JR291 Cruise Report

Western Core Box, Moorings , CGS-87 and CGS-88

12th November to 19th December 2013

Contents

Tables and Figures

1 Introduction

1.1 Rationale

JR291 is a combined science and logistics leg of the 2013-14 voyage of the RRS James Clark Ross to the Antarctic. As part of the logistics element, the ship undertook base reliefs at Bird Island, King Edward Point and Signy. During the science part of the cruise we undertook the Western Core Box survey to determine the distribution and biomass of krill and other plankton to the northwest of South Georgia, refurbished 3 biological moorings in the South Georgia region. In addition samples were collected to undertake a suite of upper ocean carbon export measurements in collaboration with NOC (CGS-88). Finally the University of Hull undertook inter-tidal zone sampling at each of the Antarctic bases (CGS-87).

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

Table 1: Cruise Narrative

Time	Wind speed	Air pressure	Comment
12/11/2013 23:00	16.7	989.86	Depart Stanley for overnight transit to Mare Harbour SPM
13/11/2013 08:00	23.3	995.06	MPA unable to deliver fuel today. Science party continue mobilisation of laboratory equipment
14/11/2013 14:00	33	998.83	Fuelling completed. Ships set sail to KEP for first PAX transfer
17/11/2013 19:00	13.3	992.94	Arrive KEP and transfer first PAX. We will run over to BI overnight.
18/11/2013 21:00	10.4	999.31	A successful day of depositing cargo at BI. All fuel drums transferred and aft deck cleared ready for science.

19/11/2013 21:00	23.8	984.57	A slow start due to high winds, but then cargo work for BI resumed. All science gear and food delivered. Cargo ended on a blowey note, with still the waste to back load on the ship. As a result of wx forecast the decision was made to depart to KEP
20/11/2013 21:00	26	992.55	A day of cargo at KEP whilst the science team built the nets that are to be used during the cruise. Mobilisation went well, with even a bit of hexacopter flying for some personnel.
21/11/2013 21:00	18	987.28	A further day of cargo and handovers for KEP workers, whilst the science kit building continued. All tasks completed ready for a day of science in Cumberland Bay. A bar-b-que with KEP guys to finish the day off.
22/11/2013 21:00	8.3	1007.34	A day of bongoing, boxcoring and CTDing in Cumberland Bay to collect pteropod samples for the OA crew and copepods for Pete Ward. Six stations were completed in total from 250 m (a repeat of an Ocean Acidification station) to 25 m near Morraine Fjord. The only down was the bongo wire parting in the last cast of the day. This was followed by a search of the ship for 5 mm wire to replace it.
23/11/2013 21:00	18.5	1016.87	The morning was spent finishing off BI relief, picking up 160 (!!) waste fuel drums. Then on the way to P2 we tested the newly rebuilt bongo net, MOCNESS, RMT8 and snow catcher. The MOCNESS depth sensor reads incorrectly. Barring that all equipment worked. After the tests, we set forward to P2.
24/11/2013 21:00	14.1	1004.34	In transit to P2 to attempt to pick up mooring. Foggy day, low vis and on the edge sea state wise for recovery. The P2 mooring was unresponsive to the release gear, and we were unable to get an accurate response from the release unit. In the end it was decided to not release the mooring, as its exact position was unclear and the fog would make locating it difficult.
25/11/2013 21:00	41.3	975.48	In transit to Signy base relief and Signy mooring
26/11/2013 21:00	24.5	981.93	Arrived at Signy mooring location at 04:30 and assessed weather conditions for recovery. Despite windy conditions the sea state was decided to be suitable for recovery. Several attempts were made to communicate with the Signy mooring but no success. The vessel also moved on top of the weight deployment location, but the mooring was not seen on the echosounder. At 09:30, with concern that the release deck unit was not functioning correctly, we moved off towards the Signy base supply and a location to test the deck unit. The Signy BC and a few others started to open Signy. On their return we went 50 m waters to test the release gear on board with the deck unit. The release gear successfully worked with both the

			portable hydrophone and one of the ships transducers (although more temperamental)
27/11/2013 21:00	24.8	965.9	Signy base relief continues. All science personnel visited the base and partook in relief.
28/11/2013 21:00	5.1	957.38	The second day of base relief went relatively well, until the evening when Signy called to say a generator coupling had blown and spares and an engineer were required for the next day.
29/11/2013 21:00	18.1	966.13	Engineer and spares dropped at Signy, then ship moved round to drop water at Cummings hut. Returned to Signy evening after incident with rib. After Signy declared happy, the ship left for the Signy mooring site.
30/11/2013 21:00	9.1	976.52	Ship undertook an acoustic survey of the mooring area to see if it was visible on the EK60, EM122 or EA600. Mooring not seen. Many attempts were made to interrogate either release on the mooring with no response. At 11:00 a decision was made to dredge for the mooring near the release site. This came up with mud, but no mooring. At 15:30 the ship finished operations to locate the mooring and headed north to the Not Ice station to undertake some science before bad weather arrived. MOCNESS and CTD were completed.
01/12/2013 21:00	25.1	983.85	SAPS and snowcatcher finished off Ice1 station. The vessel moved an hour north to Ice 2 station and a MOCNESS, bongo, CTD and snowcatcher completed operations near Signy. Once the station finished, in worsening weather the ship set sail for P2.
02/12/2013 21:00	15.7	993.38	Arrived at P2 and commenced attempting to communicate with the mooring releases. The new release was unresponsive, but eventually communication with the old release was established and the mooring released. Recovery went smoothly and then station activities commenced at a location 5 miles away from the mooring site. MOCNESS, CTDs and Snowcatcher all went smoothly. The MOCNESS contained a large number of pteropods, in the middle of a large quantity of phytoplankton that clogged the nets. In the mean time attempts were made to turn the mooring around for a morning deployment before bad weather kicks in.
03/12/2013 21:00	34.8	977.67	P2 operations continuing with MOCNESS, CTD, SAPS more snowcatcher and bongos. Activities ceased at 17:00 in worsening weather to relocate to Stromness to hide from a weather front coming through and to undertake calibration of the echosounders.
04/12/2013 21:00	17.6	957.27	Arrived Stromness at ~15:00 local and undertook a CTD prior to calibration of the ES853 and EK60. The ES853 calibration went smoothly. This was followed by the EK60 calibration. The first 38 kHz

			sphere was put into place, and just as calibration was going to start the EK60 computer failed. After switching to the spare EK60 computer, the 38 kHz calibration went smoothly. However, on recovery of the 38 kHz sphere the sphere got snagged on the underside of the ship. Several attempts to release by running a shackle down the forward lines didn't work. At 23:30, in worsening weather and squalls the calibration was postponed until daylight to retrieve the sphere.
05/12/2013 21:00	16.8	979.7	At 07:00 calibration resumed. A shackle run down the aft line cleared the sphere. The calibration was then once again postponed due to bad weather and resumed at 10:45. After that things went smoothly and the EK60 calibration was finished by 13:00. The ship headed round to Cumberland bay to drop off Hugh Marsden, before undertaking some trial RMT8s in Cumberland Bay with the USBL mounted on the wire to examine position behind the ship. The evening ended with Bongos towards Kind Edward Cove.
06/12/2013 21:00	14.7	980.86	Work recommenced at the WCB mooring. First with a stratified RMT8, where we also tested the USBL. Followed by a CTD and bongo and finally ending with a successful deployment of the mooring. The buoy was located at 250 m in the water in the EA600, lying in 320 m water depth. The ship then headed for P2 to redeploy the P2 mooring.
07/12/2013 21:00	11	979.16	The day commenced with a few bongos first to try and find some pteropods for experiments. With perfect weather, the P2 mooring was deployed within 4 hours. The rest of the day was spent undertaking SAPS, snowcatchers, CTD and bongos. A decision was made to cease operations at P2 to head to P3 to occupy a weather window to recover the P3 mooring.
08/12/2013 21:00	27.6	984.95	Arrived P3 at 07:00 to commence mooring recovery in moderate winds and seas. The mooring responded to the first ping and it was decided to go for recovery. Recovery finished at 10:00 followed by a CTD and SAPS in worsening weather. The rest of the day was spent examining the weather and undertaking activities as possible. Some horizontal bongos were followed by a night time CTD. P3 was departed at midnight to head to the beginning of the WCB W1.1N.
09/12/2013 21:00	24.2	989.95	The core box started at 06:00 local time. Weather typically lumpy. Xbts through the day as expected but the weather prevented the RMT and bongo nets overnight, whilst CTDs continued.
10/12/2013 21:00	20	994.04	The second day of the core box resumed at 06:00. All xbts undertaken and net hauls. In addition target fishing over night caught krill for length frequency

			measurements.
11/12/2013 21:00	20.8	988.88	The third day of the core box saw slightly calmer sees. The daytime activities had better acoustics and the nighttime activities went smoothly. More oblique RMT8s and more target fishing.
12/12/2013 21:00	23.7	993.88	The final day of the core box, all xbts completed. RMT8 nets for target fishing overnight, in addition we headed west towards W1.2S to complete the oblique haul missed from the first day.
13/12/2013 21:00			Completed W1.2S oblique RMT8 and continued on to P3 for mooring deployment.
14/12/2013 21:00			The P3 mooring was not re-deployed due to failed sediment trap and ADCP. Instead station work continued with MOCNESS (x3), snowcatcher (x2), CTDs and bongos. Pteropods caught in amounts. At midday we relocated towards W1.2N. However, it was found to be unworkable due to weather so the decision was made to relocate north to the previously identified (from the Discovery 2010 cruise JR177) upwelling site.
15/12/2013 21:00			CTDs started at around 03:00 LT when weather had ameliorated and daylight was sufficient. Four CTD sites later and upwelling was suspected at all. As a result bongos were undertaken at the last station, before heading south for a last effort at target fishing.
16/12/2013 21:00			Three RMT8s were completed with krill found in all, the last one with large krill that we had been searching for. At 01:30 local time we turned west towards Stanley to rock and roll home.
17/12/2013 21:00			Rocking and rolling towards Stanley. The cruise dinner also.
18/12/2013 21:00			Demob continued. The container was packed mostly, with only a few boxes to add at the end.
19/12/2013 21:00			Arrived Stanley alongside at 07:15 LT. Container packing continued and lab clearing. Pick up at 04:15!

1.4 Cruise Track

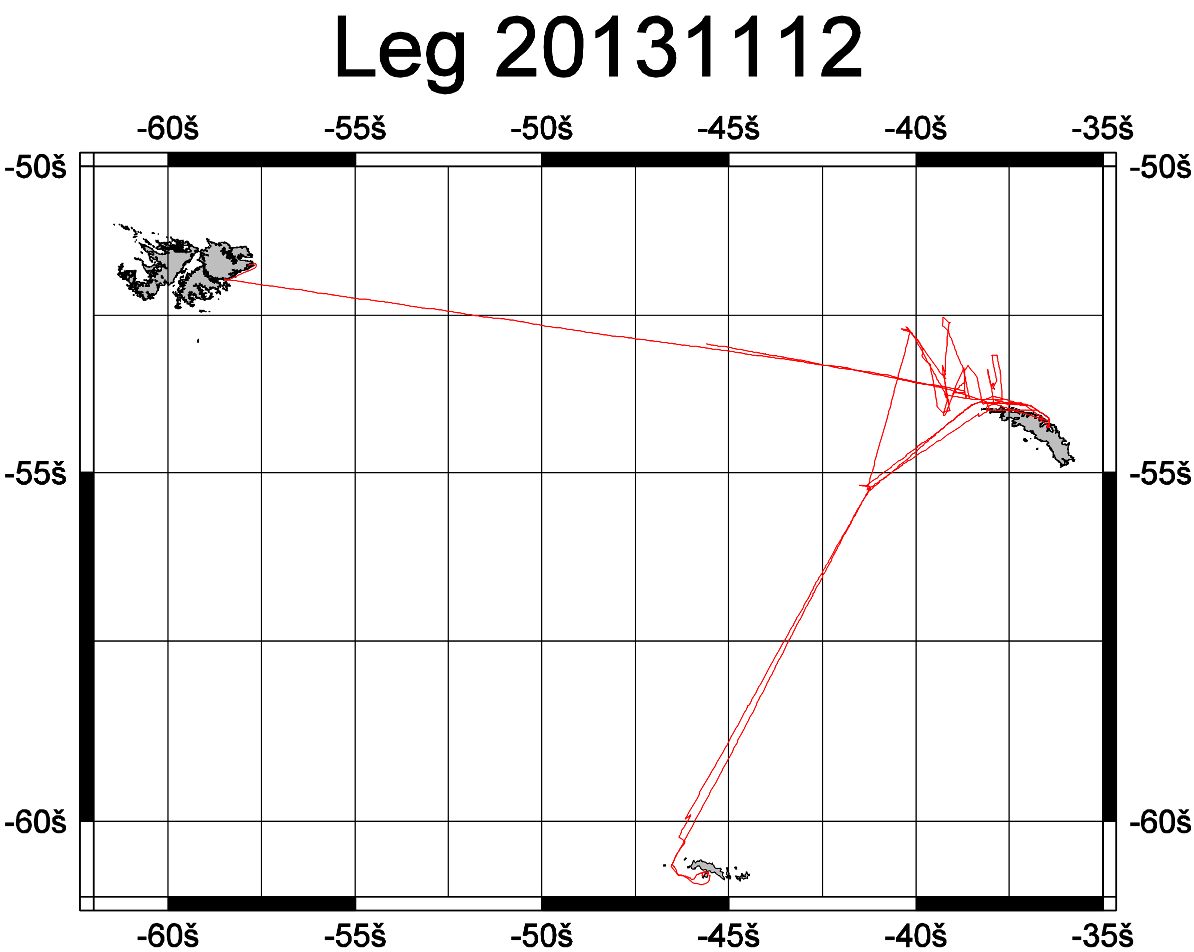


Figure 1: Cruise Track

1.5 Personnel

Table 2: Cruise Staff

Scientific staff

Name	Organisation (Funding Body)	Email Address	Scientific Interest	Equipment operated or used
Fielding, Sophie	BAS (NERC)	sof@bas.ac.uk	Principle Scientific Officer	Acoustics, RMT8
Bazeley-White, Ellen	BAS (NERC)	eab@bas.ac.uk	Data Manager	XBTs & CTDs
Belcher, Anna	NOC (NERC)	A.Belcher@noc.soton.ac.uk	Marine snow	Marine Snow Catcher
Ceballos-Romero, Elena	University of Sevilla	elecebrom@alum.us.es	Radionucleides	Underway water & CTD water samples
Enderlein, Peter	BAS (NERC)	pend@bas.ac.uk	Gear	Moorings
England, Andrew	BAS (NERC)	aeng@bas.ac.uk	ICT	XBTs
Klepacki, Julian	BAS (NERC)	jzk@bas.ac.uk	Marine Engineer	CTDs
Manno, Clara	BAS (NERC)	clanno@bas.ac.uk	Zooplankton	Nets
Moigne, Frederic Le	NOC (NERC)	F.LeMoigne@noc.soton.ac.uk	Radionucleides	SAPs
Guihen, Damien	BAS (NERC)	damaoi@bas.ac.uk	Biological oceanography	Acoustics, RMT8
Peck, Victoria	BAS (NERC)	vlp@bas.ac.uk	Foraminifera/pteropods	Nets, boxcorer
Polfrey, Scott	BAS (NERC)	scopol@bas.ac.uk	Marine Engineer	Marine Engineer
Richardson, Andrew	University of Hull	a.j.richardson@2005.hull.ac.uk	Coastal biology	Inter-tidal sampling
Robst, Jeremy	BAS (NERC)	jpro@bas.ac.uk	ICT	XBTs
Stowasser, Gabriele	BAS (NERC)	gsto@bas.ac.uk	Bioenergetics	Nets
Tarling, Geraint	BAS (NERC)	gant@bas.ac.uk	Zooplankton	Nets
Ward, Peter	BAS (NERC)	pwar@bas.ac.uk	Zooplankton	Nets, boxcorer

Others on board during cruise		
Brown, Craig	BAS (NERC)	Elec Serv Tech BI
Canham, Stephen	BAS (NERC)	Facilities Engr
Fothergill, Clare	BAS (NERC)	Environmental
Marsden, Hugh	BAT	BAT Postal Clerk

BAS staff and collaborators in transit to/from bases:	
Adlard, Stacey	Signy

Bokhorst, Stef (collaborator)	Signy
Bradley, Adam	Bird Island
Cousens, Paul	KEP
Harvey, Mark	Signy
Hooper, Matthew	KEP
Hunt, Julie	KEP
Jobson, Matthew	Signy
Luck, Cian	Bird Island
Maltman, Bruce	Signy
McKenna, James	KEP
Phillips, Matthew	KEP
Ratcliffe, Norman	Signy
Tsentides, Manos	Bird Island
Ulaganathan, Yogabaanu (collaborator)	Signy
Walkup, Jessica	Bird Island
Whittamore, Leslie	KEP

JCR Officers and Crew

Chapman, Graham	Master
Evans, Simon	Chief Officer
Hipsey, Christopher	2nd Officer
Delph, Georgina	3rd Officer
Waddicor, Charles	ETO (Coms)
Parnell, Luke	Chief Engineer
Collard, Glynn	2nd Engineer
McManus, Graeme	4th Engineer
Eadie, Steven	4th Engineer
WRIGHT Simon A	Deck Engineer
Dunbar, Nicholas	ETO (Eng)
Gibson, James "Hamish"	Purser
Stewart, George	Bosun SciOps
Mullaney, Clifford	Bosun
O'Duffy, John	Bosun's Mate
Triggs, David	AB
Leggett, Colin	AB
Riddell, Terrence	AB
Cordiner, Norman	AB
Horton, Richard	AB
Wilson, Paul	Motorman
Munoz Garcia, Paula	Motorman
Walker, Keith	Cook
Molloy, Padraig	2nd Cook
Weston, Kenneth	Senior Steward
Newall, James	Steward

Lee, Derek	Steward
Patterson, Thomas	Steward
Woodland, Hazel	Doctor

1.6 Acknowledgements

This cruise is part of a long term commitment by the BAS Ecosystems programme to investigate the ecology of the Scotia Sea ecosystem and understand the variability and change occurring in the region. The cruise was undertaken by a small team of scientists and support staff who carried out both their own work and all the general cruise tasks. Their enthusiasm and teamwork enabled the objectives to be completed successfully.

