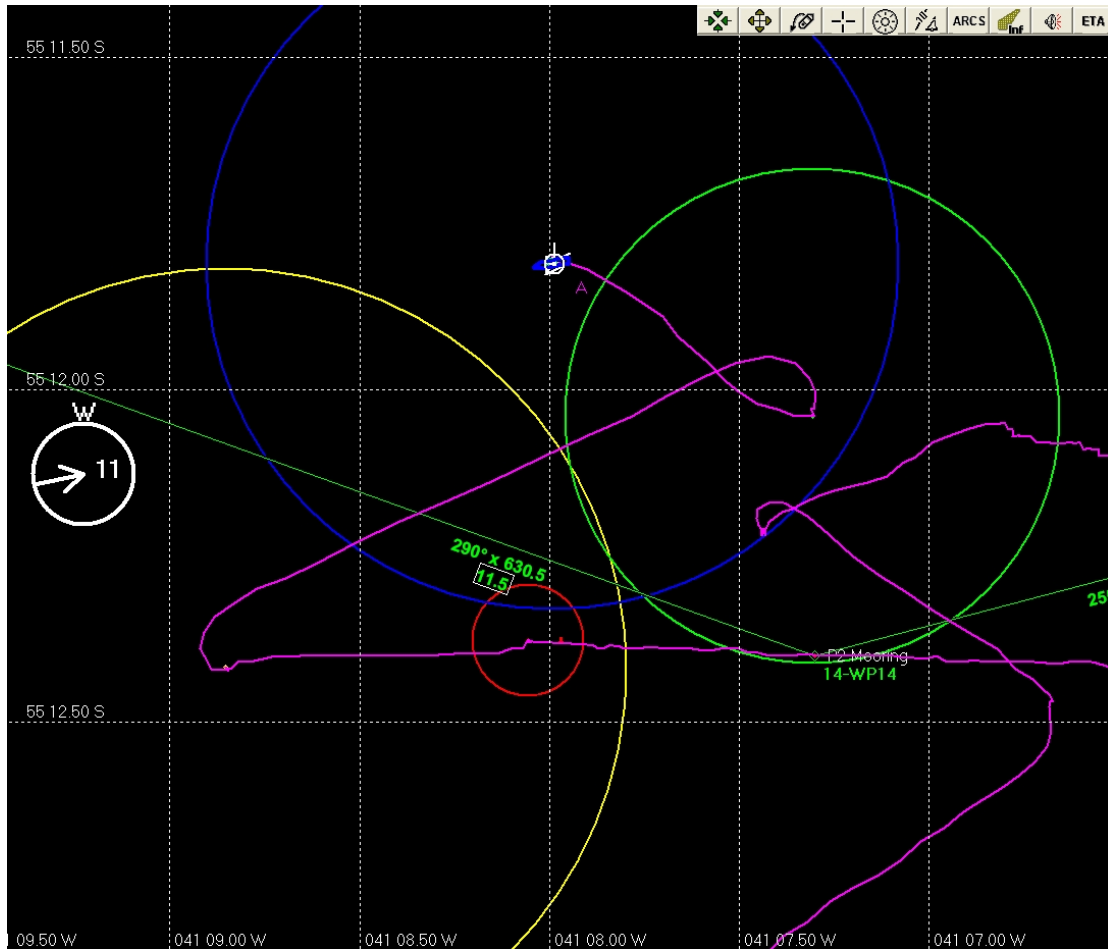


Figure 3. Calculated P2 mooring position on JCR microplot with cruise track in purple

4.1.2 3700m sediment trap mooring @ P3

The 3700 mooring was recovered on the **19.12.09** @ 12:21 GMT, with the buoy sighted @ 12:22 GMT. The recovery was completed at 14:53 GMT. The mooring was redeployed on **24.12.09** @ 09:43 GMT with the buoy first again. After the deployment of all the equipment the weight was finally released at 11:57 GMT in 3790 m of water depth at 52.72291 S and 40.15570W

Again the mooring was pinged after the deployment to determine its position by triangulation. The ship moved from its position approx. ½ nm first E and then again ½ nm S. The positions, water depth, acoustic distance and the calculated radius are shown in Table 10.

Table 10. Triangulation data for position of P3 mooring

| Position | Time | Triangulation | | Latitude | Longitude |
|----------|-------|---------------|------|----------|-----------|
| P1 | 12:30 | Depth | 3748 | 52.72275 | 40.15537 |
| | | Ping distance | 3761 | | |
| | | Radius | | | |
| P2 (E) | 12:42 | Depth | 3748 | 52.72333 | 40.16213 |
| | | Ping distance | 3951 | | |
| | | Radius | | | |
| P3 (S) | 13:02 | Depth | 3748 | 52.71757 | 40.15284 |
| | | Ping distance | 3841 | | |
| | | Radius | | | |

This gave the following triangulation, with a relative position of **52° 43.4668 S and 40° 09.5185 W** where we believe the 3700m mooring is sitting:

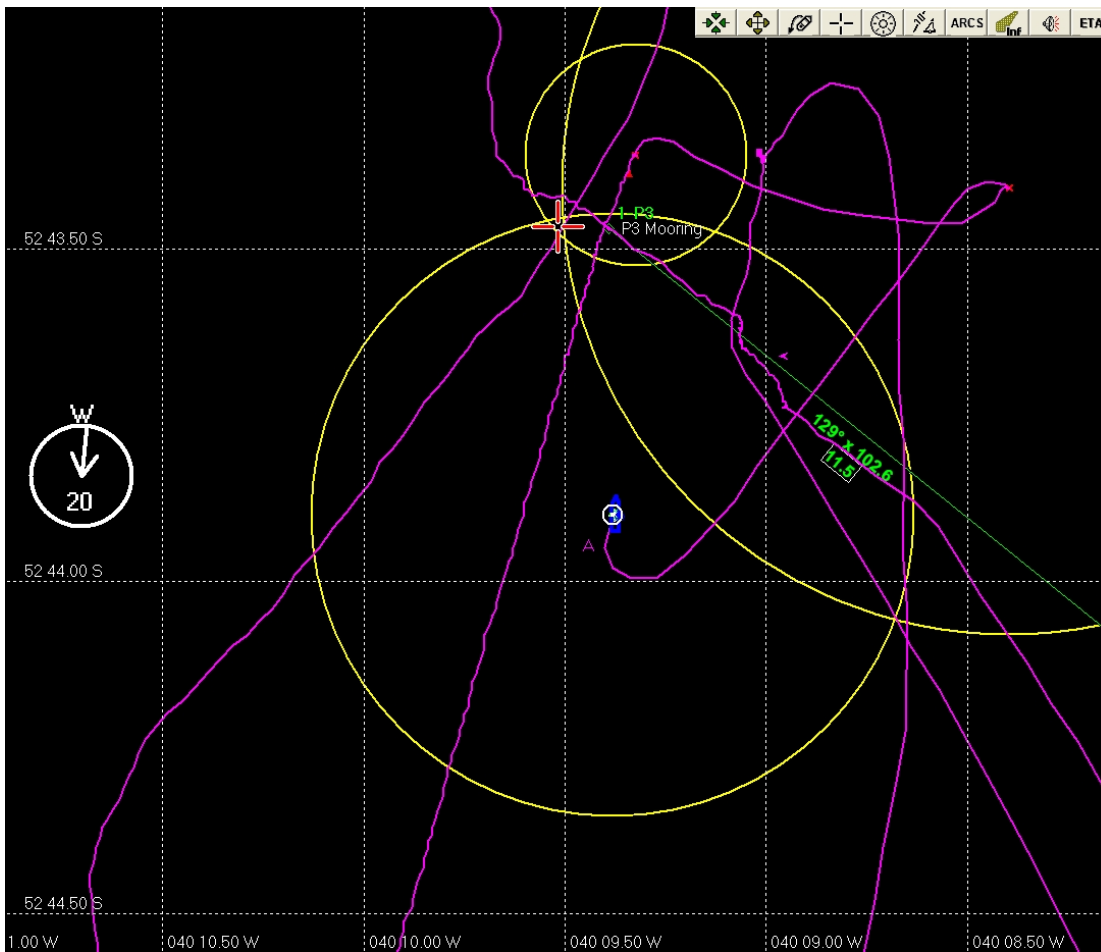


Figure 4. Calculated P3 mooring position by triangulation

Overall the two mooring recoveries and redeployments were all smooth operations even in marginal conditions, so they took less time than expected. For the next recoveries and redeployments however **12 hours for each operation** should be allowed to cover for any unexpected problems, which could easily occur as it happened with the shallow water WCB mooring.

4.1.3 Work carried out and setup:

4.1.3.1 3200m sediment trap mooring @ P2

NOVATEC beacon: R09, Ch B, 159.48 MHz

Acoustic Releases:

Codes:

Release No: 93 release code: **0484 + 0455**

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

Acoustic releases: 93 + 573

- new batteries
- tested

ARGOS beacon: 35519

- new batteries
- tested

NOVATEC Combo beacon: R09-020

- new batteries
- tested

CTD 37 SMP 29579: 2462 on main buoy

- data downloaded during JR228
- new batteries
- new O-rings

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

ADCP WHS300 – I – UG26: 2965

- data downloaded during JR228
- new batteries

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
- start time: 00:01:00 29.12.09

- 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

Sediment trap: Parflux No: ML11966-02

- data downloaded
- new batteries (14x C – Cells + 1x 9V Block battery)
 - do not remove both batteries at the same time!
- **Always disconnect the cable on the Sediment trap first, before unplugging the Computer end!!**

Parflux sediment trap deployment settings:

PS2 Sediment Trap Deployment December 2009 JR228

Schedule Verification

Event 1 of 22 = 01/01/2010 00:00:00

Event 2 of 22 = 01/15/2010 00:00:00

Event 3 of 22 = 02/01/2010 00:00:00

Event 4 of 22 = 02/15/2010 00:00:00

Event 5 of 22 = 03/01/2010 00:00:00

Event 6 of 22 = 04/01/2010 00:00:00

Event 7 of 22 = 05/01/2010 00:00:00

Event 8 of 22 = 06/01/2010 00:00:00

Event 9 of 22 = 07/01/2010 00:00:00

Event 10 of 22 = 08/01/2010 00:00:00

Event 11 of 22 = 09/01/2010 00:00:00

Event 12 of 22 = 10/01/2010 00:00:00

Event 13 of 22 = 11/01/2010 00:00:00
Event 14 of 22 = 12/01/2010 00:00:00
Event 15 of 22 = 12/15/2010 00:00:00
Event 16 of 22 = 01/01/2011 00:00:00
Event 17 of 22 = 01/15/2011 00:00:00
Event 18 of 22 = 02/01/2011 00:00:00
Event 19 of 22 = 02/15/2011 00:00:00
Event 20 of 22 = 03/01/2011 00:00:00
Event 21 of 22 = 04/01/2011 00:00:00
Event 22 of 22 = 05/01/2011 00:00:00

Current meter: Aquadopp No A2L - 1792

- data downloaded
- new batteries
 - The current meter batteries (lithium) are extremely expensive and those batteries deployed during last season will be returned to the UK with the view to finding a local manufacturer.

```
=====
Deployment      : 1792
Current time   : 28/12/2009 12:31:24
Start at       : 29/12/2009 00:01:00
Comment:
3200 m mooring at P2, deployed 281209
-----
Measurement interval (s) : 900
Average interval      (s) : 60
Blanking distance     (m) : 0.37
```


Diagnostics interval(min) : N/A
Diagnostics samples : N/A
Measurement load (%) : 4
Power level : HIGH
Compass upd. rate (s) : 900
Coordinate System : ENU
Speed of sound (m/s) : MEASURED
Salinity (ppt) : 34
File wrapping : OFF

Assumed duration (days) : 550.0
Battery utilization (%) : 243.0
Battery level (V) : 11.4
Recorder size (MB) : 89
Recorder free space (MB) : 85.192
Memory required (MB) : 2.1
Vertical vel. prec (cm/s) : 1.4
Horizon. vel. prec (cm/s) : 0.9

Aquadopp Version 1.28

Copyright (C) 1997-2004 Nortek AS

=====

Sediment trap mooring (3200m water depth)