The cruise also had a significant logistic element to it and the entire science team (and ship) worked tirelessly to complete the base reliefs, moving cargo and helping in a variety of tasks.

We thank the ship's officers and crew for their continued enthusiastic and expert support. We are grateful for their professionalism and helpful attitude that enables work to be completed successfully.

1.7 Station summary

Table 3: Station Visits

Dates	Events	Station	Equipment	Notes
22/11/2013	1 to 15	Cumberland Bay	Bongo Nets, CTD, Box Corer	
23/11/2013	16 to 20	Test Nets	Bongo Nets, MOCNESS, RMT 8, Marine Snow Catcher	
24/11/2013	21	P2 / Southern Mooring Site	Mooring	First visit to site – mooring located
26/11/2013	N/A	Signy Mooring Site	Mooring	First visit to site – mooring recovery failed
30/11/2013	N/A	Signy Mooring Site	Mooring	Second visit to site – mooring recovery failed
30/11/2013 & 01/12/2013	22 to 29	ICE1	Bongo Nets, CTD, MOCNESS, Marine Snow Catcher, SAPs	
01/12/2013	30 to 35	ICE2	Bongo Nets, CTD, MOCNESS, Marine Snow Catcher	North of ICE1 by 10 km
02/12/2013 & 03/12/2013	N/A (mooring), 36-47	P2 / Southern Mooring Site	Mooring, CTD, MOCNESS, Marine Snow Catcher, SAPs	Second visit to site – mooring recovered
04/12/2013 & 05/12/2013	48, N/A (calibrations)	Stromness	CTD, Echo Sounders	Calibration of Echo Sounders

05/12/2013 & 06/12/2013	49 to 56	Cumberland Bay	Bongo Nets, RMT 8	
06/12/2013	57 to 59, N/A (mooring)	Western Core Box	Bongo Nets, CTDs, RMT 8, Mooring	
07/12/2013	60 to 69	P2 / Southern Mooring Site	Bongo Nets, CTDs, Marine Snow Catcher, SAPs, Mooring	Third visit to site – mooring deployed
08/12/2013	70 to 75	P3 / Northern mooring Site	Bongo Nets, CTDs, SAPs	First visit to site – mooring recovered
09/12/2013 to 13/12/2013	76 to 122	Western Core Box	Bongo Nets, CTDs, RMT 8, XBTs	See Western Core Box table of events
13/12/2013 & 14/12/2013	N/A, 122 to 138	P3 / Northern mooring Site	Bongo Nets, CTDs, MOCNESS, Marine Snow Catcher, SAPs	Second visit to site – mooring couldn't be deployed
15/12/2013 & 16/12/2013	139 to 147	Upwelling Site / SU9	Bongo Nets, CTDs, RMT 8	

1.8 Data statement

All electronic data saved for cruise JR291 was saved to the BAS unix drives in the folder JR20131112.

2 Physical Oceanography and phytoplankton

2.1 Underway Navigational Instrumentation

Navigational data were collected continuously throughout the cruise. Data from the following instrumentation were collected:

Ashtec ADU-5 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)

VT-TSS DMS-05 (heave, pitch, roll)

Hull-mounted Simrad EA600 Hydrographic 12kHz Echosounder (transducers located approximately 5m below the water level). **It must be noted that the datastream is still called 'sim500', so all programs are named according to this, despite the instrument being an EA600.**

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

2.2 Underway Oceanlogger Instrumentation

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. Instruments were as follows:

Oceanlogger sensors

SeaBird Electronics SBE45 CTD

Chelsea Technologies 10-AU 005 Fluorometer

Litre meter F112P Flow meter

Meteorological sensors

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

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

Wetlabs C-star Transmissometer

Kipp & Zonen SPLite2 (TIR 1)

Kipp & Zonen SPLite2 (TIR 2)

Air temperature/humidity 1, Rotronic MP402H-050300

Air temperature/humidity 2, Rotronic MP402H-050300

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). Both surface ocean and meteorological data were collected at 5 second intervals.

2.3 Vessel-mounted Acoustic Doppler Current Profiler (ADCP)

Sophie Fielding BAS

No ADCP data processing was done on this cruise and this report is from JR245 to summarise the ADCP instrumentation.

2.3.1 Instrumentation

A 75 kHz RD Instruments Ocean Surveyor (OS75) ADCP was used during this cruise. The OS75 unit is sited in the transducer well in the hull of the *JCR*. This is flooded with a mixture of 90% de-ionised water and 10% monopropylene glycol. With the previous 150 kHz unit, the use of a mixture of water/antifreeze in the transducer chest required a post-processing correction to derived ADCP velocities. However, the new OS75 unit uses a phased array transducer that produces all four beams from a single aperture at specific angles. A consequence of the way the beams are formed is that horizontal velocities, derived using this instrument, are independent of the speed of sound (vertical velocities, on the other hand, are not), hence this correction is no longer required.

The OS75 transducer on the JCR is aligned at approximately 60 degrees relative to the centre line. This differs from the recommended 45 degrees. Shortly after sailing for JR139, the hull depth was measured by Robert Patterson (Chief Officer), and found to be 6.47m. Combined with a value for the distance of the transducer behind the sea-chest window of 100-200mm and a window thickness of 50mm, this implies a transducer depth of 6.3m. This is the value generally assumed, but note that the ship was very heavily laden during cruise JR139, and for other cruises it may be shallower.

The ADCP ping rate was controlled by the SSU. The EK60 was set as master through the SSU and the single-beam echosounder (EA600) and OS75 were set as slaves, pinging in multiple ping rates of 2 seconds. On occasions when the swath was run during the cruise, the swath was pinged by the SSU in a separate group within the SSU, and the EK60/ADCP pinged multiple times in a different group.

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

2.3.2 Configuration

The OS75 was controlled using Version 1.42 of the RDI VmDas software. The instrument was always synchronized with the other acoustic instruments through the SSU with a 2 second ping rate. With fifty bins the ADCP pings every 4 seconds but with fewer bins it can ping every 2 seconds. When on bottom tracking mode the bottom track ping does not synchronise with the SSU and so interference occurs in the EK60, this can therefore only be run when loss of data quality from that instrument is acceptable. Narrowband profiling was enabled with an 8 meter blanking distance (Note that this blanking distance is larger than the 2m initially used by the RDI technician during the trials cruise. This change was adopted following advice from Dr. Mark Inall and Dr. Deb Shoosmith, who voiced concerns over the quality of data in the top bin). Despite this, there were still periods, especially in bad weather, where the data in the top bin looked bad. Salinity at the transducer was set to zero, and Beam 3 misalignment was set to 60.08 degrees (see above discussion). Full configuration files for each mode used are given at the end of this section.

2.3.3 Outputs

The ADCP writes files to a network drive that is samba-mounted from the Unix system. The raw data (.ENR and .N1R) are also written to the local PC hard drive. For use in the matlab scripts the raw data saved to the PC would have to be run through the VMDas software again to create the .ENX files. When the Unix system is accessed (via samba) from a separate networked PC, this enables post-processing of the data without the need to move files.

Output files are of the form JR245_XXX_YYYYYY.ZZZ, where XXX increments each time the logging is stopped and restarted, and YYYYYY increments each time the present filesize exceeds 10 Mbyte.

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

.N1R (NMEA telegram + ADCP timestamp; ASCII)

.ENR (Beam co-ordinate single-ping data; binary). These two are the raw data, saved to both disks

.VMO (VmDas configuration; ASCII)

.NMS (Navigation and attitude; binary)

.ENS (Beam co-ordinate single-ping data + NMEA data; binary)

.LOG (Log of ADCP communication and VmDas error; ASCII)

.ENX (Earth co-ordinate single-ping data; binary). This is read by matlab processing

.STA (Earth co-ordinate short-term averaged data; binary)

.LTA (Earth co-ordinate long-term averaged data; binary).

The .N1R and .LTA files are streamed back to Cambridge for use in google earth real time plotting.

2.4 CTD deployment and data acquisition

Ellen Bazeley-White, Julian Klepacki, BAS

2.4.1 Introduction

A Conductivity-Temperature-Depth (CTD) unit was used to vertically profile the water column. 23 casts were carried out in total, as part of the Western Core Box, at mooring locations, at target fishing locations and other survey stations. The CTD was operated by Julian Klepacki, assisted by Ellen Bazeley-White who also maintained the CTD event logs.

2.4.2 CTD instrumentation and deployment

An SBE32 carousel water sampler, holding 24 12-litre niskin bottles, an SBE9Plus CTD and an SBE11Plus deck unit were used. The SBE9Plus unit held dual SBE3Plus temperature and SBE4 conductivity sensors and a *Paroscientific* pressure sensor. An SBE35 Deep Ocean Standards Thermometer makes temperature measurements each time a bottle is fired, and time, bottle position and temperature are stored, allowing comparison of the SBE35 readings with the CTD and bottle data. Additional sensors included an altimeter, a fluorometer, two oxygen sensors, a photosynthetically active radiation (PAR) sensor and a transmissometer. The altimeter returns real time accurate measurements of height off the seabed within approximately 100m of the bottom.

This allows more accurate determination of the position of the CTD with respect to the seabed than is possible with the Simrad EA600 system, which sometimes loses the bottom and, in deep water, often returns depths that are several tens of metres deeper than the true bottom location. A fin attached to the CTD frame reduced rotation of the package underwater. The CTD package was deployed from the mid-ships gantry on a cable connected to the CTD through a conducting swivel.

CTD data were collected at 24Hz and logged via the deck unit to a PC running Seasave, version 7.21d (Sea-Bird Electronics, Inc.), which allows real-time viewing of the data. The procedure was to start data logging, deploy the CTD, then stop the instrument at 10m wireout, where the CTD package was left for at least two minutes to allow the seawater-activated pumps to switch on and the sensors to equilibrate with ambient conditions. The pumps are typically expected to switch on 60 seconds after the instrument is deployed.

After the 10m soak, the CTD was raised to as close to the surface as wave and swell condition allowed and then lowered to within 10m of the seabed. Bottles were fired on the upcast, where the procedure was to stop the CTD winch, hold the package *in situ* for a few seconds to allow sensors to equilibrate, and then fire a bottle. The sensor averages these readings to produce one value for each bottle fire. Short times between firing pairs of bottles sometimes led to no SBE35 readings for the second bottle of the pair.

Bottle firing depths were determined by sampling requirements for ocean acidification and carbon export experiments.

2.4.3 Data acquisition and preliminary processing

The CTD data were recorded using Seasave, version 7.21d, which created four files:

JR291_[NNN].hex binary data file

JR291_[NNN].XMLCON ascii configuration file with calibration information

JR291_[NNN].hdr ascii header file containing sensor information

JR291_[NNN].bl ascii file containing bottle fire information

where NNN is the CTD number (column 1 in Table 3). The *.hex* file was then converted from binary to ascii using the SBE Data Processing software *Data Conversion* module. The output was a file named *jr291ctd[NNN].cnv*. The *Data Conversion* module calculates parameters using the coefficients detailed in Appendix H as follows:

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

where *P* is the pressure (dbar), *T* is the pressure period in µsec, $D = D_1 + D_2U$,

$C = C_1 + C_2U + C_3U$ and $T_0 = T_1 + T_2U + T_3U_2 + T_4U_3 + T_5U_4$ are calculated from the coefficients detailed in Appendix H, where *U* is the temperature in ˚C.

Conductivity: $$cond = \frac{(g+hf^2+if^3+jf^3)}{10(1+\delta t+\epsilon p)}$$

where *cond* is the conductivity in Sm-1, *p* is pressure, *t* is temperature, *δ* = CTcor and *ε* = CPcor. All coefficients are included in Appendix H.

Temperature: $$temp(ITS90) = \frac{1}{\{g+h[ln(f_0/f]+i[In^2(\frac{f0}{f})]+j[ln^3(\frac{f0}{f})]\}} - 273.15$$

Where the temperature, *temp*, is measured in ˚C, *g*, *h*, *i* and *j* are coefficients detailed in Appendix H and *f* is the frequency output by the sensor.

Oxygen: $$oxy = \left(Soc(V+Voffset)\right)e^{Tcor|T}Oxsat(T,S)e^{Pcor.p}$$

where *oxy* is dissolved oxygen in ml/l, *V* is the voltage output from the SBE43 sensor, *Oxsat* is oxygen saturation (ml/l), a function of temperature, *T*, salinity, *S*, and pressure, *P*, and the remaining coefficients are detailed in Appendix H.

PAR: $$PAR = \left(\frac{multiplier.10^9.10^{\frac{V-B}{M}}}{C}\right) + offset$$

where *V*, *B*, *M*, *offset*, *multiplier* and *C*, the calibration constant, can be found in Appendix H.

Fluorescence: $$flsc = \frac{slope(10e^{V/slope\,factor}) - 10e^{VB})}{10e^{V1} - 10e^{Vacetone}} + offset$$

Where *flsc* is measured in µg/l, *V* is the fluorometer output voltage and the remaining coefficients can be found in Appendix H.

Transmission: $\boldsymbol{Light\ transmission = M.output\ voltage + B}$

where light transmission is measured in % and *M* and *B* are derived from measured voltages through air and water in light and darkness, and are included in Appendix H.

The SBE Data Processing *Cell thermal mass* module was then used to remove the conductivity cell thermal mass effects from the measured conductivity. This reads in the *jr291ctd[NNN].cnv* file and re-derives the pressure and conductivity, taking into account the temperature of the pressure sensor and the action of pressure on the conductivity cell. The output is another ascii file, named as *jr291ctd[NNN]_ctm.cnv*. The correction applied to the CTD data is detailed below:

Corrected conductivity = conductivity + ctm

Where

$$ctm = -1\left(\frac{1-5\alpha}{2s\beta+4}\right)xctm_0 + \frac{2\alpha}{s\beta+2}x0.1(1+0.006[T-20])x\Delta T$$

and *s* is the sample interval, *T* is temperature, *ctm0* is the uncorrected cell thermal mass,

α = 0.03 and β = 7.0.

2.4.4 CTD casts

23 CTD casts were undertaken. Water samples were collected at some, identified in the Table 4.

Table 4: CTD stations

Station name	Time	Bridge Event Number	Lat (seatex)	Lon (seatex)	Wire out max (m)	Max Depth (m)	Bottles fired
Cumberland Bay Station 1	22/11/2013 11:39	2	-54.2783	-36.4377	243	244	1 to 24
Cumberland Bay Station 4	22/11/2013 18:57	12	-54.298	-36.4419	93	94.2	1 to 10
ICE1	30/11/2013 23:05	26	-60.2091	-46.3351	2190	2003.3	1 to 24
ICE2	01/12/2013 12:34	33	-59.9623	-46.1597	2200	2201	1 to 17
P2/Southern mooring site	02/12/2013 22:28	37	-55.1915	-41.342	3000	3003	1 to 24
P2/Southern mooring site	03/12/2013 05:59	41	-55.1914	-41.3421	198	200	1 to 11
Stromness	04/12/2013 17:07	48	-54.1597	-36.6943	76		None
Western Core Box mooring site	06/12/2013 11:53	58	-53.8017	-37.9378	305		None

P2/Southern mooring site	07/12/2013 13:41	63	-55.2586	-41.2949	3419	3000	1 to 24
P3 mooring site	08/12/2013 12:13	70	-52.7693	-40.1561	3735	3298	1 to 24
P3 mooring site	08/12/2013 22:44	75	-52.7656	-40.1573	3724	3300	1 to 20
WCB1.2N	09/12/2013 20:12	81	-53.4927	-39.2511	1000		1 and 2
WCB1.2S	09/12/2013 23:38	82	-53.8458	-39.1437	260		1 and 2
WCB2.2S	10/12/2013 19:28	88	-53.7848	-38.5839	188		1 and 2
WCB2.2N	11/12/2013 05:27	94	-53.4321	-38.695	1000		1 and 2
WCB3.2N	11/12/2013 21:52	103	-53.361	-38.0829	1000		1 and 2
WCB3.2S	12/12/2013 05:35	107	-53.7137	-37.9655	120		None
P3 mooring site	13/12/2013 12:15	122	-52.7689	-40.155	2000	2005	1 to 19
P3 mooring site	14/12/2013 05:01	132	-52.7692	-40.154	3728	3733	1 to 18
Upwelling site/SU9	15/12/2013 05:13	139	-52.6266	-39.112	1995	2000	1 to 13
Upwelling site/SU9	15/12/2013 08:03	140	-52.5327	-39.2692	1995	2000	1 to 13
Upwelling site/SU9	15/12/2013 10:41	141	-52.7609	-39.136	1995	2000	1 to 13
Upwelling site/SU9	15/12/2013 13:16	142	-52.7609	-39.136	2000	2003	1 to 13

2.5 Underway Sampling for chlorophyll

Frédéric Le Moigne, Anna Belcher and Elena Ceballos-Romero, NOC

2.5.1 Introduction

The underway (UW) supply brings external surface seawater into the ship's science labs from an inlet in the hull at about 6m below the waterline. Samples from this source were therefore always taken from the surface mixed layer of the ocean and never from a variety of depths.

2.5.2 Objectives

The first objective is characterize the different biogeochemical provinces of the Southern Ocean (Le Moigne et al., 2013a) encountered during the cruise in order to provide context to the satellite imaging of chlorophyll-a and the export measurement (see report by A. Belcher and E.Ceballos-Romero). The second objective is to look at the surface mesoscale variability of the activities of natural radio-elements ^{234}Th and ^{210}Po (see report by E. Ceballos-Romero) that provide information on the flux of particle from the surface ocean on different time scales (Le Moigne et al., 2013b). This can be further discussed in relation to the mesoscale physical dynamics (Resplandy et al., 2012) and its influence on the representativeness of discrete sampling of radio-elements ^{234}Th and ^{210}Po to derive particle flux.

2.5.3 Methods

Samples were collected manually from the underway supply in the radiochemistry lab. The interval between sampling was two hours. Samples were collected throughout the day and night (24 hours a day). Samples were not usually taken when the ship was not moving because on station.

Samples were collected for the following at each underway sampling point:

1. 300 mL for chlorophyll-a measurements
2. 20 mL for macro-nutrient concentrations (nitrate+nitrite, phosphate, silicate)
3. 3L for ^{234}Th activity (only sampling within the corebox, sample U119 to U163)
4. 5L for ^{210}Po activity (only sampling within the corebox, sample U119 to U163)

For all the continuously measured datasets the time collected (GMT) is recorded and can be used to extract the data corresponding to the individual underway samples. Likewise precise location can be determined from the ship's GPS logger files. Table 5 and Figure 2 give date and position of each underway sample along with fluorescence and temperature from the ship's UW system (data not calibrated, use with precaution).

Table 5: Time and location information for underway chlorophyll samples

Time	Latitude	Longitude	Bottle ID	Time	Latitude	Longitude	Bottle ID
13/12/2013 12:15	-52.76888	-40.15499	U170	02/12/2013 15:08	-55.44177	-41.42917	U83
13/12/2013 10:01	-53.03847	-39.87427	U169	02/12/2013 12:59	-55.84535	-41.83156	U82
13/12/2013 07:57	-53.34874	-39.59492	U168	02/12/2013 10:58	-56.23166	-42.22716	U81
13/12/2013 05:58	-53.63252	-39.32936	U167	02/12/2013 08:56	-56.60765	-42.61202	U80
13/12/2013 03:59	-53.8767	-39.11601	U166	02/12/2013 06:44	-57.02165	-43.01948	U79
13/12/2013 01:59	-53.82369	-39.17422	U165	02/12/2013 04:53	-57.36329	-43.37499	U78
12/12/2013 23:59	-53.84713	-39.02233	U164	02/12/2013 02:51	-57.73868	-43.7681	U77
12/12/2013 21:55	-53.84948	-38.42737	U163	02/12/2013 00:57	-58.09528	-44.13224	U76
12/12/2013 19:55	-53.85192	-37.86536	U162	01/12/2013 22:57	-58.46087	-44.52039	U75
12/12/2013 17:54	-53.86123	-37.61208	U161	01/12/2013 20:57	-58.82915	-44.90821	U74
02/12/2013 16:02	-55.27806	-41.27184	U160	01/12/2013 18:54	-59.20216	-45.30619	U73

12/12/2013 13:50	-53.24242	-37.80043	U159	01/12/2013 17:57	-59.36903	-45.49273	U72
12/12/2013 11:54	-53.27206	-37.92553	U158	01/12/2013 16:32	-59.62468	-45.78707	U71
12/12/2013 09:52	-53.58822	-37.82314	U157	01/12/2013 11:17	-59.96339	-46.16686	U70
12/12/2013 07:50	-53.88495	-37.73475	U156	30/11/2013 18:06	-59.96339	-46.16686	U69
12/12/2013 06:05	-53.71374	-37.96546	U155	30/11/2013 15:26	-60.57775	-46.52083	U68
12/12/2013 03:59	-53.67862	-37.91923	U154	26/11/2013 14:54	-60.70272	-45.531	U67
12/12/2013 02:00	-53.62056	-37.92879	U153	26/11/2013 12:59	-60.82835	-45.7705	U66
11/12/2013 23:57	-53.52701	-38.03311	U152	26/11/2013 12:59	-60.82835	-45.7705	B4
11/12/2013 21:57	-53.36101	-38.08292	U151	26/11/2013 11:15	-60.71141	-46.25698	U65
11/12/2013 19:56	-53.34591	-38.05501	U150	26/11/2013 04:50	-60.45516	-46.41429	U64
11/12/2013 17:54	-53.27629	-38.11026	U149	26/11/2013 02:59	-60.23112	-46.15402	U63
11/12/2013 15:59	-53.58383	-38.00924	U148	26/11/2013 00:56	-59.98488	-45.90114	U62
11/12/2013 13:56	-53.90007	-37.94713	U147	26/11/2013 00:56	-59.98488	-45.90114	B3
11/12/2013 11:52	-53.74103	-38.28118	U146	25/11/2013 22:57	-59.7581	-45.68903	U61
11/12/2013 09:55	-53.43268	-38.38153	U145	25/11/2013 22:57	-59.7581	-45.68903	B2
11/12/2013 08:00	-53.26883	-38.53071	U144	25/11/2013 21:00	-59.53644	-45.46616	B1
11/12/2013 05:58	-53.43219	-38.69492	U143	25/11/2013 20:55	-59.52697	-45.45642	U60
11/12/2013 04:06	-53.44746	-38.69272	U142	25/11/2013 18:56	-59.29008	-45.23844	U59
11/12/2013 02:04	-53.68707	-38.58711	U141	25/11/2013 16:54	-59.02901	-44.9392	U58
10/12/2013 23:52	-53.72266	-38.601	U140	25/11/2013 14:55	-58.75694	-44.59459	U57
10/12/2013 21:55	-53.80636	-38.67911	U139	25/11/2013 12:57	-58.47446	-44.27576	U56
10/12/2013 19:55	-53.785	-38.58393	U138	25/11/2013 10:58	-58.18707	-43.97568	U55
10/12/2013 17:57	-53.95389	-38.5291	U137	25/11/2013 06:52	-57.58304	-43.47933	U53
10/12/2013 15:57	-53.62378	-38.63417	U136	25/11/2013 04:49	-57.30401	-43.20997	U52
10/12/2013 13:52	-53.28309	-38.74028	U135	25/11/2013 02:59	-57.06156	-42.97006	U51
10/12/2013 11:57	-53.37291	-39.01179	U134	25/11/2013 00:58	-56.79094	-42.71265	U50
10/12/2013 09:53	-53.6991	-38.91038	U133	25/11/2013 00:08	-56.67892	-42.60355	U54
10/12/2013 07:54	-54.00589	-38.8094	U132	24/11/2013 22:58	-56.49575	-42.42594	U49
10/12/2013 05:56	-54.00537	-38.80484	U131	24/11/2013 20:58	-56.19304	-42.16103	U48
10/12/2013 03:58	-54.0834	-39.14555	U130	24/11/2013 19:00	-55.90873	-41.87627	U47

10/12/2013 01:58	-53.98769	-39.21404	U129	24/11/2013 17:00	-55.62008	-41.59823	U46
09/12/2013 23:55	-53.84594	-39.1439	U128	24/11/2013 15:00	-55.32669	-41.30746	U45
09/12/2013 21:59	-53.61745	-39.20504	U127	24/11/2013 11:10	-55.24955	-41.27624	U44
09/12/2013 19:56	-53.48999	-39.24882	U126	24/11/2013 08:51	-55.08499	-40.87413	U43
09/12/2013 17:56	-53.48999	-39.24882	U125	24/11/2013 07:00	-54.90648	-40.4371	U42
09/12/2013 15:56	-53.65577	-39.2028	U124	24/11/2013 05:00	-54.71545	-39.95942	U41
09/12/2013 13:53	-53.99135	-39.099	U123	24/11/2013 03:01	-54.52294	-39.49519	U40
09/12/2013 11:57	-53.96104	-39.42	U122	24/11/2013 00:57	-54.32366	-39.00853	U39
09/12/2013 09:56	-53.64868	-39.51346	U121	23/11/2013 22:58	-54.13056	-38.54217	U38
09/12/2013 07:56	-53.33756	-39.60494	U120	18/11/2013 07:00	-53.98171	-38.0883	U37
09/12/2013 05:57	-53.14066	-39.82262	U119	18/11/2013 04:47	-53.88705	-37.704	U36
09/12/2013 03:34	-52.88749	-39.97987	U118	18/11/2013 02:56	-53.92149	-37.32758	U35
08/12/2013 08:53	-52.81747	-40.16442	U117	18/11/2013 00:54	-53.95505	-36.91843	U34
08/12/2013 07:11	-53.14975	-40.3139	U116	17/11/2013 23:04	-54.08796	-36.58483	U33
08/12/2013 04:59	-53.56417	-40.50505	U115	17/11/2013 20:54	-54.28306	-36.49668	U32
08/12/2013 03:10	-53.90577	-40.64887	U114	17/11/2013 18:58	-54.14195	-36.46806	U31
08/12/2013 00:59	-54.33105	-40.85226	U113	17/11/2013 16:58	-53.95209	-36.95737	U30
07/12/2013 23:33	-54.60308	-40.99026	U112	17/11/2013 14:55	-53.88144	-37.56773	U29
07/12/2013 22:21	-54.83825	-41.0978	U111	17/11/2013 13:11	-53.8178	-38.07683	U28
07/12/2013 21:40	-54.97234	-41.15679	U110	17/11/2013 10:52	-53.73533	-38.78374	U26
07/12/2013 06:58	-54.97234	-41.15679	U109	17/11/2013 09:53	-53.69509	-39.07831	U27
07/12/2013 04:59	-55.04988	-40.83249	U108	17/11/2013 07:58	-53.6243	-39.66051	U25
07/12/2013 02:50	-54.83391	-40.37101	U107	17/11/2013 06:00	-53.55566	-40.24071	U24
07/12/2013 00:53	-54.64217	-39.96452	U106	17/11/2013 04:00	-53.48587	-40.82654	U23
06/12/2013 22:50	-54.43345	-39.53874	U105	17/11/2013 02:59	-53.44779	-41.11435	U22
06/12/2013 21:04	-54.25556	-39.16756	U104	17/11/2013 00:55	-53.37344	-41.72028	U21
06/12/2013 18:56	-54.03238	-38.68984	U103	16/11/2013 22:56	-53.31616	-42.30996	U20
06/12/2013 16:53	-53.86627	-38.19677	U102	16/11/2013 20:56	-53.26473	-42.9271	U19
06/12/2013 15:06	-53.80163	-37.93775	U101	16/11/2013 18:44	-53.20539	-43.61658	U18
06/12/2013 11:33	-53.79917	-37.93544	U100	16/11/2013 16:58	-53.15907	-44.17721	U17

06/12/2013 09:00	-53.8356	-37.706	U99	16/11/2013 14:57	-53.09895	-44.79858	U16
06/12/2013 06:15	-53.93708	-37.05681	U98	16/11/2013 12:52	-53.05036	-45.4186	U15
05/12/2013 19:28	-54.28563	-36.47923	U97	16/11/2013 10:51	-52.99821	-46.02622	U14
05/12/2013 16:54	-54.15302	-36.6227	U96	16/11/2013 08:54	-52.94853	-46.60762	U13
04/12/2013 19:06	-54.15944	-36.69507	U95	16/11/2013 06:50	-52.89517	-47.22523	U12
04/12/2013 14:57	-54.02073	-36.7592	U94	16/11/2013 04:56	-52.84417	-47.8058	U11
04/12/2013 12:56	-53.93838	-37.32585	U93	16/11/2013 02:53	-52.78726	-48.4237	U10
04/12/2013 10:50	-53.90521	-37.99941	U92	16/11/2013 00:56	-52.73727	-49.00921	U9
04/12/2013 08:54	-53.96903	-38.56578	U91	15/11/2013 22:52	-53.6243	-39.66051	U8
04/12/2013 07:02	-54.16783	-38.98743	U90	15/11/2013 20:58	-52.63519	-50.23797	U7
04/12/2013 05:09	-54.35481	-39.39175	U89	15/11/2013 18:58	-52.57975	-50.82886	U6
04/12/2013 05:00	-54.36854	-39.42135	U89	15/11/2013 17:00	-52.53319	-51.41077	U5
04/12/2013 02:52	-54.53666	-39.82494	U88	15/11/2013 14:58	-52.48275	-52.03421	U4
04/12/2013 01:00	-54.65884	-40.10605	U87	15/11/2013 12:58	-52.42625	-52.62193	U3
03/12/2013 22:58	-54.80937	-40.43962	U86	15/11/2013 10:58	-52.37656	-53.21641	U2
03/12/2013 21:00	-55.00701	-40.87106	U85	15/11/2013 08:58	-52.31719	-53.8378	U1
03/12/2013 19:15	-55.19313	-41.28277	U84				

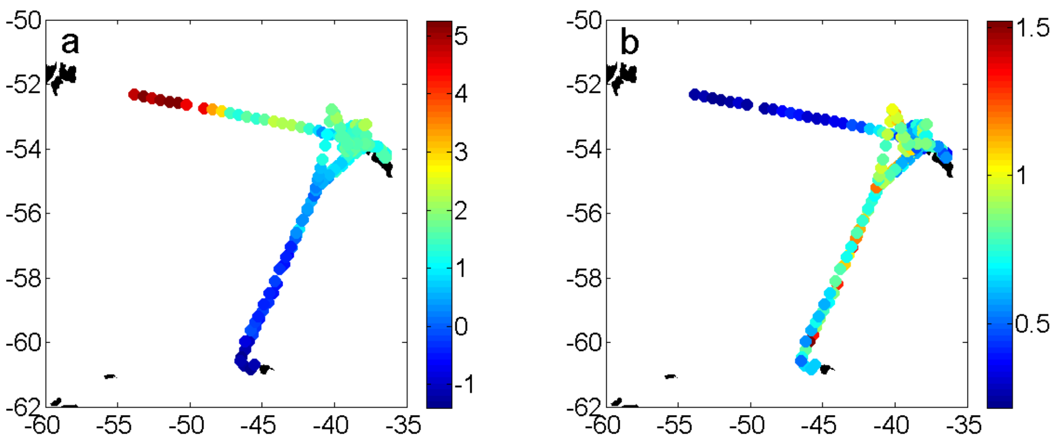


Figure 2: (a) Temperature (°C) and (b) fluorescence(mgm-3) from ship underway system

2.5.4 References

Le Moigne, F. A. C., Boye, M., Masson, A., Corvaisier, R., Grosstefan, E., Guenegues, A., and Pondaven, P.: Description of the biogeochemical features of the subtropical southeastern Atlantic and the Southern Ocean south off South Africa during the austral summer of the International Polar Year, Biogeosciences, 10, 1-15, 2013a.

Le Moigne, F. A. C., Villa-Alfageme, M., Sanders, R. J., Marsay, C. M., Henson, S., and Garcia-Tenorio, R.: Export of organic carbon and biominerals derived from ^{234}Th and ^{210}Po at the Porcupine Abyssal Plain., Deep Sea Research Part I, 72, 88-101, 10.1016/j.dsr.2012.10.010, 2013b.

Resplandy, L., Martin, A. P., Le Moigne, F., Martin, P., Aquilina, A., Mémery, L., Lévy, M., and Sanders, R.: Impact of dynimical spatial variability on estimates of organic material export to the deep ocean, Deep Sea Research I, 68, 24-45, 2012.

3 Carbon and Biomineral Export (^{234}Th, ^{210}Po and SAPS)

Elena Ceballos Romero, University of Seville (Spain) and Frederic Le Moigne, NOC

3.1 ^{234}Th derived carbon and biomineral fluxes

3.1.1 Scientific motivation

The Radioactive short-lived Thorium-234 (^{234}Th, $T_{1/2}$ = 24,1 d) has been used as a tracer of several transport processes and particle cycling in aquatic systems by different techniques. It can be used to estimate how much POC is exported into the deep ocean (Buesseler et al., 1992). ^{234}Th is the daughter isotope of naturally occurring 238-Uranium (^{238}U, $T_{1/2}$ = 4,47.109 y) which conservative in the seawater and proportional to salinity in well oxygenated environment. Unlike ^{238}U, ^{234}Th is particle reactive in the water column. As particles with ^{234}Th sink through the water column, a radioactive disequilibrium is formed between ^{238}U and ^{234}Th, which can be used to quantify the rate of carbon and biominerals export from the surface ocean. This is possible with the ratios of POC, PIC or BSi to particulate ^{234}Th activity obtained from large volume samples (e.g. in situ pumps: SAPS). ^{234}Th, POC, PIC and opal downward fluxes will be calculated to assess the strength of downward export of particulate matter and interactions between POC and biomineral fluxes (Le Moigne et al., 2013b;Le Moigne et al., 2013c;Resplandy et al., 2012;Le Moigne et al., 2012) along contrasted environments in the southern ocean as described in (Le Moigne et al., 2013a).

3.1.2 Sampling methodology and sampling treatment on board

Samples for thorium analysis were collected from a stainless steel CTD rosette at various stations (see Figure 3 and Table 6). 3L water samples were collected at five horizons from surface to 800m depth where a significant export of particles are expected and thereby a disequilibrium between ^{234}Th and ^{238}U. ^{238}U concentration is derived from salinity measurement and thus is not directly measured from seawater samples. A total of 72 samples were collected, including 5 blanks and 1 replicate sample to ensure reproducibility.

Total ^{234}Th is obtained by adding $KMnO_6$ (potassium permanganate), $MnCl_2$ (manganese dichloride) and concentrated ammonia (NH_3) to the 3L. Thorium is precipitated with MnO_2 within 8 hours after a spike a 230Th was added as a yield monitor as described in (Pike et al., 2005). The formed precipitate is filtered onto 25mm precombusted QMA filters. Filters were then wrapped in mylar foil and counted in a Riso beta counter as described in (Le Moigne et al., 2013c). Corrections are made for ^{234}Th decay and ^{234}Th in growth from ^{238}U decay since sampling. To calibrate ^{234}Th counting efficiency, mid water (2000m) samples were used, away from the surface ocean, coastal areas and seafloor nephleloid layers, where the secular equilibrium between ^{234}Th and ^{238}U is expected. The ratios of POC, PIC or BSi to particulate ^{234}Th activity will be obtained from particles from several depths sampled using SAPS as described in (Le Moigne et al., 2013c).