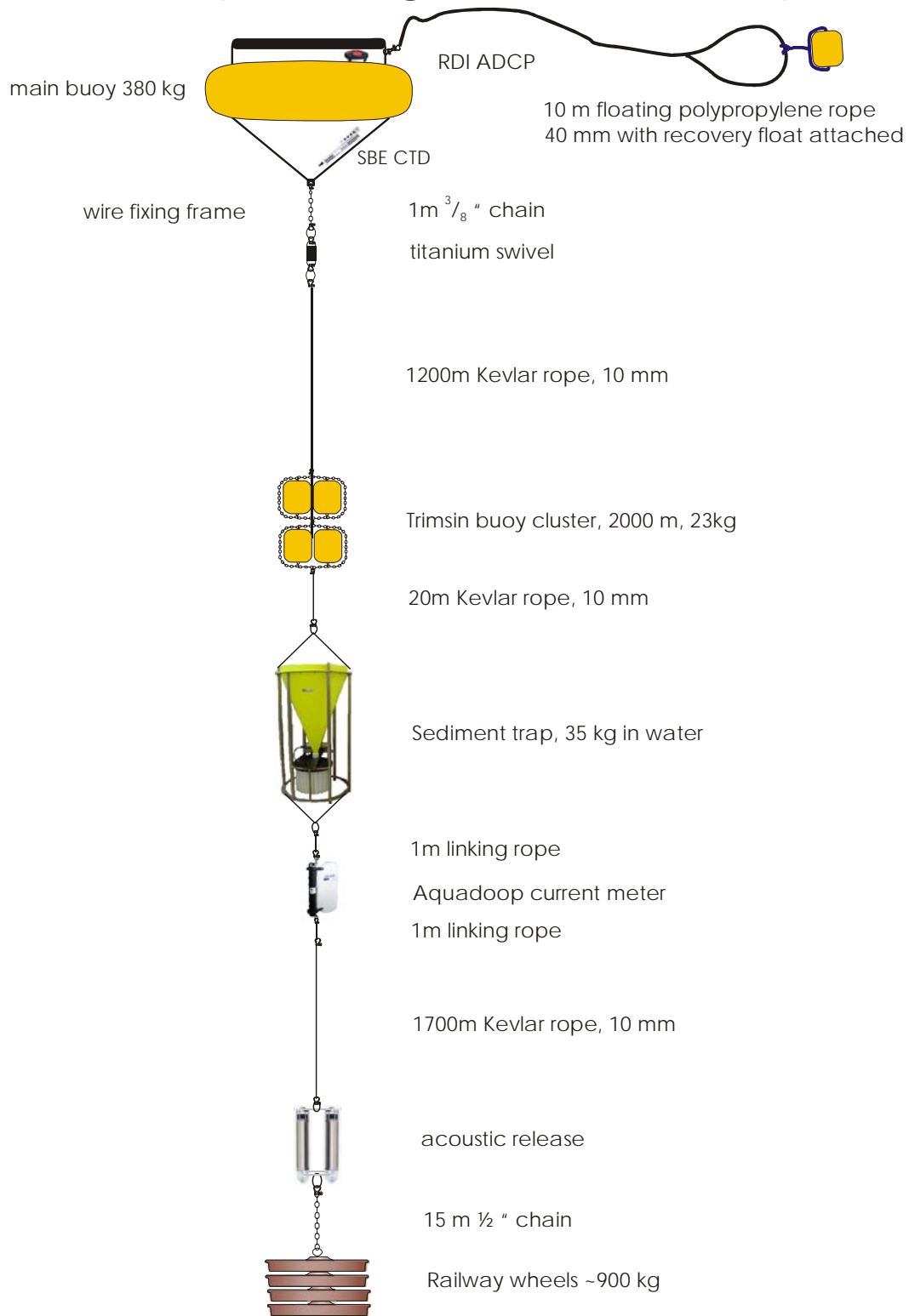


Figure 5. Diagram of P2 sediment trap mooring as deployed on JR228

4.1.3.2 3700m sediment trap mooring @ P3

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

Acoustic Releases:

Codes:

Release No: 290

On FR1 FR2 : B637

Release: **B639**

Diagnostic: B640

Pinger: B636 + B694

On new deck unit:

Option 1. RXTX settings

Option 1. Immediate Transmit

RXX=6xx

Transmit=mono

Transmit=8kHz

Release= B639

Release No: 1022

ARM, Ranging: 1890

Release code: **1890 + 1855**

Release + Pinger: ARM + 1856

Pinger on: ARM + 1847

Pinger of: ARM + 1848

Diagnostic: ARM + 1849

Acoustic releases: 290 + 1022

- new batteries
- tested
- part Simon DE made being replaced with a new one from Ixsea.

ARGOS beacon: SN 280, ID 60210

- new batteries
- tested

NOVATEC Combo beacon: U07-029

- new batteries
- tested

CTD 37 SMP 43742: 4852 on main buoy

- data downloaded during JR228
- new batteries

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

CTD 37 SMP 43742: 4855 at estimated 500 m

- data downloaded during JR228
- new batteries

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

ADCP WHS300 – I – UG26: 7522

- data downloaded during JR228
- new batteries

- ❑ 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

Sediment trap: Parflux No: ML11966-01

- new batteries (14x C – Cells + 1x 9V Block battery)
 - do not remove both batteries at the same time!
- **Always disconnect the cable on the Sediment trap first, before unplugging the Computer end!!**

Parflux sediment trap deployment settings (21 cups)

PS3 Sediment Trap Deployment December 2009 JR228

Schedule Verification

Event 1 of 22 = 01/01/2010 00:00:00

Event 2 of 22 = 01/15/2010 00:00:00

Event 3 of 22 = 02/01/2010 00:00:00

Event 4 of 22 = 02/15/2010 00:00:00

Event 5 of 22 = 03/01/2010 00:00:00

Event 6 of 22 = 04/01/2010 00:00:00

Event 7 of 22 = 05/01/2010 00:00:00

Event 8 of 22 = 06/01/2010 00:00:00

Event 9 of 22 = 07/01/2010 00:00:00
Event 10 of 22 = 08/01/2010 00:00:00
Event 11 of 22 = 09/01/2010 00:00:00
Event 12 of 22 = 10/01/2010 00:00:00
Event 13 of 22 = 11/01/2010 00:00:00
Event 14 of 22 = 12/01/2010 00:00:00
Event 15 of 22 = 12/15/2010 00:00:00
Event 16 of 22 = 01/01/2011 00:00:00
Event 17 of 22 = 01/15/2011 00:00:00
Event 18 of 22 = 02/01/2011 00:00:00
Event 19 of 22 = 02/15/2011 00:00:00
Event 20 of 22 = 03/01/2011 00:00:00
Event 21 of 22 = 04/01/2011 00:00:00
Event 22 of 22 = 05/01/2011 00:00:00

Current meter: Aquadopp No A2L - 1793 at estimated 2000 m water depth

- data downloaded
- new batteries
 - The current meter batteries (lithium) are extremely expensive and those batteries deployed during last season will be returned to the UK with the view to finding a local manufacturer.

Aquadopp current meter deployment settings

=====

Deployment : 1793

Current time : 24/12/2009 01:32:59

Start at : 25/12/2009 00:01:00

Comment:

3700 m mooring at P3, deployed 241209

Measurement interval (s) : 900

Average interval (s) : 60

Blanking distance (m) : 0.37

Diagnostics interval(min) : 720

Diagnostics samples : 20

Measurement load (%) : 4

Power level : HIGH

Compass upd. rate (s) : 900

Coordinate System : ENU

Speed of sound (m/s) : MEASURED

Salinity (ppt) : 34

File wrapping : OFF

Assumed duration (days) : 550.0

Battery utilization (%) : 258.0

Battery level (V) : 11.4

Recorder size (MB) : 89

Recorder free space (MB) : 87.527

Memory required (MB) : 3.0

Vertical vel. prec (cm/s) : 1.4

Horizon. vel. prec (cm/s) : 0.9

Aquadopp Version 1.28

Sediment trap mooring (3700m water depth)

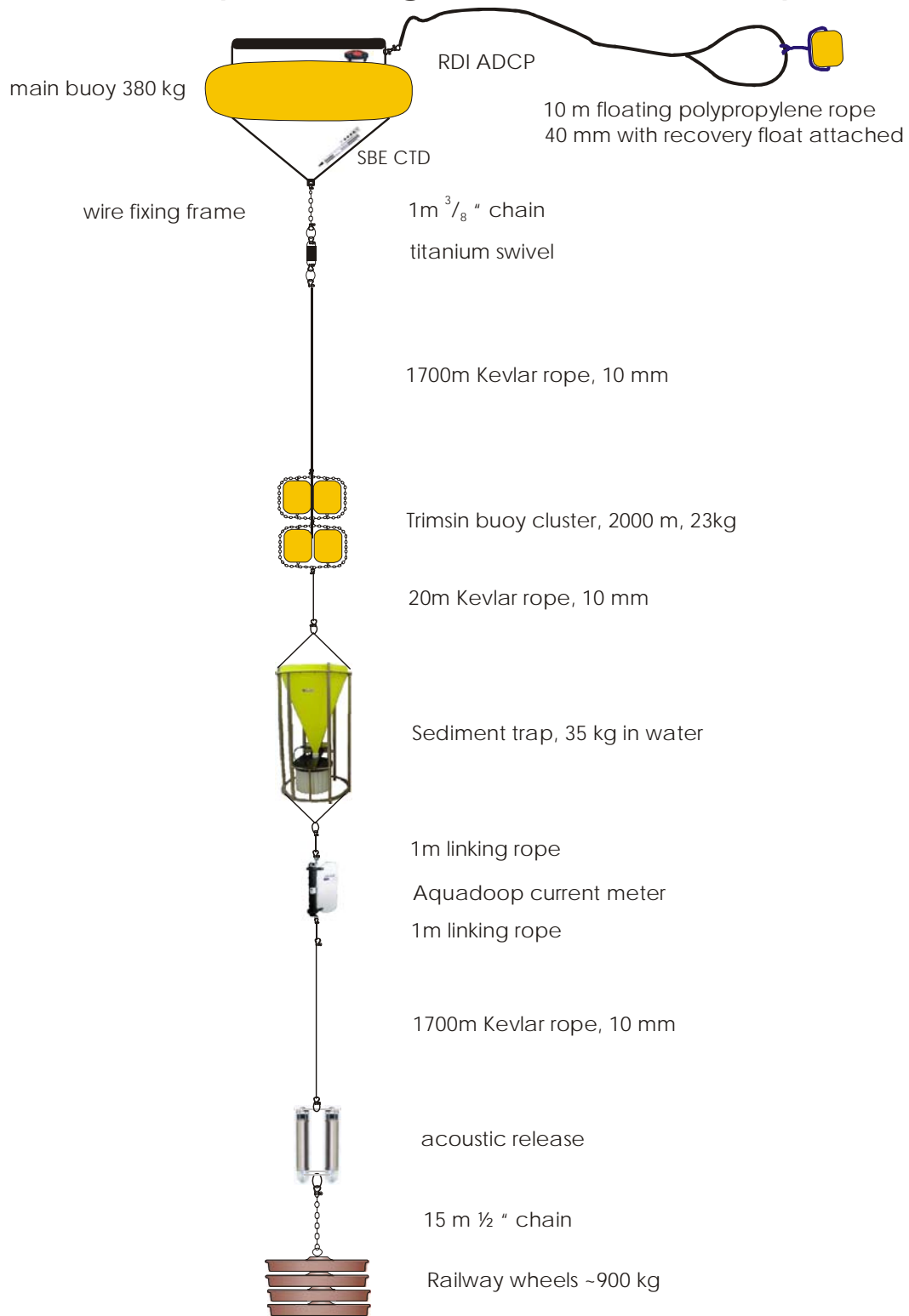


Figure 6. Diagram of P3 sediment trap mooring as deployed on JR228

4.1.3.3 Shallow water WCB mooring:

The shallow water WCB mooring was pinged on the 23.12.09 and initially the release responded with a distance reading of 455m. The mooring was released at 19:23 and responded with: released ok. As the mooring did not surface within the expected timeframe, the second release was fired at 19:35: Response was: released ok. At 19:42 both releases were fired again with positive feedbacks, but the buoy still did not surface. Vessel moved off 300m south of mooring position and the second release was fired again with a positive feedback. The mooring still appeared not to have released. Vessel moved off 370 north and the releases were triangulated. Thereafter the vessel moved into the approx. position until the mooring was found on the EK60 scientific echo sounder. After discussing the options, the decision was made at 20:57 to deploy a weighted coring wire over the stern and wrap around the mooring to attempt to release the mooring. The wire was deployed at 21:17 but encountered winch problems. At 21:45 the winch problems were solved and at 22:25 two complete turns of coring wire were wrapped around the mooring and the vessel moved off to release the mooring. At 22:54 the mooring was released and sighted on the surface approx. 100m behind the stern. The mooring was then recovered the normal way by grappling the middle section of the floating rope and recovering the trimsim buoy cluster first. The recovery was successful, but there were no releases at the end of the rope. The rope showed considerable damage caused by the coring wire above where the rope snapped. The cause for the malfunction of both releases is still unknown, as both releases seem to have worked perfectly fine, their responses and diagnostics showed that they had enough battery power, were upright in the water column and confirming every release command with released ok, indicating that there was nothing wrong with them. One possible explanation would be that they were entangled in some fishing gear which prevented them from rising after the release command.

After the usual turnaround with data download, replacing of worn hardware and batteries, the mooring was deployed with a spare single release and new ropes of 20m length, so the rig is approx. 15m shorter than usual. Decision was made that this setup with a single release at the shallow position and using new ropes was the best option given.