3.1.3 Further work and scientific outcomes

These results of ^{234}Th will be corrected with two "background counting" in three and six months. The ^{238}U results will be calculated from calibrated salinity measurements. The recovery will be calculated by ^{230}Th measured with an ICPMS at University of Seville. Once corrected, the ^{234}Th results will be integrated in order to obtain the ^{234}Th fluxes (dpm m^{-2} d^{-1}) to further extrapolate POC, calcite and opal export (g m^{-2} d^{-1}) with POC/^{234}Th, PIC/^{234}Th and BSi/^{234}Th ratio obtained from high volume collection of particulate matter (SAPS).

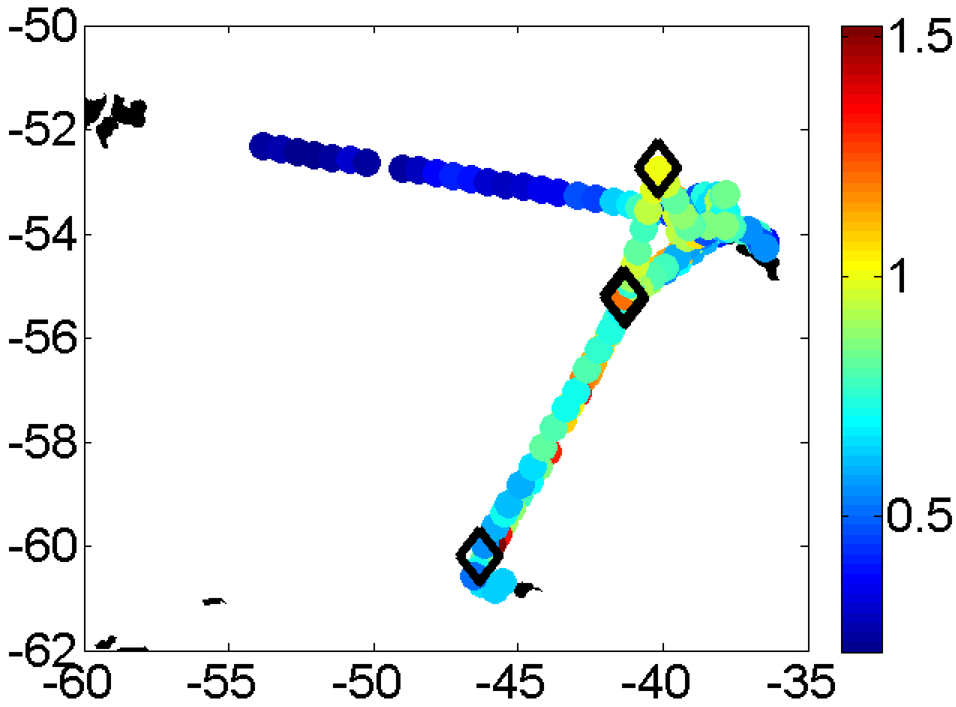


Figure 3: Station positions (diamonds) and UW fluorescence data

Table 6: ID, time and sample information for 234Th and 210Po samples

Event Number	Sampling date	Number of samples	Depth range (m)	Lat	Lon
26	30/11/13	14	5-600	60°12.545S	46°20.102W
37	02/12/13	5	200-600	55°11.490S	41°20.518W
41	03/12/13	9	5-170	55°11.490S	41°20.518W
63	07/12/13	14	5-700	55°15.517S	41°17.695W
70	08/12/13	14	5-700	52°46.158S	40°09.367W
122	13/12/13	16	10-800	52°46.133S	40°09.300W

3.2 ^{210}Po derived carbon and biomineral fluxes

3.2.1 Scientific motivation

^{210}Pb ($T_{1/2}$ = 22.3 yr) and its daughter ^{210}Po ($T_{1/2}$ = 138.4 d) are natural particle reactive radioisotopes that can be used as tracers of particle cycling in the upper ocean (Cochran and Masque, 2003). Both radioisotopes have a strong affinity for particles, but whereas ^{210}Pb is only adsorbed on particle surfaces, ^{210}Po is also bioaccumulated, being incorporated into the cytoplasm of some species of phytoplankton and bacteria; its partitioning is similar to that of protein and sulphur within the cell. These differences result in ^{210}Po being more efficiently removed from surface waters than ^{210}Pb via sinking particles. Hence, disequilibrium between the two radionuclides occurs when biological activity is high and downward ^{210}Po fluxes can be calculated. During JR291, ^{210}Po downward fluxes will be calculated to assess the strength of downward export of particulate matter. POC/^{210}Po ratios measured in sinking particles (from SAPS, see SAPS report) will be used to obtain into POC, PIC and opal fluxes from ^{210}Po fluxes.

Those results will be complementary with the export fluxes that will be obtained from the disequilibrium between ^{234}Th and ^{238}U (see ^{234}Th report above). ^{210}Po fluxes obtained from to ^{210}Pb and ^{210}Po disequilibrium differ from the ^{234}Th fluxes from ^{234}Th/^{238}U disequilibrium in several ways. First, ^{234}Th is attached to the surface of the particles, on the contrary ^{210}Po is also assimilated by the organic matter. Thus it is expected that ^{210}Po/^{210}Pb disequilibrium allow us to better estimate POC fluxes whereas ^{234}Th will be used to estimate particle scavenging. Study timescales are different, going from several days (^{234}Th) to several months (^{210}Po) due to the different half lives of ^{234}Th (24d) and ^{210}Po (138.4d). Finally, due to ^{210}Po longer half-life and its highest affinity with carbon, ^{210}Po-^{210}Pb disequilibrium occurs from 0 to 500-600m, allowing us to quantify carbon fluxes in deeper depths (down to 400m) than using ^{234}Th method (~150 m).

3.2.2 Sampling summary

Samples for ^{210}Po and ^{210}Pb analysis were collected from a stainless steel CTD rosette at several stations (see Table 6). 5L water samples were collected from 5 to 16 depths between 5-3000m. The sampling distribution was focused between 0 and 500 m, where the most significant disequilibrium between ^{210}Po and ^{210}Pb is expected.

Seawater profiles of 9-16 depths (5-3000 m) for the ^{210}Pb/^{210}Po work were collected from 5 stations. A total of 88 samples were collected, including 10 blanks and 1 replicate sample to ensure reproducibility.

3.2.3 Pre-treatment on board

Samples were immediately acidified, spiked with radioactive ^{209}Po, stable Pb2+, as yield tracers, and Fe3+ carrier added. After equilibration, the pH was adjusted to 8.5 with NH_4OH, and $Fe(OH)_3$ allowed to form and settle. The supernatant was carefully removed via siphoning and the precipitate transferred to 250 mL bottles and stored for its later treatment. The radiochemical analysis of these samples will be done at University of Seville.

3.2.4 Further work

Once in the laboratory, in order to isolate ^{210}Po and ^{210}Pb and take it to an appropriate form for its proper measurement, radiochemical purification of polonium must be conducted. Afterwards, polonium will be plated onto silver discs and measured. For ^{210}Pb determination, the plating solution will be stored for at least 6 months to allow for ^{210}Po in growth and to permit determination of ^{210}Pb by re-plating of the ^{210}Po. Pb yields will be determined through measurement of stable Pb by ICP-OES. ^{210}Po yields will be determined using radioactive 209Po as internal tracer. ^{210}Po and ^{210}Pb will be analysed at the University of Seville through alpha spectrometry using Canberra PIPS detectors. Decay corrections would be done to ^{210}Pb and ^{210}Po results before obtaining activity concentration in water.

3.2.5 Scientific outcomes

^{210}Po fluxes will be calculated from the disequilibrium between ^{210}Pb and ^{210}Po activities in each depth and integrating to depths 50, 150 and 400m. SAPS pumps were deployed for every ^{210}Po-^{210}Pb water depth profile (see SAPS report). ^{210}Po and ^{210}Pb, together with POC, PIC and BSi in particles, will be measured in the particles collected from in-situ pumps. The ratio ^{210}Po/POC, ^{210}Po/PIC, ^{210}Po/BSi in sinking particles, can be then calculated and ^{210}Po export fluxes will be converted into POC, opal and calcite fluxes. Those results will be complemented with the information obtained from ^{234}Th derived fluxes (see ^{234}Th report) for a global assessment of the strength of downward export of particulate matter. Both radionuclides will be evaluated in order to establish the conditions under which whether ^{234}Th-POC derived fluxes or ^{210}Po-POC derived fluxes should be better used. It may be that each radionuclide is better couple with certain variables (i.e. primary production, geographical and temporal variability...). Furthermore, due to POC:radionuclide is a key parameter to calculate these ^{234}Th-POC and ^{210}Po-POC derived fluxes, its influence to the accuracy of the results will be evaluated, as well as the variables that affect this parameter. Finally, in the use of temperature as a proxy for export efficiency, the possibility of being variability in the relationship at cold temperatures due to phytoplankton community composition will be studied.

3.3 SAPS deployment

During the JR291, five standing alone pumping system (SAPS) were devoted for Th and Po derived carbon and biomineral fluxes as summarised in Table 7. SAPS pumping time was set as 90min allowed a filtration volume from 500 to 2000L. After recovery, particles were rinsed off the mesh on ^{234}Th-^{210}Po devoted SAPS and split in five portion (six in only two stations) for further ^{210}Po-^{210}Pb, ^{234}Th POC, PIC and Bsi (and exceptionally POP) analysis back in homelab. ^{210}Po and ^{210}Pb will be analysed at University of Seville.

Table 7: SAPS depths, filter types and splits

Event No	Sampling date	Lat	Lon	Depths (m)	Type of mesh	Splits
28	30/11/13	60°12.545S	46°20.102W	60	1um NITEX	1/4Po-Pb, 1/4Th, 1/8PIC, 1/8POC, 1/8BSi, 1/8POP
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8PIC, 1/8POC, 1/8BSi, 1/8POP
				160	1um NITEX	1/4Po-Pb, 1/4Th, 1/8PIC, 1/8POC, 1/8BSi, 1/8POP
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8PIC, 1/8POC, 1/8BSi, 1/8POP
				400	1um NITEX	1/4Po-Pb, 1/4Th, 1/8PIC, 1/8POC, 1/8BSi, 1/8POP
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8PIC, 1/8POC, 1/8BSi, 1/8POP
42	03/12/13	55°11.490S	41°20.518W	60	1um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
				160	1um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
				400	1um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
66	07/12/13	55°15.517S	41°17.695W	60	1um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
				160	1um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
				400	1um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
73	08/12/13	52°46.158S	40°09.367W	60	1um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/8PIC, 1/8POP
				160	1um	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC,

					NITEX	1/8PIC, 1/8POP
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/8PIC, 1/8POP
				400	1um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/8PIC, 1/8POP
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/8PIC, 1/8POP
128	13/12/13	52°46.133S	40°09.300W	60	1um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
				160	1um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
				400	1um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC
					53um NITEX	1/4Po-Pb, 1/4Th, 1/8BSi, 1/8POC, 1/4PIC

3.4 References

Buesseler, K. O., Bacon, M. P., Cochran, J. K., and Livingston, H. D.: Carbon and nitrogen export during the JGOFS North Atlantic Bloom Experiment estimated from ^{234}Th:^{238}U disequilibria, Deep-Sea Research I, 39, 1115-1137, 1992.

Cochran, J. K., and Masque, P.: Short-lived U/Th series radionuclides in the ocean: Tracers for scavenging rates, export fluxes and particle dynamics, Uranium-Series Geochemistry, 52, 461-492, 2003.

Le Moigne, F. A. C., Sanders, R. J., Villa-Alfageme, M., Martin, A. P., Pabortsava, K., Planquette, H., Morris, P. J., and Thomalla, S. J.: On the proportion of ballast versus non-ballast associated carbon export in the surface ocean, Geophys. Res. Lett., 39, L15610, 10.1029/2012GL052980, 2012.

Le Moigne, F. A. C., Boye, M., Masson, A., Corvaisier, R., Grosstefan, E., Guenegues, A., and Pondaven, P.: Description of the biogeochemical features of the subtropical southeastern Atlantic and the Southern Ocean south off South Africa during the austral summer of the International Polar Year, Biogeosciences, 10, 1-15, 2013a.

Le Moigne, F. A. C., Henson, S. A., Sanders, R. J., and Madsen, E.: Global database of surface ocean particulate organic carbon export fluxes diagnosed from the ^{234}Th technique, Earth Syst. Sci. Data, 5, 295-304, 10.5194/essd-5-295-2013, 2013b.

Le Moigne, F. A. C., Villa-Alfageme, M., Sanders, R. J., Marsay, C. M., Henson, S., and Garcia-Tenorio, R.: Export of organic carbon and biominerals derived from ^{234}Th and ^{210}Po at the

Porcupine Abyssal Plain., Deep Sea Research Part I, 72, 88-101, 10.1016/j.dsr.2012.10.010, 2013c.

Pike, S. M., Buesseler, K. O., Andrews, J., and Savoye, N.: Quantification of Th-234 recovery in small volume sea water samples by inductively coupled plasma-mass spectrometry, Journal of Radioanalytical and Nuclear Chemistry, 263, 355-360, 10.1007/s10967-005-0062-9, 2005.

Resplandy, L., Martin, A. P., Le Moigne, F., Martin, P., Aquilina, A., Mémery, L., Lévy, M., and Sanders, R.: Impact of dynimical spatial variability on estimates of organic material export to the deep ocean, Deep Sea Research I, 68, 24-45, 2012.

4 Marine Snow Catcher

Anna Belcher, National Oceanography Centre, UK and Andy Richardson, University of Hull, UK

4.1 Objectives and Aims

The aim of the cruise was to investigate the controls on export and remineralisation processes in two contrasting regions (different ecosystem structure but of similar temperature) in the Scotia Sea. The marine snow catcher (MSC) was utilised to collect marine snow particles from the water column and examine the size, composition and abundance of marine snow material at different depths and make estimates of particle flux. As such it was aimed to use the MSC to:

1) Measure any variation in the particle flux (in terms of magnitude, particle size and composition) with depth
2) Measure the sinking rates of particles to investigate any relationship with particle size
3) Collect water from the MSC to measure the particulate organic carbon (POC), particulate inorganic carbon (PIC), biogenic silica (BSi), and chlorophyll (Chl) in the suspended and slow sinking carbon pools
4) Investigate the influence of community structure on export through samples taken for Scanning Electron Microscope (SEM) analysis and size fractionated Chl, as well as data from plankton net tows carried out on board.

4.2 Methods

95 litres of water were collected in each of two marine snow catchers (a PVC closing water bottle designed to minimise turbulence) at 10m and 110m below the chlorophyll maximum (determined from the most recent CTD profile). The two MSC's were deployed one after the other to provide a depth comparison for a particular station, with deployments carried out at a range of times during the day. As soon as the MSCs were on deck, an initial two litre sample was taken from the bottom tap on the MSC. The MSCs were then left upright for two hours to allow the marine snow particles to sink to the bottom and to be able to distinguish between suspended and sinking pools. One litre of the initial sample (Time zero - T_0 sample) was filtered immediately for POC and represents the homogenous water column. The remaining litre was left to stand for two hours before also being filtered for POC (T_2 sample).

After standing for two hours, a four litre sample was taken from the bottom tap of the MSC representing the suspended pool, before draining the remaining top 82 litres. The bottom section of the MSC containing 7 litres of water and settled particles was then removed. A four litre sample was siphoned out of the base section (representing the slow sinking pool) before carrying the bottom section to a 2°C temperature controlled laboratory.

Water samples collected from both the top and base sections of the MSC were filtered for analysis of POC, PIC, POC, BSi, Chl (size fractionated) and SEM analysis.

Particles that had settled to the base of the bottom chamber were removed using a wide-bore pipette and photographed using an Olympus SZX16 microscope with Canon EOS 60D camera and Olympus BX-SZX Micro Cam. These particles represent the fast sinking pool. In addition, simple sinking rate experiments were carried out on particles that were visible by eye, using a measuring cylinder and stopwatch.

4.3 Filter Sample Preparation, Preservation and Analysis

POC: Each sample was filtered through a 25mm diameter, ashed GF/F filter, rinsed with milliQ water, placed in a Petri dish, oven dried at 40-50 °C and stored at room temperature for later analysis.

PIC: Each sample was filtered through a 0.8µm pore size, 25mm diameter, nucleopore polycarbonate membrane filter, rinsed with pH adjusted milliQ water, stored in a centrifuge tube, oven dried at 40-50 °C and stored at room temperature for later analysis.

BSi: Each sample was filtered through a 0.8µm pore size, 25mm diameter, nucleopore polycarbonate membrane filter, rinsed with pH adjusted milliQ water, stored in a centrifuge tube, oven dried at 40-50 °C and stored at room temperature for later analysis.

Chl <10µm: Each sample was filtered through a 0.8µm pore size, 25mm diameter, MPF300 filter, rinsed with milliQ water, placed in an eppendorf tube and stored at -20°C for later analysis.

Chl >10 µm: Each sample was filtered through a 10µm pore size, 25mm diameter nucleopore polycarbonate membrane filter, rinsed with milliQ water, placed in an eppendorf tube and stored at -20°C for later analysis.

SEM: Each sample was filtered through a 0.8µm pore size, 25mm diameter, nucleopore polycarbonate membrane filter, rinsed with pH adjusted milliQ water, placed in a Petri dish, oven dried at 40-50 °C and stored at room temperature for later analysis.

4.4 Preliminary Results

During the cruise a total of 14 successful snow catcher deployments were made (Table 8) with two misfires. Table 9 details the water samples taken from each MSC deployment.

Table 8: Details of MSC deployments during JR291

Date	Time (GMT)	Event Number	Station	Latitude	Longitude	MSC	Depth (m)
01/12/2013	01:45	27	ICE1	-60.2091	-46.335	A	60
	02:21	28		-60.2091	-46.335	B	160
01/12/2013	12:58	34	ICE2	-59.9623	-46.1597	B	70
	13:37	35		-59.9623	-46.1597	A	170

02/12/2013	22:52	38	P2	-55.1915	-41.342	A	70
	23:45	39		-55.1916	-41.342	B	170
03/12/2013	15:34	46	P2	-55.1962	-41.3321	A	100
	15:54	47		-55.1962	-41.3321	B	200
07/12/2013	14:08	64	P2	-55.2586	-41.2949	A	100
	15:07	65		-55.2586	-41.2949	B	200
13/12/2013	12:45	123	P3	-52.7689	-40.155	A	100
	13:49	125		-52.7689	-40.155	B	200
14/12/2013	05:47	134	P3	-52.7693	-40.154	A	80
	06:33	135		-52.7693	-40.154	B	180

Table 9: Summary of water samples and volumes taken from MSC

		Initial (T_0, T_2) (volume ml)	Suspended (SP) (volume ml)						Slow Sinking (SS) (volume ml)					
Event	**MSC**	**POC**	**POC**	**PIC**	**BSi**	**Chl >10 µm**	**Chl <10 µm**	**SEM**	**POC**	**PIC**	**BSi**	**Chl >10 µm**	**Chl <10 µm**	**SEM**
27	A	1000	1000	500	500	300	300	500	1000	500	500	300	300	500
28	B	1000	1000	500	500	300	300	500	1000	500	500	300	300	500
34	A	1000 (T_2=750)	1000	500	500	300	300	500	1000	500	500	300	300	500
35	B	1000	1000	500	500	300	300	500	1000	500	500	300	300	500
38	A	1000	1000	500	500	300	300	500	1000	500	500	300	300	500
39	B	1000	1000	500	500	300	300	500	1000	500	-	-	300	-
46	A	1000 (T_2=995)	1000	500	500	300	300	500	1000	500	500	300	300	500
47	B	1000	1000	500	500	300	300	500	1000	500	500	300	300	500
64	A	1000	1000	500	500	300	300	500	1000	500	500	300	300	500
65	B	1000	1000	500	500	300	300	500	1000	500	500	300	300	500
123	A	1000	1000	500	500	300	300	500	1000	500	500	300	300	500
125	B	1000	1000	500	500	300	300	500	1000	500	500	300	300	500
134	A	1000	1000	500	500	300	300	500	1000	500	500	300	300	500
135	B	1000	1000	500	500	300	300	500	1000	500	500	300	300	550

MSCs were deployed in pairs at different depths to investigate changes in sinking material with depth. It was noted for all stations that much less material was recorded in the deep MSC (110 m below the mixed layer) when compared to the shallow MSC (10 m below the mixed layer), as expected considering remineralisation and bacterial degradation processes. A range of particles were observed in the base of the MSC's, with a high abundance of fecal pellets and plankton cells such as radiolarians and diatoms (Figure 4). Marine snow aggregates and 'fecal fluff' were also observed, as well as unidentifiable detrital material. Preliminary assessment of sinking material suggests that fecal pellets were more dominant at stations ICE1 and P3, with mixed plankton cells more prominent at P2.

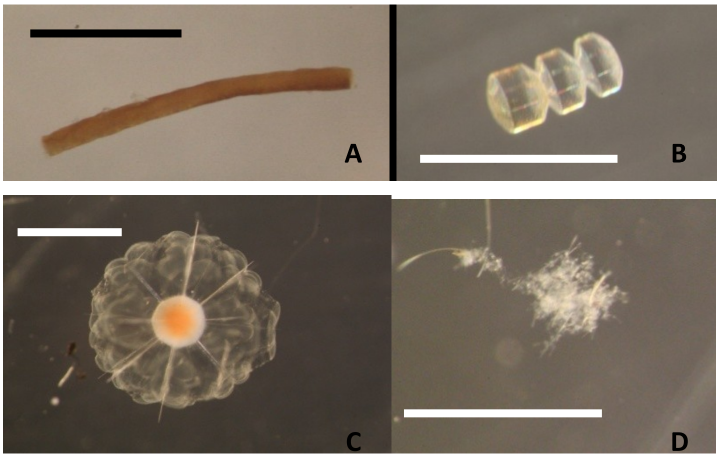


Figure 4: Examples of particles recovered in MSC, A: Fecal pellet, B: Diatom chain, C: Radiolarian, D: Marine Snow Aggregate. Scale bar = 1mm

Sinking rate experiments were carried out on those particles large enough to see by eye, with the range of measured velocities reflecting the variation in particle composition, size and density. Sinking velocities ranged from 12 – 1326 m/day with an average of 200 m/day. Later analysis of microscope data will enable any relationship with sinking speed and particle size to be determined.

Further results will be worked up following laboratory analysis of sample filters (POC, PIC, BSi, Chl and SEM). It will then be possible to calculate the sinking rates and export of slow sinking material, and allow a more in depth analysis of the composition of sinking material and any variation across stations. An estimate of the fast sinking POC flux will be made based on microscope photographs and volume calculations of particles (Alldredge et al., 1998). In addition to this, some fast sinking material were collected on GF/F filters for analysis of POC content, providing further means to estimate the fast sinking POC flux. A few samples of fast sinking particles were collected for isotopic analysis of carbon:nitrogen ratios which will enable basic assessment of the degree of particle degradation.

Data from the MSC will be compared with other data collected from the cruise, such as CTD data, and information on biological community structure from plankton net tows, to explain any variations and trends in particle size, composition and export at the stations sampled.

4.5 References

Alldredge, A.L., U. Passow, and S.H.D. Haddock, 1998, The characteristics and transparent exopolymer particle (TEP) content of marine snow formed from thecae dinoflagellates, *J.Plankton Res*., 20 (3), 393-406.

5 Acoustics

Sophie Fielding, Peter Enderlein, Gabi Stowasser, BAS

5.1 Ship-borne Acoustic instrumentation EK60

5.1.1 Introduction

The EK60 was run throughout JR291 to collect information on the horizontal and vertical distribution of krill and to derive estimates of krill biomass for the Western Core Box and to contribute data from transects from the Falklands to South Georgia.

5.1.2 Aim

Collection of acoustic data to accompany all transects, acoustic surveys, and net tows during the South Georgia survey.

Backup and process the acoustic data

5.1.3 Methods/System specification

Software versions

Simrad ER60 v. 2.0

Sonardata Echolog 60 v 4.10.1.6230

Sonardata Echoview v 4.20.59.8698 Live viewing

Sonardata Echoview v 4.20.59.8698 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 1010 m. Echolog was run on workstation 2 and wrote compressed files also directly to the Sun workstation via a Samba connection.

Echolog compression settings

Final compression settings used in Echolog for all frequencies were:

1) Power data only (angle data is still available from the raw files)

2) From 0 - 1000 m (38 kHz), 0 – 1000 (120 kHz) and 0 – 1000 (200 kHz) data only (data from greater depths are available from the raw files)

3) Average samples where both Sv below –100 dB and TS below –20 dB

4) Maximum number of samples to average: 50

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

File locations

All raw data were saved in a general folder JR291/raw, all echolog data were saved in the folder JR291/data/echoview. All files were prefixed with JR291. Calibration data were additionally saved to the calibration folder.

EK60 (ER60) settings

The EK60 was run initially using default settings (Table 10). During the middle of the calibration the EK60 computer failed and the spare was used. The environment settings were updated to a temperature of 1.53 and salinity of 33.7, these resulted in new settings for c and alpha (in brackets in Table 10). The transducer settings were reset to default (from the manufacturer's tests) and the gain settings reset to the last measured values.

The EK60 was calibrated on the 5th December 2013, and the calibration was NOT applied to the transducers.

Table 10: EK60 default settings

Variable	38 kHz	120 kHz	200 kHz
Ping interval (per sec)	2	2	2
Sound velocity (m/s)	1465 (1458)	1465 (1458)	1465 (1458)
Mode	Active	Active	Active
Transducer type	ES38	ES120-7	ES200-7
Transceiver Serial no.	009072033fa5	00907203422d	009072033f91
Transducer depth (m)	0	0	0
Absorption coef. (dB/km)	10.0072 (10.0035)	28.156 (26.5832)	41.245 (39.9485)
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)	25.51	21.15	23.61
Sa correction (dB)	-0.52	-0.41	-0.22
Angle sensitivity along	22	21	23
Angle sensitivity athwart	22	21	23
3 dB Beam along	7.15 (7.00)	7.47 (7.00)	6.72 (8.00)
3 dB Beam athwart	7.05 (7.10)	7.43 (7.10)	6.75 (7.90)
Along offset	-0.06 (0.00)	-0.14 (0.00)	-0.10 (0.00)
Athwart offset	-0.05 (0.00)	-0.02 (0.00)	-0.06 (0.00)

The EK60 was controlled through the SSU, under a group EK60&EA600&ADCP. The EK60 was the master, with a ping rate set to 2 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.

SSU settings

EA600	external trigger	Tx pulse	
EK60	external trigger	Calculated	(Set to 2 seconds in ER60 software)
ADCP	external trigger	Tx pulse	(this setting only works if the bottom tracking mode is off)

5.1.4 EK60 Calibration

An acoustic calibration was carried out in Stromness Harbour, South Georgia on 04/12/2013. The ship was anchored, its movement balanced by minimal DP usage, and all over the side water deposits stopped. The EK60 was triggered through the SSU and the EA600 and ADCP was 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 48) was undertaken on the morning of the calibration. Temperature and salinity were averaged from the surface to 30 m (depth of the calibration sphere) and were 1.53 °C and 33.7 PSU resulting in a speed of sound constant of 1458 m/s (Kongsberg software calculation).

Each transducer was calibrated at the settings used throughout the cruise. Parameters from the ER60 lobes calibration were NOT updated onto the ER60 software (Table 11), in addition an Echoview calculation of the calibration was calculated (Table 12).

Three issues arose during the calibration. First, once the 38 kHz sphere was in place and prior to calibration, the EK60 computer failed. The spare EK60 pc was resurrected and used for the calibration and subsequently throughout the cruise. Second after the calibration, the 38 kHz sphere got stuck fast under the ship. Calibration was suspended on the 4th December was postponed until daylight allowed the situation to be resolved. As a result, the 38 kHz was calibrated on the 4th and the other frequencies were calibrated on the 5th. Third, the 120 kHz calibration was slightly different from last year's so was repeated in order to confirm the values.

Table 11: ER60 Calibration

Date (dd/mm/yyyy)	04/12/2013	05/12/2013	05/12/2013
Location	Stromness	Stromness	Stromness
Time (GMT)	23:33	13:06	14:15
Frequency (kHz)	38	120	200
GPT serial no	009072033fa5	00907203422d	9072033191
Comments	EA600 on	EA600 on	EA600 on

Water temperature (°C)	1.53	1.53	1.53
Salinity (PSU)	33.7	33.7	33.7
Sound velocity (m/s)	1458	1458	1458
Absorption coeff (dB/km)	10.00035	26.5832	39.9485
Ping rate (sec^{-1})	1	1	1
Transmit Power (W)	2000	500	300
Pulse length (ms)	1.024	1.024	1.024
Bandwidth (kHz)	2.43	3.03	3.09
Sample Interval (m)	0.186	0.186	0.186
Original gain (dB)	25.51	22.15	23.61
Original Sa correction (dB)	-0.52	-0.41	-0.22
Theoretical TS of sphere (dB)	-33.705	-40.40	-44.9
New gain (dB)	25.53	21.85	23.61
New Sa correction (dB)	-0.49	-0.44	-0.22

Table 12: Echoview Calibration

Parameter	38kHz	120 kHz	200 kHz
Alpha (dB/km)	10.0035	26.5832	39.9485
Theoretical TS (dB)	-33.705	-40.4	-44.90
TS gain	25.40	21.84	22.87
Sa correction	-0.35	-0.14	-0.37

5.1.5 Data coverage

Acoustic transects

The WCB was run in a west to east direction starting at the Northern end. Weather conditions were bad during the first transect.

Table 13: Transect times, directions and speeds

Transect	Date	Start time (GMT)	End time (GMT)	Comments
WCB1.1	09/12/2013	08:00	12:31	Bumpy weather
WCB1.2	09/12/2013	13:40	18:00	
WCB2.1	10/12/2013	08:00	12:29	Still bumpy weather
WCB2.2	10/12/2013	13:40	18:00	
WCB3.1	11/12/2013	08:30	13:02	Not so bumpy
WCB3.2	11/12/2013	14:03	18:28	
WCB4.1	12/12/2013	08:05	12:42	
WCB4.2	12/12/2013	13:13	17:45	

5.1.6 Problems encountered

Interference from other acoustic instruments was at a minimum with respect to the other scientific instruments. The Doppler logger was switched off at the end of transect 1.1.

5.2 The ES853 Echo-Sounder

Damien Guihen and Sophie Fielding, BAS

5.2.1 Introduction

The ES853 echo-sounder was commissioned from Imagenex and is 3.5 inches (88.9 mm) tall with a diameter of 3.25 inches (82.55 mm), operates from a 24V DC power supply with a draw of 0.25 W and communicates with a PC through a serial connection. The ES853 is a single-beam echo-sounder and has an operating frequency of 120 kHz, a pulse length of 100 µs, beam angle of 10°, range of 100 m, configurable gain of either 20 or 40 dB (only the 40 dB gain is considered here) and measures mean volume backscattering (S_v, dB re 1 m^{-1}) per range bin interval of 0.5 m. The ES853 can operate in three modes: real-time logging to a computer with a variable ping rate dependent on serial communication rate (typically ~2 Hz), self-logging with a ping rate of 1 Hz, or self-logging at a rate of 0.25 Hz ('glider mode'). The ES853 records echo intensity counts on a linear scale, which are converted to mean volume backscattering strength using an active version of the SONAR equation (Eq. 1) for distributed targets (Urick, 1983).

$$S_v = RBV + 20log_{10}R + 2\alpha R - (RR + SL) - \left(10\,log_{10}\frac{c\tau}{2}\right) - (10log_{10}EBA) - C - g$$

where R is range (m), RBV is the recorded count (20log_{10}(signal level/1V peak-peak), RR is the transducer receiving response (dB re 1 V/µPa) and SL is the transducer source level (dB re 1 µPa/V at 1m) supplied by the manufacturer, α is the absorption coefficient (dB m^{-1}), c is sound velocity (m s^{-1}), τ is pulse length (s), EBA is the equivalent beam angle (steradians), *C* is a constant calculated during the calibration of the echo-sounder and *g* is the gain (dB). The ES853 has a dynamic range of 120 dB and records signals as integer values, thus the resolution in signal strength is reduced compared with ship-based echo-sounders such as the EK60.

5.2.2 ES853 calibration

Calibration of the ES853 was performed in Stromness Bay, South Georgia using an on-axis, standard-target sphere calibration (Foote *et al.*, 1987), performed with the ES853, using a 22 mm tungsten carbide sphere suspended from a small floating platform next to the ship. Calibrations were performed at gains of 40 and 20 dB and at variable distances from the transducer face. Relevant values of speed of sound and sound absorption were derived from a CTD cast immediately prior to the calibration.

An assembly was constructed such that the echo sounder could be positioned facing downwards while the platform was floating level on the surface of the water. The assembly consisting of a large inflatable ring, cross supports with fishing reel with line at each end and a downright, central pole A battery pack was mounted on one of the cross supports and a 20 mm tungsten carbide sphere attached to the lines from the fishing reels (Figure 5a). The target sphere was weighted using a weight separated by 2 m of line. The echo sounder was connected to a laptop by a 50 m serial cable and the assembly lowered into the water and stabilised by the fore ship 30 tonne crane. The tungsten carbide sphere was then lowered to varying depths using the fishing reels (Figure 5b).

ES853 unit 5379 was deployed in the calibration assembly and data recorded to a laptop running Win853 in record mode. The laptop was operated on battery power as it was identified during JR280 that an AC adapter used with the laptop can introduce interference. Recording was performed using two different laptops over the course of the calibration. Once the battery of the first laptop drained, recording was paused and recommenced on the second. The files were later consolidated for analysis in Echoview. It was noted that the ship's doppler logger caused interference with the ES853 at the start of the calibration.

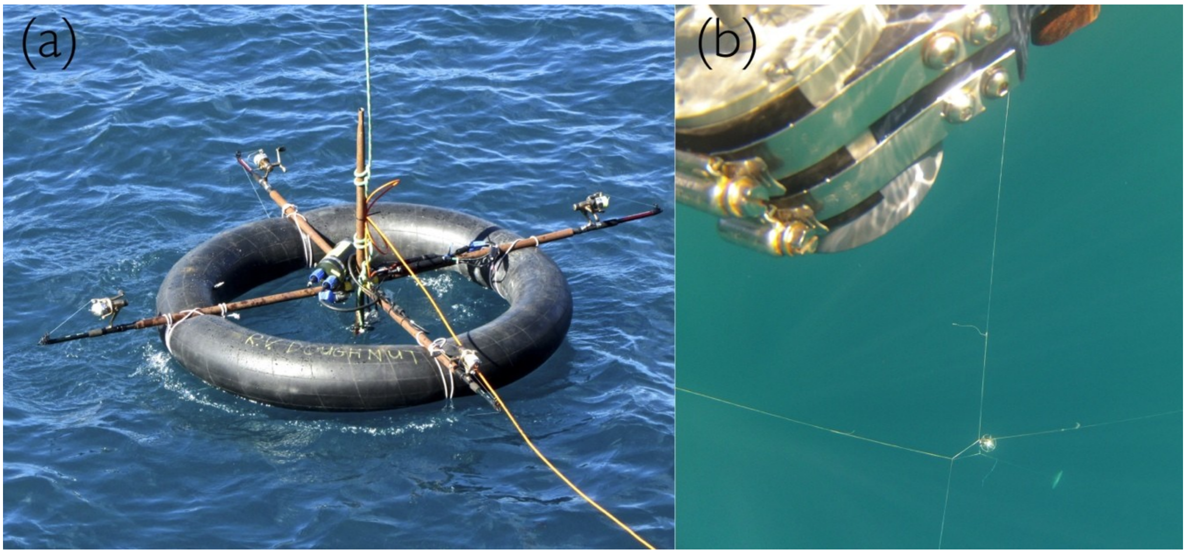


Figure 5: (a) Calibration assembly, (b) Target sphere suspended below echo-sounder

The target reached a maximum depth of 47 m before the reels became inoperable. The target was slowly reeled in and data recorded at discrete depth intervals ~10 m apart for 10 minutes at 40 dB gain and 5 minutes at 20 dB gain. During recording to the second laptop the Win853 software froze, requiring a restart of the programme and resulting in a third .853 being generated.