The mooring was redeployed on the **27/12/2009** and the weight was released at **00:47 GMT @ 53.79498S and 37.93676W**

NOVATEC beacon R09-021: Ch. C.: 160.725 MHz

Acoustic Releases:

Code shallow water mooring:

release:No: 572

release code: **15E0 + 1555**

work after recovery on mooring:

Acoustic release 572

- new batteries
- tested

NOVATEC Combo beacon: R09-021

- new batteries
- new plastic collar attached
- tested

ARGOS beacon 35520

- new batteries
- new plastic collar attached
- tested

WCP 004

- new batteries
- data downloaded during JR228
- set-up instrument for deployment
 - set real time clock to PC clock [shift F7] (p.48)
 - check for correct time [shift F1]
 - run RAM & Memory Test to check instrument and erase all data
 - set-up instrument (p.15 pp)
 - Burst Resolution (sec): 1
 - Burst Interval (sec): 240
 - Burst counts (pings): 18
 - Ping length (micro sec): 600
 - Max range (m): 200
 - Bin size: 8
 - Gain: 1

Start time: 26.12.2009

Stop time: 03.01.2011

- save deployment settings as .dpl file in prepared folder

CTD 37 SMP 43742: 2463

- data downloaded during JR228, flat batteries stopped CTD on 23 of June 09
- new O-rings
- new batteries

- 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: 240 sec

ADCP *WHS300 – I – UG26: 2967*

- data downloaded during JR228
 - new batteries
- 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

4.1.3.4 hardware in general on all three moorings:

- The main section of chain, which the Trimsin buoy clusters are attached, replaced on all 3 moorings
- Section of chain connecting the main buoy replaced on all 3 moorings
- Shackles on the main buoy changed on all 3 moorings
- Shackles replaced where necessary on all other parts of the moorings
- New eyelinks added to the moorings to increase ease of recovery and deployment of moorings
- Due to releases not working, ending in the dragging up of the shallow mooring, both lengths of rope were replaced with new 20m, 12mm Dyneema rope

shallow water mooring (300m water depth)

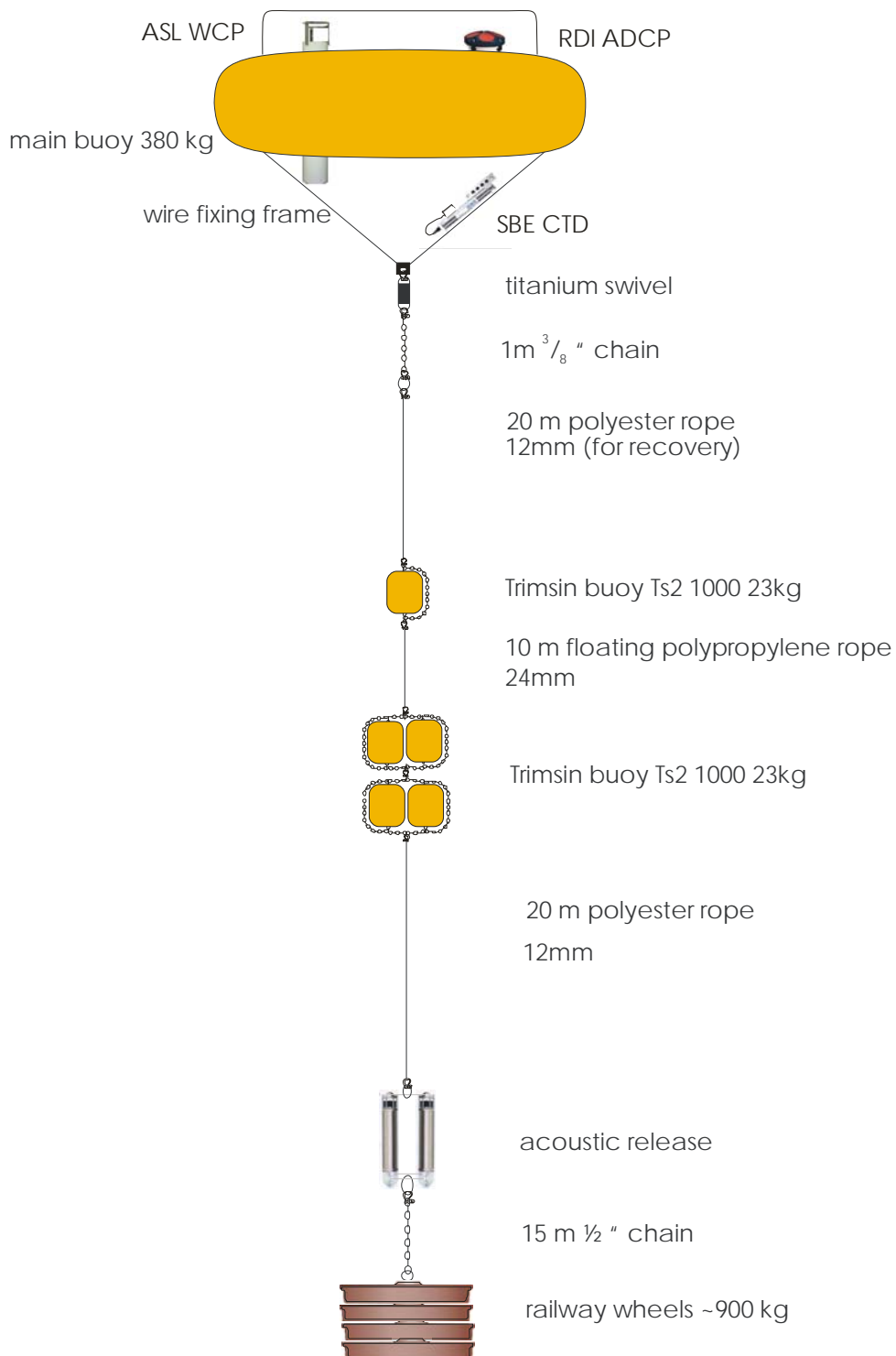


Figure 7. Diagram of WCB Shallow mooring as deployed on JR228

5 Phytoplankton biomass

Rebecca Korb

5.1 Introduction & aims

The quantity of phytoplankton in the water column will have important implications to the structure of the pelagic foodweb as well as determining the quality, timing, magnitude and vertical flux of carbon. Phytoplankton biomass was measured from the surface waters around South Georgia.

5.2 Methods and data coverage

Water samples for total Chl a were collected from the ships underway seawater supply (see Table 11), filtered through 47 mm glass fiber filters (Fisher GF/F) under low (<70 mmHg) vacuum pressure and immediately frozen at -20 °C until further analysis. After freezing, filters were extracted in 10 ml of 90% acetone in the dark, for 24 h (Parsons et al., 1984). Fluorescence of the extract was measured before and after acidification with 1.2M HCl on a TD-700 Turner fluorometer. The instrument was calibrated against commercially prepared Chl-a standards (Sigma).

Additional samples were collected at the Chl maxima (as indicated from the fluorometer on the downcast of the CTD) at a number of CTD stations. See Table 12.

5.3 Results

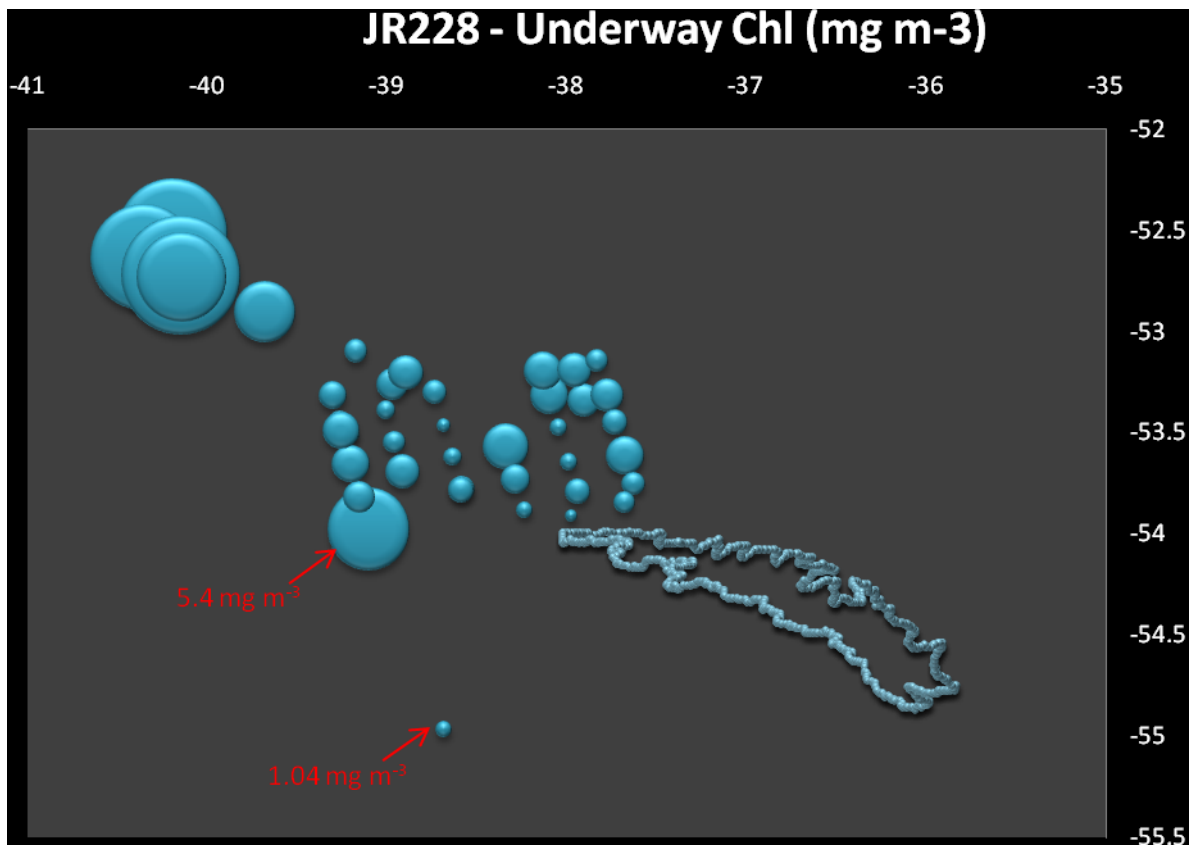


Figure 8. Map of underway Chl collected during JR228

Table 11. Underway Chl samples collected during JR228.

| Sample # | Time | Lat | Lon | Chl (mg m ⁻³) | Oceanlogger | | | |
|----------|------------------|---------|---------|------------------------------|-------------|--------|-------|------|
| | | | | | PAR 1 | PAR 2 | Fluor | Temp |
| 7 | 19/12/2009 17:00 | -52.521 | -40.195 | 7.23 | 595.6 | 603.2 | 1.91 | 2.88 |
| 8 | 19/12/2009 21:05 | -52.635 | -40.353 | 6.97 | 246.3 | 249.2 | 2.20 | 2.75 |
| 9 | 20/12/2009 00:21 | -52.723 | -40.150 | 7.84 | -3.6 | -4.0 | 2.54 | 2.64 |
| 10 | 20/12/2009 13:58 | -53.979 | -39.103 | 5.38 | 2129.8 | 2168.7 | 1.29 | 2.53 |
| 11 | 20/12/2009 14:56 | -53.819 | -39.152 | 2.04 | 2819.3 | 2853.4 | 1.11 | 2.58 |
| 12 | 20/12/2009 15:55 | -53.658 | -39.201 | 2.42 | 2079.7 | 2127.8 | 1.10 | 2.57 |
| 13 | 20/12/2009 17:02 | -53.473 | -39.256 | 1.72 | 1733.2 | 1786.3 | 1.14 | 2.99 |
| 14 | 20/12/2009 18:00 | -53.315 | -39.304 | 1.79 | 1459.0 | 1501.0 | 1.16 | 2.78 |
| 15 | 20/12/2009 18:59 | -53.451 | -39.262 | 1.49 | 761.4 | 764.1 | 1.17 | 2.9 |

| | | | | | | | | |
|----|------------------|---------|---------|------|--------|--------|------|------|
| 16 | 20/12/2009 19:49 | -53.517 | -39.185 | 0.75 | 467.6 | 473.8 | 1.18 | 2.09 |
| 17 | 20/12/2009 22:36 | -53.494 | -39.253 | 2.39 | 33.8 | 33.5 | 2.06 | 3.19 |
| 18 | 21/12/2009 09:56 | -53.693 | -38.913 | 2.24 | 1252.3 | 1278.2 | 1.40 | 2.26 |
| 19 | 21/12/2009 10:56 | -53.547 | -38.958 | 1.40 | 1652.1 | 1657.3 | 1.34 | 2.02 |
| 20 | 21/12/2009 11:59 | -53.391 | -39.006 | 1.20 | 1833.6 | 1836.5 | 1.33 | 1.85 |
| 21 | 21/12/2009 13:00 | -53.264 | -38.968 | 2.05 | 1948.1 | 1989.1 | 1.38 | 2.97 |
| 22 | 21/12/2009 14:02 | -53.303 | -38.736 | 1.55 | 2063.8 | 2100.8 | 1.32 | 2.25 |
| 23 | 21/12/2009 15:01 | -53.466 | -38.684 | 0.89 | 2062.0 | 2090.3 | 1.29 | 1.95 |
| 24 | 21/12/2009 15:58 | -53.620 | -38.635 | 1.15 | 1998.6 | 2013.3 | 1.27 | 2.59 |
| 25 | 21/12/2009 16:56 | -53.780 | -38.585 | 1.66 | 1855.3 | 1862.5 | 1.29 | 2.73 |
| 26 | 21/12/2009 18:01 | -54.965 | -38.686 | 1.04 | 1061.6 | 1069.6 | 2.15 | 1.6 |
| 27 | 21/12/2009 22:06 | -53.786 | -38.589 | 1.67 | 87.7 | 89.1 | 1.48 | 2.65 |
| 28 | 22/12/2009 10:00 | -53.571 | -38.336 | 3.00 | 234.2 | 237.7 | 1.47 | 2.88 |
| 29 | 22/12/2009 11:01 | -53.732 | -38.284 | 1.93 | 184.9 | 186.5 | 1.46 | 2.46 |
| 30 | 22/12/2009 12:00 | -53.885 | -38.234 | 1.08 | 195.2 | 197.0 | 1.30 | 2.27 |
| 31 | 22/12/2009 13:06 | -53.913 | -37.972 | 0.78 | 516.1 | 528.0 | 1.21 | 2.31 |
| 32 | 22/12/2009 14:01 | -53.793 | -37.940 | 1.65 | 570.8 | 583.7 | 1.35 | 2.66 |
| 33 | 22/12/2009 14:56 | -53.645 | -37.989 | 1.09 | 740.8 | 754.8 | 1.24 | 2.81 |
| 34 | 22/12/2009 15:59 | -53.476 | -38.045 | 1.07 | 1171.8 | 1183.1 | 1.23 | 1.91 |
| 35 | 22/12/2009 16:57 | -53.320 | -38.097 | 2.46 | 786.5 | 794.0 | 1.64 | 2.88 |
| 36 | 22/12/2009 18:00 | -53.197 | -38.133 | 2.48 | 690.7 | 697.6 | 1.88 | 3.12 |
| 38 | 23/12/2009 11:01 | -53.343 | -37.902 | 2.16 | 791.5 | 793.8 | 1.98 | 2.86 |
| 39 | 23/12/2009 12:01 | -53.195 | -37.954 | 2.18 | 826.8 | 834.1 | 1.95 | 2.97 |
| 40 | 23/12/2009 12:57 | -53.146 | -37.833 | 1.42 | 1016.9 | 1028.4 | 1.27 | 2.49 |
| 41 | 23/12/2009 14:04 | -53.317 | -37.776 | 2.14 | 1103.4 | 1114.7 | 1.38 | 3.03 |
| 42 | 23/12/2009 14:58 | -53.451 | -37.731 | 1.63 | 906.8 | 914.7 | 1.41 | 2.38 |
| 43 | 23/12/2009 16:03 | -53.615 | -37.675 | 2.48 | 1112.7 | 1123.2 | 1.37 | 2.84 |
| 44 | 23/12/2009 16:59 | -53.753 | -37.628 | 1.49 | 1311.3 | 1304.6 | 1.34 | 2.82 |
| 45 | 23/12/2009 18:03 | -53.844 | -37.680 | 1.38 | 1259.2 | 1280.4 | 1.33 | 2.73 |

| | | | | | | | | |
|----|------------------|---------|---------|------|-------|-------|------|------|
| 46 | 24/12/2009 14:23 | -52.736 | -40.142 | 5.88 | 382.9 | 385.1 | 3.01 | 3.24 |
| 47 | 24/12/2009 16:02 | -52.905 | -39.681 | 4.00 | 378.9 | 381.0 | 2.66 | 3.27 |
| 48 | 24/12/2009 17:52 | -53.098 | -39.173 | 1.48 | 408.0 | 411.1 | 2.18 | 2.43 |
| 49 | 24/12/2009 18:53 | -53.207 | -38.894 | 2.26 | 262.2 | 263.7 | 2.57 | 3.2 |

Table 12. Chl a values at CTD stations.

| Date | Station | Depth | Chl (mg m ⁻³) |
|------------|---------|---------|---------------------------|
| 16/12/2009 | P2 | Chl max | 1.12 |
| 19/12/2009 | P3 | Chl max | 6.12 |
| 20/12/2009 | W1.2N | Chl max | 2.42 |
| 21/12/2009 | W2.2S | Chl max | 2.07 |
| 22/12/2009 | W3.2N | Chl max | 2.53 |
| 24/12/2009 | P3 (2) | Chl max | 4.27 |

6 Southern Ocean prokaryote diversity – biodiversity across different spatial scales

David Pearce & María Luisa Ávila Jiménez

6.1 Introduction

The previous cruise to JR228, the Marguerite Bay Benthic-Pelagic coupling cruise JR230 (1st – 11th December 2009) aimed to assess biodiversity and interaction across the sea bed and water column, from the microbes to the megafauna, in an area from the inner shelf in Marguerite Bay to the shelf break. In this cruise further North, samples were taken at a series of depths around South Georgia to compare the prokaryote diversity at a far wider spatial scale. Similar vertical profiles were used at shallow areas in the Western Box Core, to match the recently collected data in Marguerite Bay. Taking the opportunity to compare the two systems and to trial techniques which may be used around South Georgia in the future.

6.2 CTD

As for the sampling carried out during JR230 cruise, physical profiles were taken with the CTD (Figure. 9) during descent, and the profiles, in conjunction with altimeter data were then used to select appropriate sample depths. Two-and-a-half liters of seawater samples were collected at Bottom +10 m, Bottom +20 m, Bottom + 50 m, mid-water (those variable depending on total depth), the chlorophyll maximum (at 10 meters) and the surface (5 m) (Table 13). Two liters of the water collected were filtered onto 0.2 μm cellulose nitrate filter papers, re-suspended in 5 ml of seawater and centrifuged to produce a pellet for subsequent analysis (Figure. 10). The remainder of the sample was used to pre-rinse the sterile filter apparatus and sample collection bottles.



Figure 9: CTD



Figure 10: Sartorius filtration system and units.

Table 13. Samples summary

| Sample site | Date | Total depth in meters (Sonar) | Samples Depth in meters (Cable length) | | | | | Chl max | Surface |
|-------------|------------|-------------------------------|--|------------|-----------|------------|----|---------|---------|
| | | | Bottom+10 | Bottom +20 | Bottom+50 | Mid- water | | | |
| jr228-156 | 21.12.2009 | 275 | 274 | 264 | 224 | | 10 | 5 | |
| jr228-162 | 21.12.2009 | 200 | 195 | 185 | 155 | 75 | 10 | 5 | |
| jr228-187 | 23.12.2009 | 132 | 123 | 103 | 83 | 60 | 10 | 5 | |

6.3 Laboratory Analysis

After DNA extraction from cells suspension DGGE/tRFLP analyses will be used to determine prokaryote diversity at profiles, clone libraries will be constructed and in funds permit, a representative sample of the diversity sequenced.

7 Mesozooplankton

Peter Ward

7.1 *Bongo and N70 nets*

Sampling during this cruise took place at 5 of the stations occupied; north and south mooring sites and 3 stations within the core box (see event log). Both nets were deployed to 200 m and hauled vertically to the surface. Each net deployment took in the order of 20 minutes. Two deployments of a paired bongo (2 X 200 μm nets) and 4 of the N70 (single net but variable mesh sizes of 455 μm and 190 μm) were carried out at each station in a 2h time slot. A total of 20 bongo and 20 N70 samples spread across 5 stations was obtained which combined with material collected during the preceding JR230 makes a total of 40 samples from each net, collected across 10 stations.

Sample data will be used as part of a project, investigating potential long-term change in plankton composition and abundance in the Southern Ocean. Catch composition and abundance from the current version of the N70 will be compared to bongo catches and as a basis for investigating composition and abundance as provided by the N70V, the net widely used during the Discovery Southern Ocean Investigations of the 1920s-30s.

Additionally a number of species stages of the small cyclopoid copepod *Oithona similis* were removed from bongo net samples and placed individually in small vials containing chloroform. These were frozen at -80°C and will be used in an ongoing project investigating individual variability of fatty acid composition under contrasting food regimes.

8 Macrozooplankton

Gabriele Stowasser, Jonathan Watkins, Peter Ward, Natalie Ensor and Sophie Fielding

8.1 Gear

The RMT8 was used to characterise the macrozooplankton community in the Western Corebox in 200m stratified hauls (Table 14). The RMT8 was rigged with 2 nets. The first net was opened at the surface and closed at 200m; the second net was then opened at 200m and closed at the surface. Both nets were kept open for 30 min. As part of the long-term monitoring programme of the Western Core Box 3 hauls were undertaken targeting krill marks identified on the EK60 Echosounder (Table 14) in order to measure krill length frequencies. All catches were carried out during the night or at dawn. Opening and closing of the nets was controlled through the down wire net monitor system which additionally recorded depth, flow, temperature, salinity and PAR.

8.2 Catch sorting and processing

8.2.1 Stratified hauls

For the stratified hauls the total catch was sorted and quantified (Table 15). Numbers caught and total weight (when > 1 g) was obtained for each species. For some groups specific identification was not possible and identification will be verified through re-examination in the laboratory in either Cambridge or by consulting colleagues specializing in these taxa outside BAS. All material collected was preserved in formalin. All data were recorded in an Excel database.

8.2.2 Targeted hauls

The catch of targeted hauls was sorted and quantified. Where live *Euphausia superba* was caught subsamples (Events 155 and 188) were preserved separately for genetic studies in RNA later and specimens were frozen for iron excretion studies. In hauls (Events 155, 186, 188), where sufficient numbers of *E. superba* were caught, length-frequency data was collected (Figure 11). Krill total length was measured on 100 fresh krill, using the standard BAS measurement from the anterior edge of the eye to the tip of the telson, with measurements rounded down to the nearest mm (Morris et al. 1988). Maturity stage was assessed using the scale of Makarov and Denys with the nomenclature described by Morris et al. (1988).

8.3 Particulates

Particulate material was collected from the chlorophyll maxima from CTDs to determine the food availability and quality for meso- and macro-zooplankton communities at sites where copepod communities (*Oithona similis*) were investigated. Additional samples of particulate material were collected from CTDs (chlorophyll maxima) at sites where sediment traps were deployed for the analysis of a wide suit of lipid biomarkers (Table 16).

8.4 Results

Table 14. RMT8 stations during cruise JR228

| Event | Net | Start time | End time | Start Lat. | Start Long. | End Lat. | End Long. | Water Depth | Net depth min. | Net depth max. | Haul type |
|-------|-------|---------------------|---------------------|------------|-------------|----------|-----------|----------------|-------------------|-------------------|------------|
| 146 | Net 1 | 20/12/2009 20:01 | 20/12/2009 20:11 | -53.5129 | -39.1974 | -53.5092 | -39.2076 | 3185-3204 | 76 | 91 | Target |
| 146 | Net 2 | 20/12/2009 20:13 | 20/12/2009 20:28 | -53.5087 | -39.2090 | -53.5034 | -39.2244 | 3161-3184 | 57 | 64 | Target |
| 154 | Net 1 | 21/12/2009 00:17 | 21/12/2009 00:49 | -53.5100 | -39.2101 | -53.4963 | -39.2428 | 3155-3186 | 10 | 199 | Stratified |
| 154 | Net 2 | 21/12/2009 00:49 | 21/12/2009 01:20 | -53.4961 | -39.2434 | -53.4840 | -39.2719 | 3118-3155 | 18 | 198 | Stratified |
| 155 | Net 1 | 21/12/2009 03:59 | 21/12/2009 04:02 | -53.7515 | -39.1474 | -53.7507 | -39.1510 | 3379-3772 | 21 | 22 | Target |
| 155 | Net 2 | 21/12/2009 04:02 | 21/12/2009 04:05 | -53.7507 | -39.1513 | -53.7500 | -39.1545 | 3379-3380 | 21 | 24 | Target |
| 170 | Net 1 | 22/12/2009 00:14 | 22/12/2009 00:43 | -53.8126 | -38.5772 | -53.7925 | -38.5826 | 191-197 | 5 | 157 | Stratified |
| 170 | Net 2 | 22/12/2009 00:44 | 22/12/2009 01:14 | -53.7915 | -38.5829 | -53.7710 | -38.5863 | 199-225 | 1 | 162 | Stratified |
| 171 | Net 1 | 22/12/2009 03:23 | 22/12/2009 03:55 | -53.4622 | -38.6916 | -53.4393 | -38.6934 | 1691 | 7 | 202 | Stratified |
| 171 | Net 2 | 22/12/2009 03:55 | 22/12/2009 04:25 | -53.4392 | -38.6934 | -53.4178 | -38.6982 | 1691 | 203 | 7 | Stratified |
| 185 | Net 1 | 22/12/2009 22:25 | 22/12/2009 22:55 | -53.3650 | -38.0364 | -53.3625 | -38.0709 | 2553-2672 | 20 | 203 | Stratified |
| 185 | Net 2 | 22/12/2009 22:56 | 22/12/2009 23:25 | -53.3624 | -38.0722 | -53.3586 | -38.1083 | 2671-2706 | 13 | 206 | Stratified |
| 186 | Net 1 | 23/12/2009 01:57 | 23/12/2009 02:27 | -53.7222 | -37.9128 | -53.7165 | -37.9464 | 123-130 | 10 | 90 | Stratified |
| 186 | Net 2 | 23/12/2009 02:28 | 23/12/2009 02:58 | -53.7163 | -37.9483 | -53.7127 | -37.9828 | 131-137 | 9 | 97 | Stratified |
| 188 | Net 1 | 23/12/2009 06:21 | 23/12/2009 06:31 | -53.8489 | -37.5909 | -53.8487 | -37.6038 | 113-119 | 26 | 26 | Target |
| 188 | Net 2 | 23/12/2009 06:37 | 23/12/2009 06:44 | -53.8483 | -37.6115 | -53.8472 | -37.6193 | 122-123 | 23 | 28 | Target |