The data were recorded in .853 format and read into Matlab using the *read853.m* function. The raw bin values, depth and time variables were then written to an Echoview compatible sv.csv file using the function *calibrationtoechoview.m*. The bin values were assessed and ranges extracted upon import into Echoview. A histogram of range values was created for each range at which the target rested. This was performed using the 40 dB gain data only, as the 20 dB gain data shows very weak signals.

The recorded bin value of the target sphere was quite consistently offset from the calculated display value, varying between -14 dB and -14.6 dB, except in the case of the data from a range of 10 m, where the offset was -12.4 dB (Figure 6). This point was excluded as above threshold, however this issue requires a closer examination of the data. The average of the other offsets was -14.3035, from which a calibration value is derived by multiplication by -1. An ES853 calibration file was created with this calibration value for use in processing of the RMT8 data.

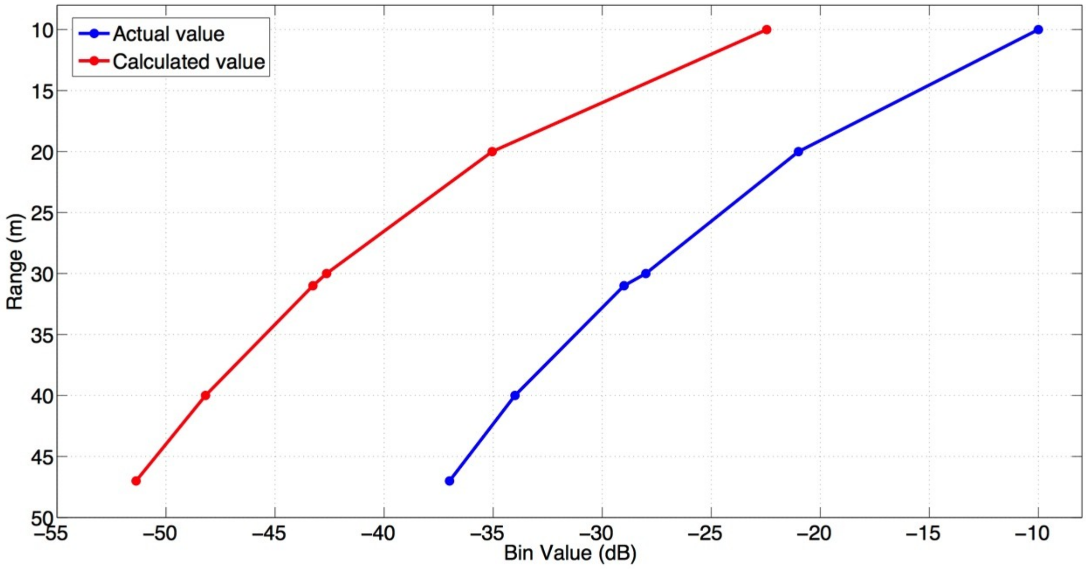


Figure 6: Calibration results showing calculated bin and recorded bin values for target sphere

5.2.3 Deployments of ES853 on the RMT8 cross

The echo sounder system was mounted on the RMT cross during all net deployments. The cable was strapped in place around the frame and the echo sounder was mounted on a bracket in the space normally occupied by the RMT altimeter. The altimeter was repositioned at the rear of the cross. The echo sounder's transducer was positioned at approximately 45 ° to the crosses orientation, such that it would be facing downwards during towing (Figure 7).

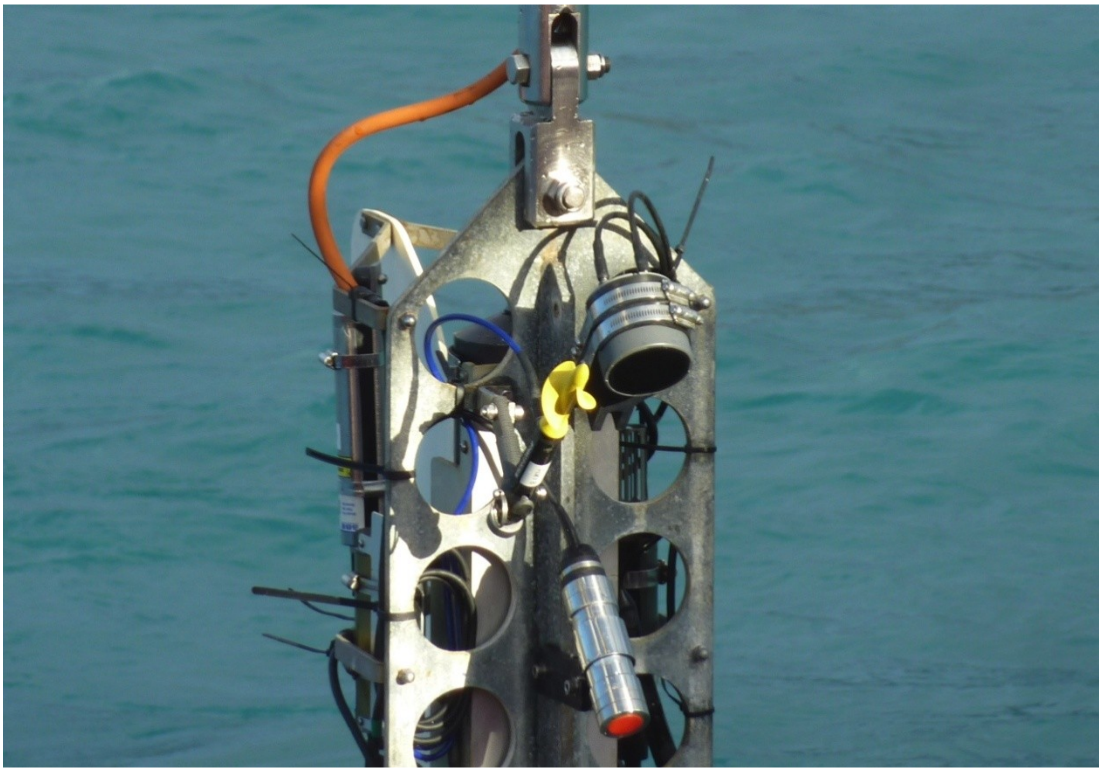


Figure 7: RMT8 cross during deployment. From the top, ES853, flowmeter and altimeter

Unit 5379 was deployed during each deployment of the RMT8 trawls. A summary of the ES853 deployments are given in Table 14. Deployments with no stop time were ceased by switching off the downwire net monitor power. During the summer the downwire net monitor electronics board was modified to supply power to the ES853. Powering the ES853 directly from the downwire net monitor has the considerable advantage of constant voltage, without the need to recharge. One disadvantage is that the ES853 function ceases once the net operator switches off power to the cable. This has no adverse affects on the echo-sounder but a post-deployment communication with the ES853 is useful to confirm that it is still operating. During initial testing direct power was found to work but interfered with the signals being passed back through the cable. The ES853 was thus deployed in standard battery configuration for the first test station at Bird Island (Events 18 and 19). Following this the downwire net monitor was serviced and the source of interference removed so that following deployments could power the ES853. The ES853 was powered by battery for one additional deployment when it was suspected that the downwire net monitor power might be responsible for data loss in the unit (Event 101).

Initial deployments of the ES853 were positive, with data recorded and recovered successfully. After Event 90 it was discovered that while serial communication with the ES853 was possible and that it was confirmed to be pinging on deck prior to and following a deployment, data were not being recorded. The downwire net monitor power was substituted for battery power for Event 101, though this was found to have no effect on recording. Unit 5370 was disassembled and the memory card discovered to be loose. It was re-seated and fixed in place. No further data loss was experienced. Data were truncated to only the deck portion for Event 57 and no data were recorded for Events 90, 91, 92, 93 or 101. Data should be downloaded from the ES853 as often as conditions allow to monitor the performance of the unit and to ensure that the card has not become unseated.

It has previously been found that the IE55W Impulse connectors on the ES853 are liable to corrosion (JR260b, JR280) and so adapter cables have been manufactured such that all interaction with the unit can be performed using the more durable Birns type connectors. Data can now be downloaded from the unit using USB without the risk of exposing the pins to moisture. Despite these efforts corrosion was still discovered in the 4 pin USB connector, resulting in the loss of a bulkhead pin. This may be due to the forces on the connectors during deployment, though requires further investigation.

A consequence of the revision of the ES853 hardware is that the echo sounder does not create new files each time it is set to stand alone mode using the standard Win853 software. Instead it appends a single file unless it receives a serial command to generate a new file. This required the splitting of the file into distinct events, achieved by searching for gaps in the time series. A Matlab function, *makeuniqueecho.m,* is used for this purpose. The Win853 software was used to control the ES853 during Events 18 and 19 but following that a new Matlab interface was trialled and ultimately used successfully for the subsequent deployments. The function, *ESping.m*, uses commands from the Seaglider interface and stipulates individual dive numbers, which are used in the naming of the files, thus generating unique files (Table 14).

Table 14: Summary of ES853 deployments

Deployments with no stop time were ceased by switching off the downwire net monitor power.

Event	Date	Start	Stop	Deployment Type	Note	Filename
18&19	23/11/13	20:22	21:35	BI Test station	Data	JR291_ES00001A.853
-	05/12/13	19:46	19:49	Deck test	Data	JR291_ES00002A.853
-	05/12/13	19:49	19:52	Deck test	Data	JR291_ES00002A.853
49,50&51	05/12/13	19:55	21:53	Cumberland Bay Training	Data	JR291_ES00003A.853
57	06/12/13	10:08	11:39	WCB Mooring Location	Truncated Data – deck only	JR291_ES00004A.853
-	09/11/13	19:35	-	Not deployed	Data – deck only	JR291_ES00005A.853
90	10/12/13	20:10	-	Oblique haul	No data	
91	10/12/13	23:34	00:06	Target	No data	
92	11/12/13	00:55	-	Target	No data	
93	11/12/13	03:30	-	Oblique haul	No data	
101	11/12/13	19:31	20:49	Oblique haul	No data	
-	11/12/13	23:25	23:42	Deck test	Data – deck only	JR291_ES00011A.853
104	12/12/13	02:12	02:57	Target	Data	JR291_ES00012A.853
105	12/12/13	03:33	04:11	Target	Data	JR291_ES00013A.853
106	12/12/13	04:30	04:59	Oblique haul	Data	JR291_ES00014A.853
119	12/12/13	19:18	19:42	Target	Data	JR291_ES00015A.853

121	13/12/13	01:11	02:26	Oblique haul	Data	JR291_ES00016A.853
145	15/12/13	23:30	00:06	Target	Data	JR291_ES00017A.853
146	16/12/13	01:48	02:40	Target	Data	JR291_ES00018A.853
147	16/12/13	03:06	03:36	Target	Data	JR291_ES00019A.853

5.2.4 Calculation of ES853 position

The position of the RMT8 cross with the ES853 is calculated using data downloaded from the SCS database. The data to be downloaded from the SCS is specified using the Matlab function *DWNMcapture.m*, which generates a CSV file with the start and stop times for each loaded ES853 file. The output CSV file can then be used with a process on the JRLB server (/packages/dps/current/utils/dps.p) to export the winch, netmonitor and navigation streams from the database, as defined by an additional XML file. The process outputs individual files for each ES853 file loaded and are read into Matlab using the function *readDWNM.m*. The calculation of the net position and echo-sounder orientation is performed using the function *aligndwnm.m*.

The calculated position of the net has a number of inherent assumptions and takes no account of the currents, drag on the net or sag in the cable. To test the calculation a Sonardyne WSM6 Wideband Submini locating transducer (USBL) was attached to the biowire cable at the closest point to the RMT8 cross during Events 49, 50, 51 and 57 (**Error! Reference source not found.**Figure 8). No data were collected by the ES853 during Event 57 so only the first three are considered. The USBL responds to interrogation by transmitting a ping back to a lowered transducer on the ship, from which its position is calculated.

Figure 8: USBL attached to biowire cable, directly above termination

The data from the USBL showed that there was a difference between calculated net position and USBL location of the up to 65 m at a depth of almost 80 m. To deep deployments this difference could be expected to gro proportionally. The data showed that the error was mostly in distance from the ship and that the side to side variation was just a scaled factor. Therefore, distance behind the ship is the largest source of error in the net calculations.

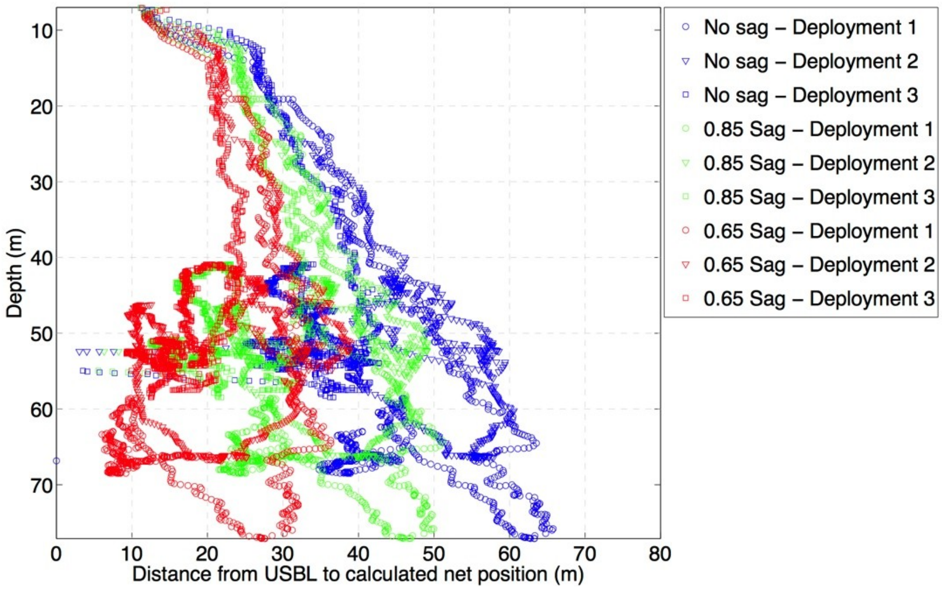


Figure 9: Net distance from USBL calculated with varying sag coefficients

The introduction of a sag coefficient into the *aligndwnm.m* function was seen to decrease the error by up to 50% at depths below 40 m (**Error! Reference source not found.**Figure 9). A sag coefficient of 0.65 was found to be the most useful, i.e. multiplying cable out by 0.65. Sag is a function that is not static and a more nuanced approach should see even closer correspondence between net calculation and actual location.

5.2.5 Processed ES853 acoustic data

The ES853 acoustic data were processed with the calibration values and positioned with the updated *aligndwnm.m,* accounting for static sag and export for further analysis to Echoview. The weight bar is visible in the data between 7.5 and 9 m from the ES853, though this can be masked out. There are various interferences from acoustic systems visible in the data but they too can be masked. A number of krill swarms are present in the data (**Error! Reference source not found.**Figure 10) and have appropriate backscatter values.

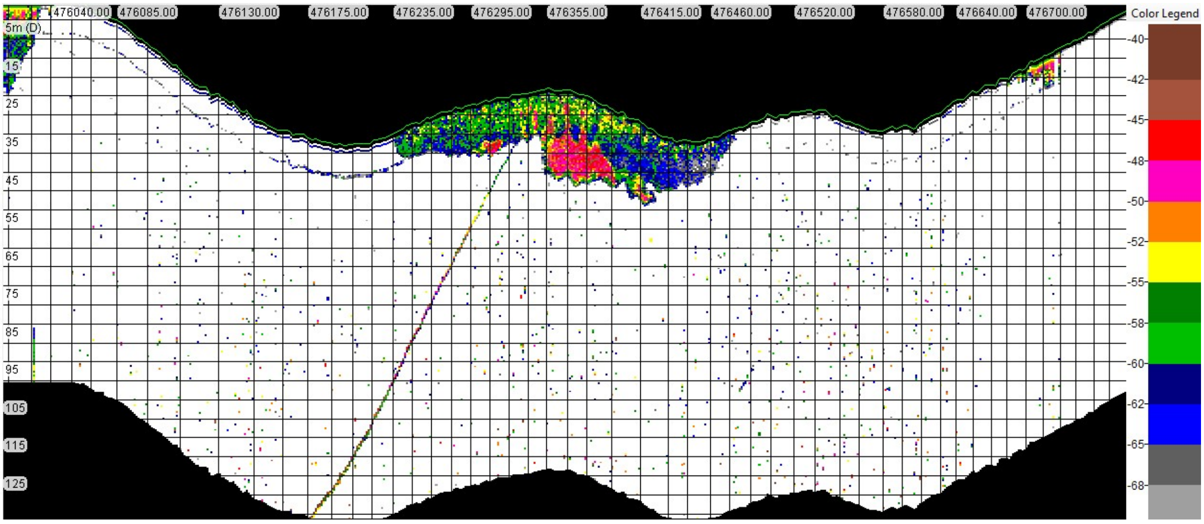


Figure 10: Calibrated Mean Volume BackScattering data for Event 119

All referenced functions have been saved to the cruise directory.