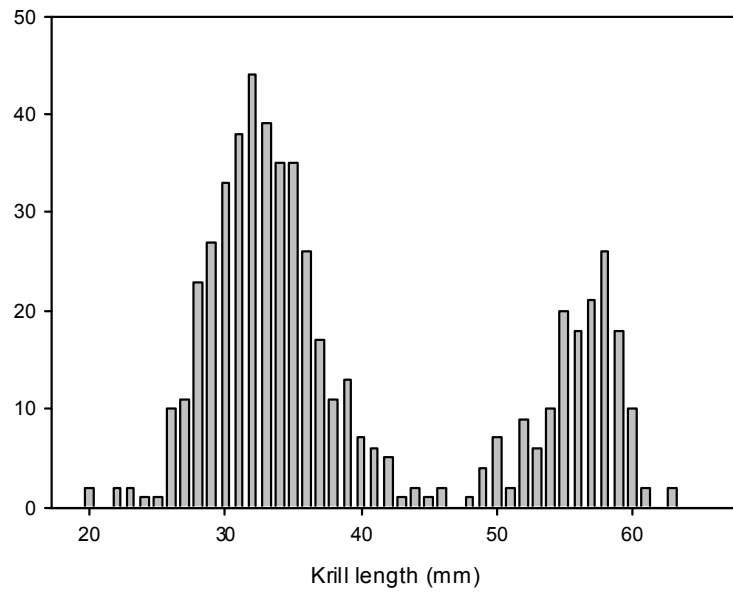


Figure. 11. Length frequency distribution of krill (*Euphausia superba*) caught in RMT8 nets during JR228 (Events 155 and 188)

Table 16. Particulate organic matter (POM) samples taken from CTDs. The downcast fluorescence trace was used to establish depth of the chlorophyll maxima.

| Event | Date | Lat. | Long. | Depth Chl.max | Litres filtered |
|-------|------------|-----------|-----------|------------------|--------------------|
| 126 | 16/12/2009 | -55.20881 | -41.09817 | 50 | 3 |
| 134 | 20/12/2009 | -52.72267 | -40.14997 | 20 | 3 |
| 147 | 20/12/2009 | -53.49304 | -39.25103 | 30 | 3 |
| 162 | 21/12/2009 | -53.78571 | -38.58632 | 10 | 3 |
| 178 | 22/12/2009 | -53.36116 | -38.08244 | 50 | 3 |
| 199 | 24/12/2009 | -52.73175 | -40.15626 | 15 | 3 |

9 Computing setup & support Jeremy Robst

Jeremy Robst

9.1 Personal Computers

No problems were encountered with the personal computers used during this cruise.

9.2 Netware

JRNA ran without any faults and no work was required during the cruise.

9.3 Unix

JRLB ran out of space on the root (/) filesystem on 19th December, due to /sysadmin/packages being on the root filesystem instead of the /sysadmin volume. The system was rebooted leading to ACQ being restarted at 12:25Z before the filesystem layout was fully understood. The apache logs were moved to the /sysadmin volume, freeing up 1.5GB of disk space and preventing the root filesystem from filling up further, until all the packages can be moved.

9.4 SCS Logging system / Data logging

v4.2.3 of the SCS logging system was used during the cruise.

The Ashtech GPS regularly (approx every 5 days) stops outputting heading information and requires power cycling, although this is less important now that the heading data from the Seatex GPS (which does not suffer this problem) is logged.

On the 27th December, the XBT machine started logging data before the pin was pulled; rebooting the PC before a drop helped a couple of times, but the cause was probably due to water getting into the contacts.

| Date / Time | Event / Reason |
|------------------|--|
| 2009/12/14 | Data logging continuing from previous run to Rothera (Leg 20091112). |
| 2009/12/19 12:20 | JRLB started having problems due to full root filesystem. ACQ restarted 12:24 – 12:25 to resume logging to the U: drive. |
| 2009/12/19 12:40 | Recreated ACO files after JRLB reboot – took approximately 90 mins for 35 days of data. |
| 2009/12/31 12:35 | Leg switched to 20091231 and backups taken |

Table 17. Data acquisition events.

9.5 Network

No problems reported.

9.6 Cruise Track

GMT was used to produce a cruise track, first listit was run to produce an xy track plot (note longitude first then latitude)

```
listit -i 600 -hw seatex-gga seatex-gga-lon seatex-gga-lat | perl -  
nale 'print join(" ", $F[3]+0, $F[5]+0)' > xy.track
```

Then pscoast and psxy were used to produce plots of the whole leg and of the JR228 specific part.

```
pscoast -R-72/-36/-68.2/-51 -JM-59.5/6i -K -Df ¥  
-W "-B5g2.5:.Leg 20091112:" -Ggray > map.ps  
psxy -R-72/-36/-68.2/-51 -JM-59.5/6i -0 -K < xy.track ¥  
-W1, red >> map.ps
```

9.7 EM120 Swathing

The EM120 was run during the cruise to on an opportunistic basis and where it did not interfere with the acoustic transects.

Minimal data clean was done on the data, just the removal of obviously incorrect depths due to ice conditions or ship motion (e.g during turns) if a printout was required.

10 Appendix 1: Bridge log for JR228 showing time and position of all events

Note event numbers 001 to 123 form part of cruise JR230

| Time | Event number | Lat | Lon | Activity | Comment |
|------------------|--------------|----------|----------|--|---|
| 14/12/2009 01:40 | | -60.6273 | -53.9002 | Vessel reducing speed for Myrtle station. | |
| 14/12/2009 01:52 | | -60.6203 | -53.8458 | Vessel stopped on DP and deploying POL hydrophone. | |
| 14/12/2009 01:54 | | -60.6203 | -53.8450 | Hydrophone deployed. | |
| 14/12/2009 01:56 | | -60.6203 | -53.8450 | Signal recieved twice with confirming ranges. | |
| 14/12/2009 02:03 | | -60.6207 | -53.8354 | Hydrophone recovered | vessel off DP and resuming passage. |
| 15/12/2009 04:05 | | -60.5573 | -46.4434 | Vessel reducing speed for CPR deployment. | |
| 15/12/2009 04:07 | 124 | -60.5522 | -46.4459 | Vessel at deployment speed and commenced deploying CPR | |
| 15/12/2009 04:19 | | -60.5257 | -46.4596 | CPR secured on deck with 30 m of submerged wire | commenced increasing speed |
| 16/12/2009 10:51 | | -55.2270 | -41.1327 | Commence reducing speed for CPR recovery. | |
| 16/12/2009 10:56 | | -55.2168 | -41.1261 | CPR out of the water. | |
| 16/12/2009 10:57 | | -55.2152 | -41.1250 | CPR recovered on deck. | |
| 16/12/2009 11:10 | | -55.2078 | -41.1111 | Vessel all stopped on DP heading 320 | depth 3236 metres. Corrected depth 3195 metres. |
| 16/12/2009 11:16 | | -55.2079 | -41.1112 | Hydrophone deployed return signal recieved at 3206 metres. | |
| 16/12/2009 11:21 | | -55.2079 | -41.1111 | Hydrophone out of the water. | |
| 16/12/2009 11:34 | | -55.2035 | -41.1239 | Vessel relocated 350 metres upwind of mooring position | hydrophone deployed. Corrected EA600 depth 3103 metres. |
| 16/12/2009 11:36 | 125 | -55.2035 | -41.1240 | Contact made with mooring at 3139 metres range. | |
| 16/12/2009 11:50 | | -55.2035 | -41.1240 | Hydrophone deployed. | |
| 16/12/2009 11:52 | | -55.2035 | -41.1240 | Buoy released. | |
| 16/12/2009 11:55 | | -55.2035 | -41.1240 | Buoy believed to have surfaced | DF returning heading. |
| 16/12/2009 12:01 | | -55.2025 | -41.1211 | Buoy sighted | vessel moving towards buoy. |
| 16/12/2009 12:07 | | -55.2008 | -41.1135 | Vessel on DP moving towards buoy. | |

| | | | | | |
|------------------|-----|----------|----------|--|---|
| 16/12/2009 12:09 | | -55.2010 | -41.1130 | Grappling hook on recovery line. | |
| 16/12/2009 12:11 | | -55.2011 | -41.1128 | Recovery buoy on deck. | |
| 16/12/2009 12:14 | | -55.2013 | -41.1116 | Buoy trailing astern. | |
| 16/12/2009 12:22 | | -55.2015 | -41.1092 | Main buoy landed on deck. | |
| 16/12/2009 12:27 | | -55.2020 | -41.1075 | Hauling on first cable | length approx 1100 metres. |
| 16/12/2009 13:01 | | -55.2041 | -41.1029 | Trimsin buoy cluster recovered on deck. | |
| 16/12/2009 13:11 | | -55.2048 | -41.1019 | Aquadoop recovered on deck. | |
| 16/12/2009 13:13 | | -55.2049 | -41.1018 | Sediment trap recovered on deck. | |
| 16/12/2009 13:21 | | -55.2051 | -41.1015 | Commence hauling in the last 1700 metres of rope. | |
| 16/12/2009 14:01 | | -55.2086 | -41.0982 | Acoustic release recovered on deck | nothing in the water. |
| 16/12/2009 14:03 | | -55.2088 | -41.0981 | Vessel all stopped on station for CTD. | |
| 16/12/2009 14:19 | 126 | -55.2088 | -41.0982 | CTD deployed. | |
| 16/12/2009 14:28 | | -55.2088 | -41.0982 | CTD on its way down to 1kM | |
| 16/12/2009 14:48 | | -55.2088 | -41.0982 | CTD all stopped at depth 1010 metres. | |
| 16/12/2009 15:11 | | -55.2088 | -41.0982 | CTD recovered and gantry stowed | |
| 16/12/2009 15:21 | 127 | -55.2088 | -41.0982 | Bongo (1) deployed | |
| 16/12/2009 15:36 | | -55.2088 | -41.0982 | Bongo (1) recovered | |
| 16/12/2009 15:37 | 128 | -55.2088 | -41.0982 | Bongo (2) deployed | |
| 16/12/2009 15:53 | | -55.2086 | -41.0980 | Bongo (2) recovered | |
| 16/12/2009 16:03 | 129 | -55.2086 | -41.0980 | N70 deployed (1) | |
| 16/12/2009 16:19 | | -55.2076 | -41.0962 | N70 recovered (1) | |
| 16/12/2009 16:25 | 130 | -55.2070 | -41.0962 | N70 deployed (2). | |
| 16/12/2009 16:36 | | -55.2059 | -41.0959 | N70 (2) recovered. | |
| 16/12/2009 16:39 | 131 | -55.2059 | -41.0959 | N70 deployed (3). | |
| 16/12/2009 16:53 | | -55.2044 | -41.0955 | N70 net recovered (3) | |
| 16/12/2009 16:55 | 132 | -55.2043 | -41.0954 | N70 deployed (4). | |
| 16/12/2009 17:10 | | -55.2026 | -41.0950 | N70 net (4) recovered. | |
| 16/12/2009 17:26 | | -55.1919 | -41.0759 | Vessel off D.P and proceeding towards Bird Isl. | |
| 18/12/2009 11:26 | | -54.1517 | -37.2848 | Vessel all stopped on DP 0.4 miles west of Vincent Islands | King Haakon Bay assessing possible landing positions for field party. Landing possible, but |

| | | | | |
|------------------|-----|----------|----------|--|
| | | | | no female breeding seals. |
| 18/12/2009 13:08 | | -54.1497 | -37.5218 | Ship stopped on DP in Cheapman Bay. |
| 18/12/2009 14:28 | | -54.1460 | -37.5257 | Boats launched to assess beach |
| 18/12/2009 15:08 | | -54.1460 | -37.5261 | Vessel off DP and proceeding to Wilson Harbour. |
| 18/12/2009 17:34 | | -54.1115 | -37.6688 | Vessel on DP at Wilson Harbour. |
| 18/12/2009 20:47 | | -54.1098 | -37.6681 | Whiskey field party deployed. V/L off DP to proceed to Northern mooring P3 |
| 19/12/2009 11:30 | | -52.7290 | -40.1490 | Vessel all stopped on DP for mooring P3 |
| 19/12/2009 11:52 | | -52.7289 | -40.1490 | Decision made to attempt P3 mooring recovery |
| 19/12/2009 12:10 | | -52.7274 | -40.1509 | Vessel stopped 487 metres SE of p3 mooring |
| 19/12/2009 12:14 | | -52.7272 | -40.1510 | Hydrophone deployed. |
| 19/12/2009 12:17 | 133 | -52.7270 | -40.1510 | Release unit pinged |
| 19/12/2009 12:20 | | -52.7269 | -40.1510 | Buoy released |
| 19/12/2009 12:22 | | -52.7268 | -40.1509 | Buoy sighted |
| 19/12/2009 12:25 | | -52.7262 | -40.1527 | Vessel moving towards buoy off DP. |
| 19/12/2009 12:30 | | -52.7245 | -40.1566 | Vessel on DP next to buoy. |
| 19/12/2009 12:34 | | -52.7238 | -40.1582 | Recovery line and buoy on board. |
| 19/12/2009 12:35 | | -52.7237 | -40.1587 | Recovery line attached. |
| 19/12/2009 12:41 | | -52.7232 | -40.1601 | Main buoy recovered on deck. |
| 19/12/2009 13:06 | | -52.7149 | -40.1647 | CTD recovered on deck. |
| 19/12/2009 13:58 | | -52.6877 | -40.1560 | Trimsin buoy cluster recovered on deck. |
| 19/12/2009 14:05 | | -52.6832 | -40.1545 | Lines switched over. |
| 19/12/2009 14:10 | | -52.6803 | -40.1531 | Sediment Trap & AQUADOOP recovered on deck. |
| 19/12/2009 14:53 | | -52.6449 | -40.1404 | Acoustic release recovered on deck. |
| 19/12/2009 14:57 | | -52.6416 | -40.1393 | Vessel off D.P. |
| 19/12/2009 23:57 | | -52.7227 | -40.1500 | Vessel all stopped on DP in P3 mooring position assessing conditions for CTD and nets. Heading 215 |
| 20/12/2009 00:19 | 134 | -52.7227 | -40.1500 | CTD in the water. |
| 20/12/2009 00:21 | | -52.7227 | -40.1500 | CTD on its way down to 1000 M |

but not suitable for science work.

assessing conditions.

Captain conning.

EA 600 depth 3791 (uncorrected).

range 3794 metres.

Hydrophone clear of the water.

heading towards it on DP.

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| 20/12/2009 00:44 | | -52.7227 | -40.1500 | CTD all stopped at 1000 metres. | |
| 20/12/2009 01:05 | | -52.7227 | -40.1500 | CTD out of the water. | |
| 20/12/2009 01:08 | | -52.7226 | -40.1499 | CTD recovered on deck. | |
| 20/12/2009 01:22 | 135 | -52.7227 | -40.1500 | Bongo (1) deployed. | |
| 20/12/2009 01:37 | | -52.7226 | -40.1501 | Bongo (1) recovered. | |
| 20/12/2009 01:39 | 136 | -52.7226 | -40.1501 | Bongo (2) deployed. | |
| 20/12/2009 01:54 | | -52.7226 | -40.1502 | Bongo (2) recovered. | |
| 20/12/2009 02:02 | 137 | -52.7226 | -40.1501 | N70 deployed (1) | |
| 20/12/2009 02:16 | | -52.7226 | -40.1502 | N70 recovered (1) | |
| 20/12/2009 02:18 | 138 | -52.7226 | -40.1501 | N70 deployed (2). | |
| 20/12/2009 02:33 | | -52.7226 | -40.1501 | N70 recovered (2) | |
| 20/12/2009 02:43 | 139 | -52.7226 | -40.1501 | N70 deployed (3). | |
| 20/12/2009 02:58 | | -52.7225 | -40.1502 | N70 recovered (3). | |
| 20/12/2009 02:59 | 140 | -52.7225 | -40.1502 | N70 deployed (4). | |
| 20/12/2009 03:14 | | -52.7225 | -40.1502 | N70 (4) recovered. | |
| 20/12/2009 03:24 | | -52.7225 | -40.1501 | Gantry stowed and secured | |
| 20/12/2009 03:27 | | -52.7225 | -40.1502 | Vessel coming off DP | |
| 20/12/2009 08:00 | 141 | -53.3471 | -39.6026 | Ship passes waypoint 1.1 North. Course 170T. Deploying XBT. | |
| 20/12/2009 08:07 | | -53.3584 | -39.5993 | Complete XBT deployment at 6 knots. Increasing to 10 for transect. | |
| 20/12/2009 09:09 | 142 | -53.5234 | -39.5505 | XBT 2 Deployed. V/L speed 6 knots. Course 170T | |
| 20/12/2009 09:16 | | -53.5343 | -39.5474 | Completed XBT 2. Increase speed to 10 kts | |
| 20/12/2009 10:19 | 143 | -53.7015 | -39.4978 | XBT 3 deployed. V/L speed 6kts. Course 170T | |
| 20/12/2009 10:26 | | -53.7130 | -39.4943 | Completed XBT 3. Increase to 10kt | |
| 20/12/2009 11:29 | 144 | -53.8805 | -39.4440 | XBT 4 deployed at 6 knots on 170. | |
| 20/12/2009 11:34 | | -53.8886 | -39.4416 | XBT 4 complete | increasing speed to 10 kts. |
| 20/12/2009 12:37 | 145 | -54.0549 | -39.3918 | XBT 5 deployed at 6 knots on 170. End of W1.1 | |
| 20/12/2009 12:42 | | -54.0627 | -39.3887 | XBT 5 complete | proceeding to 350 degree transect. |
| 20/12/2009 13:42 | | -54.0229 | -39.0893 | Vessel at start of transect W1.2 | moving at 10 knots on 350 |

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| 20/12/2009 17:59 | | -53.3175 | -39.3036 | Ship passes last waypoint of W1.2 North. Course 350 T. | |
| 20/12/2009 18:14 | | -53.3276 | -39.2991 | Vessel heading for CTD W1.2 N | as well looking for targets. |
| 20/12/2009 19:40 | | -53.5212 | -39.1814 | Commence turn upwind for RMT8. | |
| 20/12/2009 19:57 | 146 | -53.5143 | -39.1933 | RMT 8 deployed | |
| 20/12/2009 20:39 | | -53.4997 | -39.2357 | RMT 8 recovered on deck. Return to W1.2N | |
| 20/12/2009 20:54 | | -53.4930 | -39.2510 | On DP for CTD. | |
| 20/12/2009 21:02 | 147 | -53.4930 | -39.2510 | CTD deployed. Depth 3150m | |
| 20/12/2009 21:23 | | -53.4930 | -39.2511 | CTD stopped at 1004m of wire out | |
| 20/12/2009 21:45 | | -53.4930 | -39.2510 | CTD recovered. | |
| 20/12/2009 21:58 | 148 | -53.4930 | -39.2511 | Bongo (1) deployed | |
| 20/12/2009 22:12 | | -53.4931 | -39.2516 | Bongo recovered. | |
| 20/12/2009 22:13 | 149 | -53.4931 | -39.2516 | Bongo (2) deployed. | |
| 20/12/2009 22:29 | | -53.4934 | -39.2527 | Bongo (2) recovered | |
| 20/12/2009 22:38 | 150 | -53.4936 | -39.2536 | N70 deployed (1) | |
| 20/12/2009 22:49 | | -53.4939 | -39.2550 | N70 (1) Recovered | |
| 20/12/2009 22:51 | 151 | -53.4940 | -39.2552 | N70 deployed (2). | |
| 20/12/2009 23:06 | | -53.4944 | -39.2572 | N70 (2) recovered. | |
| 20/12/2009 23:08 | 152 | -53.4945 | -39.2574 | N70 deployed (3). | |
| 20/12/2009 23:24 | | -53.4949 | -39.2603 | N70 (3) recovered. | |
| 20/12/2009 23:26 | 153 | -53.4950 | -39.2606 | N70 (4) recovered. | |
| 20/12/2009 23:39 | | -53.4953 | -39.2630 | N70 (4) recovered. | |
| 20/12/2009 23:45 | | -53.4954 | -39.2640 | Vessel off D.P. Relocating 2 miles downwind of station for RMT 8 | |
| 21/12/2009 00:14 | | -53.5114 | -39.2066 | Vessel on heading 305 at 2.5 knots for W1.2N RMT. | |
| 21/12/2009 00:17 | 154 | -53.5102 | -39.2096 | RMT 8 deployed. | |
| 21/12/2009 01:27 | | -53.4813 | -39.2777 | RMT recovered on deck. | |
| 21/12/2009 01:30 | | -53.4799 | -39.2808 | Vessel heading to W1.2S station. | |
| 21/12/2009 03:56 | 155 | -53.7522 | -39.1438 | Commence RMT deployment | |
| 21/12/2009 04:09 | | -53.7494 | -39.1584 | Commenced hauling RMT | |
| 21/12/2009 04:16 | | -53.7483 | -39.1669 | RMT recovered on deck | bulwark up, heading for CTD |

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| 21/12/2009 05:07 | | -53.8459 | -39.1437 | Vessel on D.P | |
| 21/12/2009 05:11 | 156 | -53.8461 | -39.1439 | CTD in the water depth 289 m | |
| 21/12/2009 05:21 | | -53.8461 | -39.1439 | CTD all stopped at 274 metres. | |
| 21/12/2009 05:33 | | -53.8461 | -39.1439 | CTD out of the water and recovered on deck | |
| 21/12/2009 05:42 | | -53.8461 | -39.1442 | Vessel off D.P and proceeding to transect W2.1 | |
| 21/12/2009 07:58 | 157 | -53.9942 | -38.8189 | XBT 6 Deployed | speed 6kt, course 350T W2.1 commenced |
| 21/12/2009 08:01 | | -53.9889 | -38.8206 | XBT 6 complete | increase to 10kt |
| 21/12/2009 09:08 | 158 | -53.8181 | -38.8740 | XBT 7 deployed. V/L speed 6kts. Course 350T | |
| 21/12/2009 09:10 | | -53.8148 | -38.8749 | XBT 7 complete. Increase to 10kts | |
| 21/12/2009 10:18 | 159 | -53.6402 | -38.9294 | XBT 8 deployed. Speed 6kts. Course 350T | |
| 21/12/2009 10:26 | | -53.6266 | -38.9333 | XBT 8 complete. Increase to 10kts | |
| 21/12/2009 11:29 | 160 | -53.4640 | -38.9832 | XBT 9 deployed | on 350 degrees at 6 knots. |
| 21/12/2009 11:37 | | -53.4504 | -38.9875 | XBT complete | increase speed to 10 KTS |
| 21/12/2009 12:38 | 161 | -53.2874 | -39.0376 | XBT 10 deployed at 6 knots on 350. W2.1 finished | |
| 21/12/2009 12:42 | | -53.2809 | -39.0398 | XBT 10 complete | proceeding to next transect. |
| 21/12/2009 13:45 | | -53.2557 | -38.7507 | Vessel commencing W2.2 transect at 10 knots on 169. | |
| 21/12/2009 18:02 | | -53.9606 | -38.5273 | Ship passes last waypoint of W2.2 South. Course 170 T. | |
| 21/12/2009 21:06 | | -53.7857 | -38.5863 | V/L on DP in position for CTD | |
| 21/12/2009 21:08 | 162 | -53.7857 | -38.5863 | CTD deployed. 206 metres. | |
| 21/12/2009 21:17 | | -53.7857 | -38.5863 | CTD near bottom. 195 metres wire out. | |
| 21/12/2009 21:29 | | -53.7857 | -38.5863 | CTD recovered. | |
| 21/12/2009 21:43 | 163 | -53.7857 | -38.5862 | Bongo (1) deployed | |
| 21/12/2009 21:55 | | -53.7858 | -38.5874 | Bongo (1) recovered | |
| 21/12/2009 21:57 | 164 | -53.7858 | -38.5875 | Bongo (2) deployed | |
| 21/12/2009 22:11 | | -53.7860 | -38.5887 | Bongo (2) recovered | |
| 21/12/2009 22:16 | 165 | -53.7861 | -38.5890 | N70 (1) deployed | |
| 21/12/2009 22:30 | | -53.7862 | -38.5896 | N70 (1) Recovered | |
| 21/12/2009 22:32 | 166 | -53.7862 | -38.5897 | N70 (2) deployed | |
| 21/12/2009 22:47 | | -53.7863 | -38.5904 | N70 (2) recovered. | |
| 21/12/2009 22:48 | 167 | -53.7863 | -38.5905 | N70 (3) deployed | |