5.2.6 References

Foote, K., H. Knudsen, G. Vestnes, D. N. Maclennan, and E. J. Simmonds. 1987. Calibration of acoustic instruments for fish density estimation: A practical guide. ICES Coop. Res. Rep. 144:69

Urick, R. J. 1983. Principles of underwater sound, 3rd ed. McGraw-Hill.

5.3 EM122 Multibeam echosounder

The EM122 was run opportunistically throughout the transit periods of the cruise. When used the EM122 was operated through the SSU triggering once for every 5-10 triggers of the EK60 depending on water depth. Data was stored in 3 folders depending on leg. JR291_a for trip from South Georgia to Signy. JR291_b for Gourlay and over the Signy mooring location, and finally JR291_c for the transit from Signy to South Georgia. No data were processed.

6 Nets

6.1 Bongo net catches

Geraint Tarling, Peter Ward, Clara Manno, Vicky Peck, BAS

A motion-compensated bongo net (60 cm diameter, 100 µm and 200 µm mesh) was deployed frequently throughout the cruise. The net was deployed to a maximum depth of 200 m, but shallower in inshore regions (generally within 50 m of bottom depth). The net was mainly deployed with plastic bags within the cod-ends which were extracted once the net was secured on board. Once extracted, the bags were gently emptied of their contents into buckets and then replaced into the cod-ends ready for the next deployment.

All Bongo net catches were initially examined to extract any juvenile or adult pteropods (notes of any specimens extracted are detailed in Table 15 below). If the catch was in a unique location, the catch remnants were the preserved - 100 µm into 75% buffered ethanol, 200 µm into formalin (although the 200µm fraction was sometimes preserved in ethanol in a small number of instances). The remnants of catches that were repeat deployments within a single location were mainly discarded.

Overall, there were 41 deployments, of which 24 catches were preserved and the remainder discarded.

Table 15: Station details and comments on fate of catch for all Bongo net deployments

Time	Latitude	Longitude	Depth	Temp °C	Salinity	Chl-a	PAR	Transmittance	Comment
15/12/2013 15:17	-52.7605	-39.1354	3763.39	2.25	33.817	1.429	456	0.520561	E144 (Upwelling). 0-200 m. Picked for pteropods - remnants 100um into 75% buffered ethanol 200um into buffered formalin
15/12/2013 14:57	-52.7604	-39.1353	3750.14	2.25	33.8159	1.457	615.8	0.523038	E143 (upwelling). 0-200 m. Picked for pteropods - remnants not retained. VLP picked 7x large L. retro 18x L. retro 10s of veligers (many veligers remained unpicked)
14/12/2013 11:20	-52.7604	-39.1353	3750.14	2.25	33.8159	1.457	615.8	0.523038	E138 (P3). 0-200 m. Picked for pteropods - remnants not retained
14/12/2013 10:58	-52.688	-40.2652	3787.58	2.13	33.8253	1.069	524	0.548967	E137 (P3). 0-200 m. Picked for pteropods - remnants 100um into 75% buffered ethanol 200um into buffered formalin. VLP picked 1x small C. pyramidata 3x L. retro 6x veligers
14/12/2013 04:13	-52.7693	-40.1528	3787.39	1.93	33.8235	1.214	-0.6	0.542882	E131 (P3). 0-200 m. Picked for pteropods - remnants 100um into 75% buffered ethanol 200um into buffered formalin. VLP picked 1x adult L. helicina several L. retroversa numerous veligers (Many many veligers remain in sample)
13/12/2013 14:46	-52.7696	-40.1549	3787.58	1.74	33.8327	1.004	2136.2	0.580156	E127 (P3). 0-200 m. Picked for pteropods - remnants not retained. VLP picked 4x L. retro several 10s veligers
13/12/2013 14:26	-52.7688	-40.155	3785.86	1.74	33.8367	0.934	2073	0.581069	E126 (P3). 0-200 m. Picked for pteropods - remnants 100um into 75% buffered ethanol 200um into buffered formalin. see E127 for

									VLP pteropod notes
13/12/2013 00:40	-53.846	-39.1419	283.01	1.67	33.8405	0.822	-0.6	0.586242	E120 (WCB). 0-200 m. Picked for pteropods - remnants 100um into 75% buffered ethanol 200um into buffered formalin. VLP picked 3x L. retro 4x veligers
12/12/2013 06:03	-53.7138	-37.9655	132.67	1.41	33.7954	0.738	6	0.605064	E108 (WCB). 0-200 m. Picked for pteropods - remnants 100um into 75% buffered ethanol 200um into buffered formalin.CM found no pteropods.
11/12/2013 21:05	-53.7138	-37.9655	132.67	1.41	33.7954	0.738	6	0.605064	E102 (WCB). 0-200 m. Picked for pteropods - remnants 100um into 75% buffered ethanol 200um into buffered formalin. VLP picked 1x L. helicina (for lipids) numerous L. retro and veligers used in D18 growth experiment
11/12/2013 06:25	-53.4322	-38.695	1497.98	1.33	33.8217	0.591	7.6	0.638187	E095 (WCB). 0-200 m. Picked for pteropods - remnants 100um into 75% buffered ethanol 200um into buffered formalin. CM picked numerous juveniles usedin D16 growth exp.
10/12/2013 19:55	-53.785	-38.5839	206.59	1.37	33.8592	0.528	171.4	0.642621	E089 (WCB). 0-150 m. Picked for pteropods - remnants 100um into 75% buffered ethanol 200um into buffered formalin. VLP picked 1x L. retro
08/12/2013 18:39	-52.7665	-40.1571	3784.7	1.62	33.8305	1.055	816.2	0.560226	E074 (P3). Picked for pteropods. Remnants not retained. VLP picked 1x adult L. helicina (for lipids) and numerous L. retro and juveniles used in D15 growth exp.
08/12/2013 18:18	-52.688	-40.265	3788.35	2.17	33.8254	1.13	679.4	0.544555	E073 (P3). Picked for pteropods. Remnants not retained.See E074 for VLP notes on 72-74
08/12/2013 17:57	-52.7685	-40.1562	3790.46	1.62	33.8254	1.009	540	0.558965	E072 (P3). 0-200 m. Picked for pteropods - remnants 100um into 75% buffered ethanol 200um into buffered formalin. See E074 for VLP notes on 72-74

07/12/2013 19:40	-55.2586	-41.2949	3469.06	0.33	33.8499	0.682	1172.2	0.60439	E069 (P2) picked for pteropods. Remnants not retained
07/12/2013 19:18	-55.2587	-41.295	3469.06	0.31	33.8563	0.668	1042.8	0.605759	E068 (P2) picked for pteropods. Remnants not retained
07/12/2013 18:53	-55.2586	-41.2949	3468.67	0.29	33.8392	0.635	1249.4	0.607346	E067 (P2) picked for pteropods. Remnants not retained
07/12/2013 07:47	-55.2526	-41.2631	3372.86	0.03	33.866	0.686	175.8	0.605716	E062 (P2) picked for pteropods. Remnants not retained. from E060-62 VLP picked 6 x adult L. helicina numerous juveniles. All used in exp. 4
07/12/2013 07:28	-55.251	-41.2632	3372.86	0.03	33.8606	0.696	98.4	0.60652	E061 (P2) picked for pteropods. Remnants not retained. See E062 for VLP notes on 60-62
07/12/2013 07:02	-55.2515	-41.2636	3372.67	0.03	33.8662	0.686	74	0.607085	E060 (P2) picked for pteropods. Remnants not retained. See E062 for VLP notes on 60-62
06/12/2013 12:23	-52.7693	-40.1561	3787.97	1.63	33.8292	0.971	701.8	0.55727	E059 (WCB mooring) picked for pteropods. 0-200 m. 100um in 75% buffered Ethanol 200um in buffered formalin. VLP found no pteropods. Krill pooh only.
06/12/2013 01:29	-54.2865	-36.4788	50.88	1.41	33.0959	0.565	-0.8	0.325473	E056 (Cumberland Bay) picked for pteropods. Remnants not retained. From E055 and 56 VLP picked 2x L. retro (large; of which was being 'eaten'?)5 L. retro (small) 9 veligers
06/12/2013 01:18	-54.2865	-36.4788	52.22	1.38	33.292	0.577	-0.8	0.368854	E055 (Cumberland Bay) picked for pteropods. Remnants not retained. see E056 for VLP pick from 55 +56
06/12/2013 00:32	-54.2835	-36.4644	143.42	1.31	32.9166	0.563	-0.8	0.307672	E054 (Cumberland Bay) picked for pteropods. Remnants not retained. VLP picked 1x adult L. helicina 2x L. retro (large) 9 x veligers
05/12/2013	-54.2809	-36.4508	197.95	2.13	32.9517	0.537	-0.8	0.444208	E053 (Cumberland Bay) picked for pteropods.

23:52									Remnants not retained. VLP picked 3 x L. retro (small)
05/12/2013 23:01	-54.2783	-36.4375	253.82	1.91	32.9551	0.542	1.2	0.400826	E052 (Cumberland Bay) picked for pteropods. Remnants not retained. VLP picked 3x L. retro (large) 7x L. retro (small) 2 veligers. Used in growth experiment 119
03/12/2013 14:57	-55.1952	-41.3348	3318.34	0.26	33.7765	1.018	488.6	0.622864	E045 (P2 mooring) picked for pteropods. Remnants not retained.
03/12/2013 14:32	-55.1938	-41.3384	3318.34	0.28	33.7799	1.004	783.8	0.617018	E044 (P2 mooring) 0-200m Picked for pteropods. Remnants of 200um in buffered 80% EtOH.
03/12/2013 14:17	-55.1937	-41.3388	3318.34	0.28	33.7795	0.929	1022.4	0.62406	E043 (P2 mooring) 0 to 50 m. Picked for pteropods. Remnants of 200 um into 80% buffered ethanol.
01/12/2013 11:58	-55.1901	-41.3609	3360	0.47	33.7828	1.093	-0.8	0.654097	E032 (ICE2) 200um formalin; 100um picked for pteropods and remants in buffered 80% EtOH. No pteropods found.
30/11/2013 19:23	-60.2732	-46.1716	2742.88	-1.57	34.0601	0.497	707.6	0.573658	E024 (ICE1) 200um formalin; 100um picked for pteropods and remants in buffered 80% EtOH. No pteropods found
30/11/2013 18:44	-59.9623	-46.16	4509.12	-0.8	34.1561	0.56	610	0.64662	E023 (ICE1) 200um formalin; 100um picked for pteropods and remants in buffered 80% EtOH. 1x adult C. pyramidata no veligers
23/11/2013 18:53	-54.118	-38.307							Test station for rebuilt net. Catch discarded. VLP picked L. retroversa and L. helicina from MOCNESS samples for use in incubation 2
22/11/2013 21:45	-54.2777	-36.4388							Wire parted during deployment - rebuilt net following day
22/11/2013 20:09	-60.2732	-46.1716	2839.71	-1.57	34.0488	0.502	785.2	0.547555	E014 (St 3 Cumberland Bay) 200um formalin; 100um picked for pteropods and remants in buffered 75% EtOH. VLP picked 2x L. retroversa and several veligers

22/11/2013 18:22	-54.298	-36.4419	102.72	2.33	32.963	0.278	1217	0.447185	E011 (St 4 Cumberland Bay) 200um formalin; 100um picked for pteropods and remants in buffered 75% EtOH.picked 1 x L. retrovera and several veligers
22/11/2013 17:20	-54.3049	-36.442	50.5	2.64	32.8855	0.281	1408.8	0.446838	E09 (St. 5 Cumberland Bay) 200um formalin; 100um picked for pteropods and remants in buffered 75% EtOH. VLP found no pteropods
22/11/2013 15:56	-54.3081	-36.4415	24.92	2.29	33.0386	0.285	2254.2	0.46968	E07 (St. 6 Cumberland Bay) 200um formalin; 100um picked for pteropods and remants in buffered 75% EtOH. VLP found no pteropods
22/11/2013 14:04	-54.2895	-36.4398	203.71	1.49	33.2152	0.281	2242.4	0.480352	E04 (St. 2 Cumberland Bay) 200um formalin; 100um picked for pteropods and remants in buffered 75% EtOH. VLP picked 3x L. retroversa and several veligers
22/11/2013 11:11	-54.278	-36.4389	252.48	8.12	33.9321	0.364	728	0.377179	E001 (St. 1 Cumberland Bay) 200um formalin; 100um picked for pteropods and remants in buffered 75% EtOH. VLP picked 8x L. retroversa and numerous veligers

6.2 MOCNESS sampling

G Tarling, G Stowasser, D Guihen, S Fielding, P Enderlein, BAS

An 8m^2 MOCNESS net equipped with 333um mesh was deployed at several locations for the purpose of obtaining depth-stratified catches of the zooplankton community to a maximum depth of 1000 m. The water column was divided into approximately 200 m depth intervals in the deeper water column, reducing to 100 m and then 50 m intervals closer to the surface. The MOCNESS was deployed with Net 1 open, with the trawl wire paid out at a speed of 30 m/min and the ship travelling at between 2 and 2.5 knots. Net 1 was closed at the maximum sampling depth of 1000 m. The trawl wire was hauled in a 20 m/min and the subsequent 8 nets (Net 2 to 9) closed in sequence as the net reascended.

6.2.1 Performance of the net

The nets are opened and closed via a stepper motor which retains 9 bridles that support 9 net bars. On sending a signal to the MOCNESS, the stepper motor rotates, releasing a bridle and allowing the corresponding net bar to descend, closing the net below and opening a new net from above. The procedure is monitored by a release trigger which confirms the successful descent of the released net bar. The stepper motor and release mechanisms performed adequately throughout apart from one deployment where the release was not aligned properly to register the dropping of the net bars.

The in-water electronics unit contains a depth sensor which was recalibrated by BESS in September 2013. We noted that it registered between -6 m and -10 m at the surface (i.e. above sea level) before deployment and were suspicious that it was not reading the correct depth when in the water. After the first test deployment where this problem was identified (E017), we performed a calibration deployment in Cumberland Bay (E022) where the system was lowered vertically downwards (all nets were removed) and a comparison made to the MOCNESS depth readings. The two sets of readings were modelled and an offset calculated to convert MOCNESS readings to true depth. This offset was applied during the ICE station and station P2 deployments. During station P3, which occurred 11 days after P2, it was noted that the depth readings at the surface appeared to differ from those noted originally, and seemed to be a better reflection of true depth. During the first deployment at P3 therefore (P3_1, E128), it was assumed that the MOCNESS was reading depth accurately when determining closing depths. A USBL system was added in deployments P3_2 (E130) and P3_DAY (E136) which gave an alternative reading of true depth. It indicated that the MOCNESS was reading deeper than the true depth value by around 50 m at ~1000m, decreasing to around 30 m at the surface. Nets were opened and closed according to the USBL values in the latter 2 events, although it is to be noted that comms with the USBL were temporarily lost during both deployments and it was necessary to make best estimates of depth on certain net increments.

6.2.2 Sample preservation

All nets were immediately picked for pteropods (thecosomes and gymnosomes) by V Peck and C Manno. On certain occasions, other organisms were removed by G Stowasser and S Fielding for genetic and stable isotope analyses. Events 031, 036 and 136 were subsampled for R. Newstead (Bangor U) for genetic analyses of stomach contents with a 50 ml Stempel pipette - 1 pipette sample was immediately frozen at -80oC, the other was preserved in formalin (note the latter was not done for event 036). The remnants of all nets were preserved in75% to 80% buffered ethanol. It is to be noted that Nets 8 and 9 at station P2 and P3 were subsampled because of large amounts of phytoplankton in the catch. Records of all specimens extracted from the catches and any subsampling were recorded on spreadsheets on the shared cruise drive

L:\scientific_work_areas\MOCNESS catches

Table 16: MOCNESS deployments from which samples were extracted, dried, frozen or preserved

(* sampled for R Newstead)

Site	Event numbers	Times of day (GMT)
Ice station 60.2707°S 46.1773°W	E025 E031*	20:02-22:36 09:04-11:25
P2 mooring 55.2029°S 41.2342°W	E036* E040	19:52-21:55 01:37-04:18
P3 mooring 52.7691°S 40.1653°W	E0128 E0130 E0136*	16:52-20:03 00:12-02:47 07:56-10:46