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| 21/12/2009 23:02 | | -53.7864 | -38.5911 | N70 (3) recovered. | |
| 21/12/2009 23:05 | 168 | -53.7864 | -38.5912 | N70 (4) deployed. | |
| 21/12/2009 23:20 | | -53.7865 | -38.5919 | N70 (4) recovered. | |
| 21/12/2009 23:22 | 169 | -53.7866 | -38.5920 | N70 (5) deployed. | |
| 21/12/2009 23:37 | | -53.7865 | -38.5921 | N70 (5) recovered. | |
| 21/12/2009 23:42 | | -53.7865 | -38.5921 | Vessel off DP heading 2 miles downwind of station to start RMT. | |
| 22/12/2009 00:07 | | -53.8178 | -38.5759 | Vessel coming ahead at 2.5 knots on 350 for W2.2S RMT. | |
| 22/12/2009 00:13 | 170 | -53.8134 | -38.5770 | RMT deployed. | |
| 22/12/2009 01:19 | | -53.7679 | -38.5870 | RMT recovered on deck | Vessel proceeding to W2.2N station for RMT. |
| 22/12/2009 03:19 | 171 | -53.4657 | -38.6915 | Commence RMT deployment | |
| 22/12/2009 04:20 | | -53.4216 | -38.6972 | Commence recovering RMT | |
| 22/12/2009 04:31 | | -53.4136 | -38.6994 | RMT recovered on deck | bulwark up |
| 22/12/2009 05:07 | | -53.4316 | -38.6955 | Vessel on DP | Commence CTD deployment |
| 22/12/2009 05:12 | 172 | -53.4317 | -38.6954 | CTD in the water depth 1000 m | |
| 22/12/2009 05:32 | | -53.4317 | -38.6953 | CTD all stopped at 1000 metres. | |
| 22/12/2009 05:52 | | -53.4317 | -38.6953 | CTD out of the water and recovered on deck | |
| 22/12/2009 06:05 | | -53.4279 | -38.6959 | Vessel off D.P and proceeding to transect W3.1 | |
| 22/12/2009 07:46 | 173 | -53.2217 | -38.4488 | XBT 11 deployed. Speed 6kts. Course 170T. Start of W3.1 | |
| 22/12/2009 07:52 | | -53.2317 | -38.4457 | XBT 11 complete. Increase speed to 10kts | |
| 22/12/2009 08:52 | 174 | -53.3967 | -38.3929 | XBT 12 deployed. Speed 6kts. Course 170T | |
| 22/12/2009 09:01 | | -53.4118 | -38.3881 | XBT 12 completed. Increase to 10kts | |
| 22/12/2009 10:01 | 175 | -53.5729 | -38.3353 | XBT 13 deployed. Speed 6kts. Course 169T | |
| 22/12/2009 10:08 | | -53.5849 | -38.3315 | XBT 13 complete | increase 10kts |
| 22/12/2009 11:09 | 176 | -53.7502 | -38.2780 | XBT 14 deployed | course 169, speed 6 knots. |
| 22/12/2009 11:11 | | -53.7535 | -38.2769 | XBT 14 complete | increasing speed to 10 knots. |
| 22/12/2009 12:17 | 177 | -53.9262 | -38.2204 | XBT 15 deployed at 10 knots on 169 degrees. | |
| 22/12/2009 12:19 | | -53.9295 | -38.2194 | XBT 15 complete | vessel heading to next transect. |

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| 22/12/2009 13:21 | | -53.9004 | -37.9048 | Vessel on W3.2S transect | 349 degrees at 10 knots. |
| 22/12/2009 17:47 | | -53.1850 | -38.1403 | Ship passes last waypoint of W3.2 South. Course 169 T. | |
| 22/12/2009 18:12 | | -53.2334 | -38.1172 | Vessel heading towards CTD W3.2 N | as well looking for targets. |
| 22/12/2009 19:05 | | -53.3612 | -38.0821 | V/L on DP in position for CTD | |
| 22/12/2009 19:07 | | -53.3612 | -38.0823 | Commence CTD deployment | |
| 22/12/2009 19:09 | 178 | -53.3612 | -38.0824 | CTD in the water | depth 1000m |
| 22/12/2009 19:30 | | -53.3612 | -38.0826 | CTD at 1000m wire out | |
| 22/12/2009 19:51 | | -53.3611 | -38.0826 | CTD recovered. | |
| 22/12/2009 20:05 | 179 | -53.3611 | -38.0827 | Bongo (1) deployed | |
| 22/12/2009 20:17 | | -53.3608 | -38.0837 | Bongo (1) recovered | |
| 22/12/2009 20:20 | 180 | -53.3607 | -38.0840 | Bongo (2) deployed | |
| 22/12/2009 20:35 | | -53.3605 | -38.0854 | Bongo (2) recovered | |
| 22/12/2009 20:42 | 181 | -53.3604 | -38.0860 | N70 (1) deployed | |
| 22/12/2009 20:55 | | -53.3604 | -38.0866 | N70 (1) Recovered | |
| 22/12/2009 20:58 | 182 | -53.3604 | -38.0867 | N70 (2) deployed | |
| 22/12/2009 21:12 | | -53.3602 | -38.0879 | N70 (2) recovered. | |
| 22/12/2009 21:14 | 183 | -53.3602 | -38.0880 | N70 (3) deployed | |
| 22/12/2009 21:27 | | -53.3600 | -38.0891 | N70 (3) recovered. | |
| 22/12/2009 21:30 | 184 | -53.3600 | -38.0894 | N70 (4) deployed. | |
| 22/12/2009 21:44 | | -53.3598 | -38.0904 | N70 (4) recovered. | |
| 22/12/2009 21:50 | | -53.3598 | -38.0903 | V/L off DP | proceed to RMT start position |
| 22/12/2009 22:22 | 185 | -53.3653 | -38.0322 | V/L 2.0' downwind of W3.2N | proceeding at 2.5kts, course 280T. RMT8 deployed |
| 22/12/2009 23:31 | | -53.3580 | -38.1156 | RMT recovered on deck. | |
| 22/12/2009 23:34 | | -53.3577 | -38.1196 | Vessel heading to CTD W3.2S station. | |
| 23/12/2009 01:53 | | -53.7227 | -37.9074 | Vessel proceeding at 2.5 knots on 282 | 2 miles downwind from station W3.2S |
| 23/12/2009 01:54 | 186 | -53.7225 | -37.9086 | RMT deployed. | |
| 23/12/2009 03:04 | | -53.7119 | -37.9900 | RMT recovered on deck | bulwark up |
| 23/12/2009 03:40 | | -53.7144 | -37.9656 | Vessel on D.P | |
| 23/12/2009 03:42 | 187 | -53.7143 | -37.9657 | Commence CTD deployment | |

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| 23/12/2009 03:45 | | -53.7142 | -37.9658 | CT D in the water depth 132 m | |
| 23/12/2009 03:53 | | -53.7142 | -37.9658 | CTD all stopped at 123 metres. | |
| 23/12/2009 04:01 | | -53.7142 | -37.9658 | CTD out of the water | |
| 23/12/2009 04:05 | | -53.7142 | -37.9658 | CTD recovered and gantry stowed | |
| 23/12/2009 04:15 | | -53.7142 | -37.9658 | Vessel off D.P | looking for targets. |
| 23/12/2009 06:15 | 188 | -53.8489 | -37.5831 | Commence RMT deployment | |
| 23/12/2009 06:54 | | -53.8454 | -37.6318 | RMT recovered on deck | bulwark up |
| 23/12/2009 07:40 | 189 | -53.8692 | -37.7284 | XBT 16 deployed. Speed 6kts. Course 349T | |
| 23/12/2009 07:43 | | -53.8617 | -37.7300 | XBT 16 complete. Increase to 10kts | |
| 23/12/2009 08:49 | 190 | -53.6931 | -37.7872 | XBT 17 deployed. Speed 6kts. Course 349T | |
| 23/12/2009 08:53 | | -53.6861 | -37.7897 | XBT 17 complete. Increase to 10kts | |
| 23/12/2009 09:56 | 191 | -53.5175 | -37.8462 | XBT 18 deployed. Speed 6kts. Course 349T | |
| 23/12/2009 10:02 | | -53.5081 | -37.8490 | XBT 18 complete. Increase to 10kts | |
| 23/12/2009 11:04 | 192 | -53.3374 | -37.9037 | XBT 19 deployed | speed 6 knots. |
| 23/12/2009 11:11 | | -53.3263 | -37.9072 | XBT 19 complete | increasing speed to 10 knots |
| 23/12/2009 12:13 | 193 | -53.1654 | -37.9639 | XBT 20 deployed at 6 knots on 348. | |
| 23/12/2009 12:19 | | -53.1551 | -37.9673 | XBT 20 complete increasing speed to 10 knots. | |
| 23/12/2009 12:59 | 194 | -53.1494 | -37.8313 | Start W4.2 XBT 21 deployed at 6 knots on 169. | |
| 23/12/2009 13:05 | | -53.1590 | -37.8276 | XBT 21 complete | increasing speed to 10 knots. |
| 23/12/2009 14:08 | 195 | -53.3250 | -37.7726 | XBT 22 deployed at 6 knots on 169. | |
| 23/12/2009 14:14 | | -53.3344 | -37.7694 | XBT 22 complete | increasing speed to 10 knots. |
| 23/12/2009 15:17 | 196 | -53.4984 | -37.7147 | XBT 23 deployed. Speed 6kts. Course 170T | |
| 23/12/2009 15:24 | | -53.5085 | -37.7108 | XBT 23 complete | increasing speed to 10 knots. |
| 23/12/2009 16:28 | 197 | -53.6762 | -37.6538 | XBT 24 deployed at 6 knots on 169. | |
| 23/12/2009 16:32 | | -53.6832 | -37.6515 | XBT 24 complete | increasing speed to 10 knots. |
| 23/12/2009 17:38 | 198 | -53.8533 | -37.5936 | XBT 25 deployed at 6 knots on 169. End of transect W4.2 | |
| 23/12/2009 17:43 | | -53.8616 | -37.5949 | Vessel heading towards WCB moorings. | |
| 23/12/2009 19:05 | | -53.7947 | -37.9292 | Vessel on DP | |
| 23/12/2009 19:15 | | -53.7947 | -37.9303 | Contact made with WCB bouy at 455m | |

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| 23/12/2009 19:23 | -53.7947 | -37.9309 | Mooring released at 401m | |
| 23/12/2009 19:24 | -53.7947 | -37.9309 | Hydrophone recovered | |
| 23/12/2009 19:33 | -53.7946 | -37.9309 | Buoy not sighted. Hydrophone redeployed | |
| 23/12/2009 19:35 | -53.7947 | -37.9309 | Secondary acoustic release activated to ensure release before v/l moves position | |
| 23/12/2009 19:42 | -53.7947 | -37.9309 | Both acoustics released a second time | |
| 23/12/2009 19:45 | -53.7946 | -37.9309 | Hydrophone recovered. V/L moving to position south to triangulate | |
| 23/12/2009 19:56 | -53.7978 | -37.9357 | V/L stopped 300m south of mooring position. Hydrophone deployed | |
| 23/12/2009 19:58 | -53.7979 | -37.9358 | Constant 394-396m received. Second release fired. | |
| 23/12/2009 20:02 | -53.7979 | -37.9358 | Mooring appears not to have released. V/L moves to new position | |
| 23/12/2009 20:17 | -53.7918 | -37.9353 | V/L stopped approx 370m north of position. Hydrophone deployed | |
| 23/12/2009 20:19 | -53.7918 | -37.9353 | Hydrophone recovered | |
| 23/12/2009 20:26 | -53.7917 | -37.9354 | Approx. position triangulated. V/L proceed to search with echo sounding | |
| 23/12/2009 20:40 | -53.7955 | -37.9346 | Mooring echoed below vessel. V/L stopped. | |
| 23/12/2009 20:57 | -53.7955 | -37.9346 | Decision to deploy weighted coring wire over stern & wrap round mooring to attempt release | |
| 23/12/2009 21:17 | -53.7956 | -37.9345 | Coring wire deployed. | |
| 23/12/2009 21:19 | -53.7956 | -37.9345 | Winch fault delays deployment | |
| 23/12/2009 21:45 | -53.7955 | -37.9346 | Winch ok. Commence wire deployment to bottom | |
| 23/12/2009 21:53 | -53.7955 | -37.9345 | Weight at bottom. Wire out 318m. V/L commences circling round mooring position | |
| 23/12/2009 22:25 | -53.7954 | -37.9343 | 2 turns around mooring complete. V/L proceed ahead course 260T. | |
| 23/12/2009 22:33 | -53.7956 | -37.9366 | V/L run approx. 100m ahead of mooring | wire out 1876m, commence hauling. |
| 23/12/2009 22:37 | -53.7957 | -37.9367 | Hydrophone deployed. 307m | |
| 23/12/2009 22:43 | -53.7957 | -37.9367 | Hydrophone recovered | |

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| 23/12/2009 22:54 | -53.7957 | -37.9368 | Mooring sighted at the surface. 800m wire remains for recovery | |
| 23/12/2009 23:01 | -53.7957 | -37.9365 | Wire off seabed. V/L commence proceeding towards recovery buoy | |
| 23/12/2009 23:09 | -53.7956 | -37.9334 | Weight for trawl wire clear of the water. | |
| 23/12/2009 23:17 | -53.7950 | -37.9326 | Grappling line attached to floating line between trimsin buoys. | |
| 23/12/2009 23:20 | -53.7951 | -37.9330 | Mooring drifting astern of the vessel. | |
| 23/12/2009 23:23 | -53.7956 | -37.9343 | Trimsin buoys recovered on deck | acoustic release lost. |
| 23/12/2009 23:27 | -53.7962 | -37.9358 | buoy clear of the water. | |
| 23/12/2009 23:28 | -53.7963 | -37.9358 | Buoy recovered on deck | mooring recovery complete. |
| 23/12/2009 23:38 | -53.7965 | -37.9357 | Sitting on DP moving buoys around aft deck | decision made to proceed to northern mooring after deck secure. |
| 23/12/2009 23:58 | -53.7964 | -37.9357 | Vessel off DP heading for Northern P3 mooring site. | |
| 24/12/2009 09:27 | -52.7632 | -40.1751 | V/L in DP | 4480m downwind of P3 position, head 215T |
| 24/12/2009 09:37 | -52.7632 | -40.1751 | Mooring ready on deck | V/L proceed towards position for depth of 3850m |
| 24/12/2009 09:43 | -52.7625 | -40.1748 | Buoy in water | V/L proceeds ahead @ 0.5kts |
| 24/12/2009 09:58 | -52.7600 | -40.1736 | CTD attached ~500m | going into water |
| 24/12/2009 10:04 | -52.7588 | -40.1730 | V/L increases speed to 1.5kts to increase weight on line | |
| 24/12/2009 10:37 | -52.7467 | -40.1672 | V/L slowed to 0.5kts | Trimsin cluster attached. |
| 24/12/2009 10:44 | -52.7455 | -40.1667 | Sediment Trap & AQUADOOP deployed | |
| 24/12/2009 11:56 | -52.7229 | -40.1557 | Acoustic release in the water. | |
| 24/12/2009 11:57 | -52.7229 | -40.1557 | Weight released | mooring deployed, EA600 uncorrected depth 3790 metres. |
| 24/12/2009 11:59 | -52.7227 | -40.1556 | Vessel all stopped on DP | awaiting buoy to sink before triangulation. |
| 24/12/2009 12:15 | -52.7228 | -40.1555 | Hydrophone deployed. | |
| 24/12/2009 12:30 | -52.7228 | -40.1554 | Acoustic release ranged at 3761 metres from hydrophone | 3748 metres corrected EA600 depth. Hydrophone recovered, vessel off DP, relocating 0.5 miles east for triangulation. |
| 24/12/2009 12:42 | -52.7236 | -40.1402 | Vessel all stopped on DP 0.5 miles east of previous | EA600 corrected depth 3748 metres. |

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| 24/12/2009 12:47 | | -52.7236 | -40.1400 | Constant reading of 3951 metres on Hydrostatic release. Hydrophone recovered. | |
| 24/12/2009 13:02 | | -52.7318 | -40.1564 | Vessel all stopped 0.5 miles south of deployment position | EA600 corrected depth 3748 metres, hydrophone deployed. |
| 24/12/2009 13:05 | | -52.7318 | -40.1563 | Hydrophone gives constant reading of 3841 metres | recovered on board. |
| 24/12/2009 13:10 | | -52.7318 | -40.1563 | Calculated position of mooring 52 43.4668S 40 09.5185W | |
| 24/12/2009 13:31 | 199 | -52.7318 | -40.1563 | CTD deployed | going to depth of 1000 metres, heading 000. |
| 24/12/2009 13:51 | | -52.7318 | -40.1563 | CTD out to 1000 metres | commence hauling. |
| 24/12/2009 14:10 | | -52.7317 | -40.1563 | CTD out of the water. | |
| 24/12/2009 14:14 | | -52.7318 | -40.1563 | Vessel off DP on course 122 | proceeding to Stromness for calibration. |
| 25/12/2009 04:12 | | -54.1601 | -36.6936 | Vessel at Stromness anchorage for calibration | Main jetty brg 273(T) X 0.59nm |
| 25/12/2009 09:08 | | -54.1597 | -36.6933 | CTD deployed | |
| 25/12/2009 09:14 | 200 | -54.1596 | -36.6935 | CTD at 72m wire out | |
| 25/12/2009 09:21 | | -54.1592 | -36.6931 | CTD recovered. | |
| 26/12/2009 06:40 | | -54.1597 | -36.6900 | Vessel on D.P | |
| 26/12/2009 08:10 | | -54.1598 | -36.6905 | Commence calibration | |
| 26/12/2009 10:39 | | -54.1598 | -36.6905 | Calibration complete. Lines clear of water | |
| 26/12/2009 11:19 | | -54.1598 | -36.6905 | Decision made to test acoustic release on CTD frame | before heading WCB mooring to attempt deployment. |
| 26/12/2009 12:08 | | -54.1596 | -36.6916 | CTD deployed with acoustic release attached for testing purposes. | |
| 26/12/2009 12:12 | 201 | -54.1595 | -36.6920 | CTD out to 50 metres and returning on its way up. | |
| 26/12/2009 12:14 | | -54.1595 | -36.6921 | CTD out of the water. | |
| 26/12/2009 12:16 | | -54.1594 | -36.6923 | CTD recovered on deck | acoustic release fine. |
| 26/12/2009 12:21 | | -54.1594 | -36.6927 | Commence heaving stbd anchor | port anchor already on its way up. |
| 26/12/2009 12:26 | | -54.1594 | -36.6927 | STBD Anchor foul with anchor cable and wire | attempting to clear. |
| 26/12/2009 17:57 | | -54.1592 | -36.6921 | Vessel off DP | proceeding to shallow mooring |

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| 27/12/2009 00:00 | | -53.7967 | -37.9346 | Vessel stopped on DP 230 metres downwind from WCB mooring position | EA600 uncorrected depth 312 metres. |
| 27/12/2009 00:31 | | -53.7967 | -37.9347 | Vessel moving ahead at 0.5 knots. | |
| 27/12/2009 00:33 | | -53.7965 | -37.9349 | Buoy deployed. | |
| 27/12/2009 00:34 | | -53.7963 | -37.9352 | Trimsin buoys deployed. | |
| 27/12/2009 00:43 | | -53.7954 | -37.9363 | Weight suspended over stern (ready to drop). Chain and acoustic release in the water. | |
| 27/12/2009 00:47 | | -53.7950 | -37.9368 | Weight released | EA600 corrected depth 301 metres. |
| 27/12/2009 00:49 | | -53.7947 | -37.9370 | Vessel moving 300 metres upwind from mooring deployment position for CTD. | |
| 27/12/2009 00:57 | | -53.7931 | -37.9397 | Vessel stopped 300 metres upwind from mooring position for CTD. | |
| 27/12/2009 01:05 | 202 | -53.7931 | -37.9397 | CTD deployed. | |
| 27/12/2009 01:14 | | -53.7931 | -37.9398 | CTD veering to approx 300 metres. | |
| 27/12/2009 01:20 | | -53.7931 | -37.9398 | CTD all stopped at 292 metres. | |
| 27/12/2009 01:27 | | -53.7931 | -37.9398 | CTD out of the water. | |
| 27/12/2009 01:29 | | -53.7931 | -37.9398 | CTD recovered on deck | |
| 27/12/2009 01:38 | | -53.7931 | -37.9397 | Vessel off DP heading for Transect's south of Bird Island. | |
| 27/12/2009 06:31 | | -54.1256 | -38.4269 | Vessel on 200 (T) trying out transect run with present weather conditions | |
| 27/12/2009 07:28 | | -54.1320 | -38.4240 | XBT at S2.2N cancelled due technical problem | |
| 27/12/2009 12:45 | | -54.9615 | -38.9428 | XBT at S2.2S deployed at 6 knots on 200. | |
| 27/12/2009 12:49 | | -54.9677 | -38.9468 | Further XBT problems encountered | continuing at 6 knots on 200. |
| 27/12/2009 13:00 | 204 | -54.9854 | -38.9581 | XBT complete | altering course to head for next transect. |
| 27/12/2009 14:00 | | -55.0033 | -38.7080 | Commencing S2.1S transect | No XBT due to technical problems. Heading in to 5 metre seas with up to 20 degrees leeway. |
| 27/12/2009 14:04 | | -54.9974 | -38.7047 | No data being recieved due to pitching and leeway | vessel continuing on transect. |

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| 27/12/2009 18:17 | -54.4983 | -38.4012 | Vessel leaving transect 2.1 S and heading towards midpoint of transect 1.2N | |
| 27/12/2009 19:05 | -54.5830 | -38.1924 | XBT deployed | joined midway along transect 1.2 |
| 27/12/2009 19:10 | -54.5924 | -38.1963 | XBT failed. Increase to 10kts | |
| 27/12/2009 20:13 | -54.7611 | -38.2968 | Transects abandoned due poor results from bad weather. V/L alters course for comfort whilst making towards southern mooring. | |
| 28/12/2009 14:51 | -55.2229 | -41.0680 | Vessel all stopped on DP Heading 253 for Southern mooring | assessing situation. |
| 28/12/2009 15:38 | -55.2229 | -41.0680 | Vessel off DP relocating position with regards to present weather | |
| 28/12/2009 15:40 | -55.2079 | -41.0603 | Vessel on DP for southern mooring | |
| 28/12/2009 16:30 | -55.2079 | -41.0625 | Vessel moving ahead at 0.5 knots on 259 | main buoy deployed |
| 28/12/2009 16:31 | -55.2079 | -41.0628 | Vessel coming ahead at 1.5 knots on 259 | and paying out 1200m of kevlar rope |
| 28/12/2009 16:38 | -55.2078 | -41.0677 | Increased ship speed to 2.0kt | |
| 28/12/2009 16:55 | -55.2074 | -41.0838 | Vessel slowing down to 1.0 knot | to deploy trimsin buoy cluster |
| 28/12/2009 16:58 | -55.2074 | -41.0853 | Trimsin buoys deployed. | |
| 28/12/2009 17:05 | -55.2073 | -41.0881 | Sediment Trap & AQUADOOP deployed | |
| 28/12/2009 17:06 | -55.2073 | -41.0886 | Increased ship speed to 1.5kt and paying out 1700m of kevlar rope | |
| 28/12/2009 17:11 | -55.2073 | -41.0922 | Increased ship speed to 2.0kts | |
| 28/12/2009 17:48 | -55.2065 | -41.1266 | Vessel slowing down to 1.0 kt | |
| 28/12/2009 18:02 | -55.2064 | -41.1336 | Railway wheel and acoustic release has been deployed | depth observed 3130m |
| 28/12/2009 18:15 | -55.2063 | -41.1340 | hydrophone deployed | |
| 28/12/2009 18:28 | -55.2063 | -41.1340 | Hydrophone back on board | Moving to new location. |
| 28/12/2009 18:39 | -55.2070 | -41.1473 | Vessel on DP | depth 3121m |
| 28/12/2009 18:45 | -55.2070 | -41.1473 | Hydrophone back on board | Moving to new location. |
| 28/12/2009 19:03 | -55.2006 | -41.1216 | V/L stopped on DP. Depth 3107 (corrected). Hydrophone deployed. | |
| 28/12/2009 19:07 | -55.2006 | -41.1216 | Hydrophone recovered. Calculated distance 691m | |
| 28/12/2009 19:18 | -55.1968 | -41.1330 | V/L stopped on DP. Hydrophone deployed. | |

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| 28/12/2009 19:22 | | -55.1968 | -41.1329 | Hydrophone recovered. Calculated distance 967m. Calc. position of mooring 55 12.3023S 041 07.7919W | |
| 28/12/2009 19:33 | 203 | -55.1968 | -41.1329 | CTD deployed | |
| 28/12/2009 19:52 | | -55.1968 | -41.1330 | CTD at depth | 1000m wire out |
| 28/12/2009 20:12 | | -55.1968 | -41.1330 | CTD recovered. | |
| 28/12/2009 20:23 | 205 | -55.1954 | -41.1494 | CPR deployed at 6 knots. | |
| 28/12/2009 20:28 | | -55.1929 | -41.1688 | V/L increases to passage speed | |