Table 17: Details and accompanying event information for MOCNESS deployments

Time	Latitude	Longitude	Depth (m)	Temp. (°C)	Salinity	Chl-a (RFU)	PAR (umol/ s m^2)	Transmittance (0<tr<1)	Comment
23/11/2013 19:32	-54.1144	-38.3094	162.24	1.38	33.8711	0.318	352.8	0.52469	MOCNESS test deployment (E017). Depth sensor reading -12m at surface; 50.3 m at 150 m wire out. Fired all 9 nets at 150 m wire out (1 min per deployment). Pteropods (*L. retroversa*) in various nets were picked for 2nd pteropod incubation (1 h exposure to calcein). Remnants discarded.
30/11/2013 18:04	-60.2707	-46.1773	2716.22	-1.54	34.0537	0.493	492.8	0.603325	E022 Test station to determine depth calibration to 250 m cable out (vertical drop)
30/11/2013 20:02	-60.2707	-46.1773	2716.22	-1.54	34.0537	0.493	492.8	0.603325	E025 (ICE 1) Net 1 20:00 GMT 0-1000m; Net 2 21:07 1000-750m; Net 3 21:41 750-675; Net 4 21:47 675-500m; Net 5 22:00 500-300m; Net 6 22:22 300-200m; Net 7 22:28 200-100m; Net 8 22:32 100-50m; Net 9 22:36 50-0m. Picked for pteropods and species for GSTO. Remnants into 80% buffered ethanol
01/12/2013 09:04	-55.2029	-41.2342	3227.33	0.68	33.7842	0.803	375.6	0.648533	E031 (ICE 2) Net 1 09:04 GMT 0-1000m; Net 2 10:05 1000-800m; Net 3 10:27 800-600m; Net 4 10:42 600-400m; Net 5 10:56 400-300m; Net 6 11:05 300-200m; Net 7 11:12 200-100m; Net 8 11:19 100-50m; Net 9 11:21 50-0m. 50 ml Stempel pipette fractions from sample volume in water of 2100ml - 1 x frozen; 1 x formalin from nets 2-9 for R. Newstead. Picked for pteropods and species for GSTO and krill adults for SOFI. Remnants into 80% buffered ethanol
02/12/2013 19:52	-55.2029	-41.2342	3227.33	0.68	33.7842	0.803	375.6	0.648533	E036 (P2_1) Net 1 195:2 GMT 0-1000m; Net 2 20:43 1000-800m; Net 3 20:53 800-600m; Net 4 21:05 600-400m; Net 5 21:19 400-300m; Net 6 21:30 300-200m; Net 7 21:39 200-100m; Net 8 21:47 100-50m; Net 9 21:51 50-0m. 2 x 50 ml from 5.5 L Stempel pipette fractions from Nets 8 and 9 because of large amount phytoplankton picked for

									pteropods. Remnants into 80% buffered ethanol. Note no feedback response so incremented manually. Response was at too steep an angle
03/12/2013 01:37	-55.1901	-41.3609	3360	0.47	33.7828	1.093	-0.8	0.654097	E040 (P2_2) Net 1 01:37 GMT 0-1000m; Net 2 02:46 1000-800m; Net 3 03:02 800-600m; Net 4 03:22 600-400m; Net 5 03:41 400-300m; Net 6 03:50 300-200m; Net 7 04:03 200-100m; Net 8 04:10 100-50m; Net 9 04:14 50-0m. 50 ml Stempel pipette fractions from sample volume in water of 2100ml - 1 x frozen for R. Newstead (NB No fractions taken for formalin preservation. Picked for pteropods. Subsamples taken of nets 8 and 9 because of large amounts of phytoplankton. Remnants into 80% buffered ethanol.
13/12/2013 16:52	-52.7691	-40.1653	3800.83	1.93	33.8337	0.887	1308.4	0.575831	Ev128 (P3_1) Net 1 16:52 GMT 0-1000m; Net 2 18:11 1000-800m; Net 3 18:28 800-600m; Net 4 18:49 600-400m; Net 5 19:13 400-300m; Net 6 19:22 300-200m; Net 7 19:37 200-100m; Net 8 19:55 100-50m; Net 9 20:00 50-0m.
14/12/2013 00:12	-52.765	-40.163	3787.78	1.97	33.8228	1.251	-0.6	0.539187	Ev130 (3_2) Net 1 00:12 0-1000m; 01:15 1000-800m; 01:30 800-600m; 01:46 600-400m; 02:04 400-300m; 02:14 300-200m; 02:28 200-100m; 02:36 100-50m; 02:41 0-50m. Surface 02:41
14/12/2013 07:56	-52.7667	-40.1586	3783.17	2.02	33.8223	1.298	116.8	0.529841	Ev136 (P3_3) Net 1 07:56 0-1000m; Net 2 09:07 1000-800m; Net 3 09:21 800-600m; Net 4 09:42 600-400m; Net 5 10:04 400-300m; Net 6 10:18 300-200m; Net 7 10:23 200-100m; Net 8 10:32 100-50m; Net 9 10:38 50-0m. 50 ml Stempel pipette fractions from sample volume in water of 2000 ml buckets 2-7 for R. Newstead

Table 18: Net depth intervals (m) and volumes filtered (m3) by the MOCNESS

Net number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Depth interval (m)	0-1000	1000-750	750-675	675-500	500-300	300-200	200-100	100-50	50-0
E022 ICE1	2302	1553	257	580	275	0	291	161	90
Depth interval (m)	0-1000	1000-800	800-600	600-400	400-300	300-200	200-100	100-50	50-0
E031 ICE2B	2125	962	670	617	383	291	276	112	142
E036 P2_1	1437	391	549	577	476	428	335	223	134
E040 P2_2	2601	745	912	900	403	610	308	183	126
E128 P3_1	3212	818	1032	1151	452	735	405	415	226
E130 P3_2	1767	648	678	842	423	635	342	??	219
E136 P3_DAY	2228	640	953	992	617	202	392	270	271

6.3 RMT8 Macrozooplankton

Gabriele Stowasser, Sophie Fielding, Peter Enderlein, Scott Polfrey, Damien O'Gaoithin, Geraint Tarling, Clara Manno, Peter Ward BAS

6.3.1 Gear

The RMT8 was used to characterise the macrozooplankton community in the Western Corebox in 200m oblique trawls and target trawls (Table 19 – RMT net events). Target trawls were undertaken on krill swarms identified from the EK60. In oblique trawls net 1 was opened at the surface and the net deployed to 200m (where water depth was sufficient) before closing and net 2 opened at 200m depth and closed at the surface. The choice of deployment type depended on the task. Target hauls were made to supply Geraint Tarling (BAS) with *Euphausia superba* (Antarctic krill) for live incubations and the WCB team with krill for length frequency measurements, speed of sound calibrations and preservation for genetic studies in Cambridge. Oblique trawls were only undertaken at the Western Core Box CTD positions. One net catch was worked up and the other preserved in 4% formalin to be analysed in the laboratory in Cambridge. Of some catches only a subsample was preserved due to the size of the catch.

6.3.2 Catch sorting and processing

Oblique hauls

For the oblique hauls the total catch of net 2 was sorted and quantified. Numbers caught and total weight was obtained for each species. For some groups specific identification was not possible and identification will be verified through re-examination in the laboratory. All material collected in net 1 was preserved in formalin. Specimens of fish species were collected for a population study on fish in the Scotia Sea (Ryan Saunders, BAS) and preserved at -80°C. All data were recorded in an Excel database.

Targeted hauls

The catch of targeted hauls was sorted and quantified. Where live E. superba were caught samples were taken for live incubations and speed of sound measurements. Further subsamples were frozen at -80 for genetic studies (Will Goodall-Copestake, BAS and Rebecca Newstead, PhD student). In hauls, where sufficient numbers of E. superba were caught, length-frequency data was collected (see chapter on krill length frequency). 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 my Morris et al. (1988).

Table 19: RMT8 hauls

Event No	Date	In water (GMT)	On deck (GMT)	Comment	Krill
18	23/11/2013	20:40	20:56	Test	
19	23/11/2013	21:07	21:26	Test	
49	05/12/2013	20:04	20:26	Test	
50	05/12/2013	20:44	21:05	Test	
51	05/12/2013	21:22	21:48	Test	
57	06/12/2013	10:13	11:06	Oblique haul	Yes
90	10/12/2013	20:22	21:25	Oblique haul	
91	10/12/2013	23:40	00:00	Target haul	Yes
92	11/12/2013	01:09	01:30	Target not located	
93	11/12/2013	03:36	04:41	Oblique haul	
101	11/12/2013	19:44	20:39	Oblique haul	
104	12/12/2013	02:27	02:50	Target haul	Yes
105	12/12/2013	03:43	03:55	Target haul	Yes
106	12/12/2013	04:25	04:50	Oblique haul	Yes
119	12/12/2013	19:27	19:37	Target haul	Yes
121	13/12/2013	01:24	02:20	Oblique haul	
145	15/12/2013	23:39	00:00	Target haul	Yes
146	16/12/2013	02:05	02:30	Target haul	Yes
147	16/12/2013	03:16	03:31	Target haul	Yes

In addition invertebrate and fish species were collected from two MOCNESS trawls close to the ice-edge (Signy waters) for the analysis of highly-branched isoprenoid (HBI) lipid biomarkers. In Antarctica, a di-unsaturated HBI isomer (diene) was isolated in lipid fractions from diatom communities in sea ice, whereas tri-unsaturated isomers were absent in sea ice samples but present in ice edge and open ocean phytoplankton communities. The aim of this study is to evaluate the usefulness of HBIs for estimating the contribution of organic matter derived from ice algae in pelagic consumers in Antarctic waters. Samples collected from MOCNESS nets were bagged per individual species and frozen at -80°C prior to analysis in the laboratory at BAS.

Table 20: Location and number of invertebrate and fish species sampled off Signy

Project	**Species**	**Event**	**Number sampled**	**Storage**
HBI analysis	Amphipoda	25	7	-80°C
	Chaetognatha spp.	25	10	-80°C
	Decapod larva	25	2	-80°C
	Diphyes sp.	25	1	-80°C
	Euphausia frigida	25	5	-80°C
	Euphausia superba	25; 30	11; 5	-80°C
	Jellyfish brown	25	1	-80°C
	Nematoda	25	10	-80°C
	Ostracoda	25	6	-80°C
	Polychaeta	25	1	-80°C

	Primno macropa	25	1	-80°C
	Thysanoessa spp.	25	4	-80°C
	Electrona antarctica	30	2	-80°C
	Salpa spp.	30	10	-80°C
	Hyperiid amphipods	30	6	-80°C
	Squid paralarva	30	1	-80°C
Genetics	Salpa spp.	30	11	-80°C
	Euphausia superba	104	20	-80°C
	Euphausia superba	119	40	-80°C
	Euphausia superba	145	20	-80°C
Fish population studies	*Gymnoscopelus fraseri*	93	5	-80°C
	Gymnoscopelus braueri	93	6	-80°C
	Protomyctophum sp.	93	3	-80°C
	Protomyctophum bolini	93	1	-80°C
	Gymnoscopelus fraseri	121	9	-80°C
	Gymnoscopelus nicholsi	121	5	-80°C

7 Western Core Box

The Western Core Box transects, XBTs, CTDs and RMT nets were undertaken between the 9th and 11th of December 2013. All details are reported in Table 21 and Table 22. CTD event numbers were 81, 82, 88, 94, 103 and 107 and RMT8 event numbers are 90-93, 101, 104-106, 119 and 121.

Table 21: Western Core Box Acoustic Transects

Reference/ name	Description	Date	Start time (GMT)	End time (GMT)	Start Lat	Start Lon	End Lat	End Lon	Direction of travel	Events while completing transect
WCB1.1	Western Core Box transect 1.1	9th Dec 2013	08:00	12:31	-53.34447	-39.60283	-54.05342	-39.39217	South	76 to 80
WCB1.2	Western Core Box transect 1.2	9th Dec 2013	13:40	18:00	-54.02412	-39.08767	-53.31594	-39.30405	North	See Table 34
WCB2.1	Western Core Box transect 2.1	10th Dec 2013	08:00	13:40	-53.99542	-38.81615	-53.28764	-39.03811	North	83 to 87
WCB2.2	Western Core Box transect 2.2	10th Dec 2013	13:40	18:00	-53.25313	-38.75096	-53.96196	-38.52643	South	See Table 34
WCB3.1	Western Core Box transect 3.1	11th Dec 2013	08:30	13:02	-53.21853	-38.44883	-53.92723	-38.22056	South	96 to 100
WCB3.2	Western Core Box transect 3.2	11th Dec 2013	14:03	18:28	-53.89548	-37.90679	-53.92723	-38.22056	North	See Table 34
WCB4.1	Western Core Box transect 4.1	12th Dec 2013	08:05	12:42	-53.87160	-37.72922	-53.15154	-37.96823	North	109 to 113
WCB4.2	Western Core Box transect 4.2	12th Dec 2013	13:13	17:45	-53.14828	-37.83179	-53.85127	-37.59410	South	114 to 118

Table 22: Western Core Box XBTs

Transect	Event Number	Time	XBT number	Filename	Notes
WCB1.1	76	09/12/2013 08:00	1	T5_00000	Filename is numbered 0 - not the number of the xbt
WCB1.1	77	09/12/2013 09:08	2	T5_00002	
WCB1.1	78	09/12/2013 10:16	3	T5_00003	
WCB1.1	79	09/12/2013 11:23	4	T5_00004	
WCB1.1	80	09/12/2013 12:33	5	T5_00005	

WCB2.1	83	10/12/2013 08:00	6	T5_00006	
WCB2.1	84	10/12/2013 09:08	7	T5_00007	
WCB2.1	85	10/12/2013 10:14	8	T5_00008	
WCB2.1	86	10/12/2013 11:22	9	T5_00009	
WCB2.1	87	10/12/2013 12:29	10	T5_00010	Oceanlogger salinity value was not used as flow rate had stopped and fault with oceanlogger data from 11:50 to approx 13:15 GMT
WCB 3.1	96	11/12/2013 08:30	11	T5_00011	
WCB 3.1	97	11/12/2013 09:40	12	T5_00012	
WCB 3.1	98	11/12/2013 10:49	13	T5_00013	
WCB 3.1	99	11/12/2013 11:56	14	T5_00014	
WCB 3.1	100	11/12/2013 13:02	15	T5_00015	
WCB 4.1	109	12/12/2013 08:05	16	T5_00016	
WCB 4.1	110	12/12/2013 09:12	17	T5_00017	
WCB 4.1	111	12/12/2013 10:19	18	T5_00018	
WCB 4.1	112	12/12/2013 11:28	19	T5_00019	
WCB 4.1	113	12/12/2013 12:42	20	T5_00020	
WCB 4.2	114	12/12/2013 13:13	21	T5_00021	
WCB 4.2	115	12/12/2013 14:23	22	T5_00022	
WCB 4.2	116	12/12/2013 15:30	23	T5_00023	
WCB 4.2	117	12/12/2013 16:38	24	T5_00024	
WCB 4.2	118	12/12/2013 17:45	25	T5_00025	

8 Krill

8.1 Krill tail flip experiments

Geraint Tarling and Sophie Fielding, BAS

Hill et al. (1996) and Croxall et al (1997) have demonstrated that there is a bias towards adult female krill in the stomach content of land based higher predators. It remains to be determined whether the bias is the result of selection by the predators or due to better escape responses in males and subadults compared to females. One of main means of escape is through the rapid flexion of the abdominal muscles (the tail flip). A protocol was carried out examining how each of the developmental stages of krill responded to stimuli evoking a tail flip response. In particular, a major objective was to determine whether stages showed different levels of stamina to repeated stimuli, as may be the case when swarms are targeted by numerous of predators over an extended period.

Krill were incubated for 24 h before being introduced into a 500 ml square edged containers containing water at ambient temperature. The krill were allowed to settle for between 5 and 10 minutes. A cable tie was the introduced every 10 seconds over a 3 minute period and the antennae or tail where gently prodded. A tail flip response to the stimuli was noted each time it occurred. The results were divided into 1 minute periods, the maximum responses per minute amounting to 6. Any krill that did not respond to the stimuli at least 3 times during the first minute was rejected.

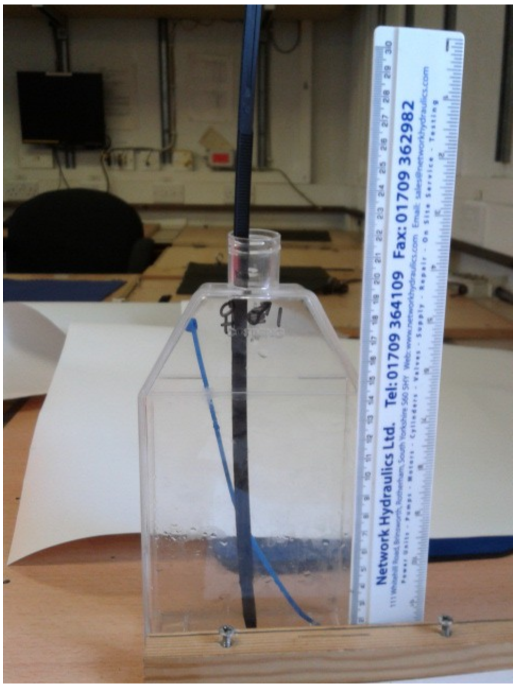


Figure 11: Apparatus showing incubation chamber and cable ties used to stimulate the tail or antennae of the krill

Preliminary analyses showed that krill did show varying levels of non-responsiveness over the 3 minute period and there was a significant decline between the number of responses during minute 1 compared to minutes 2 and 3.

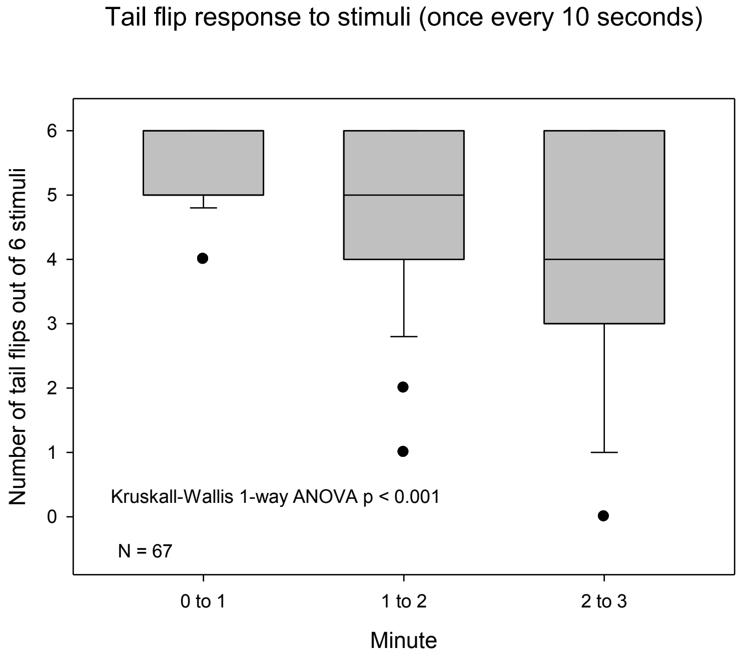


Figure 12: Tail flip response of krill to stimuli to antenna or tail every 10 seconds

However, no significant difference was found between developmental stages and sexes.

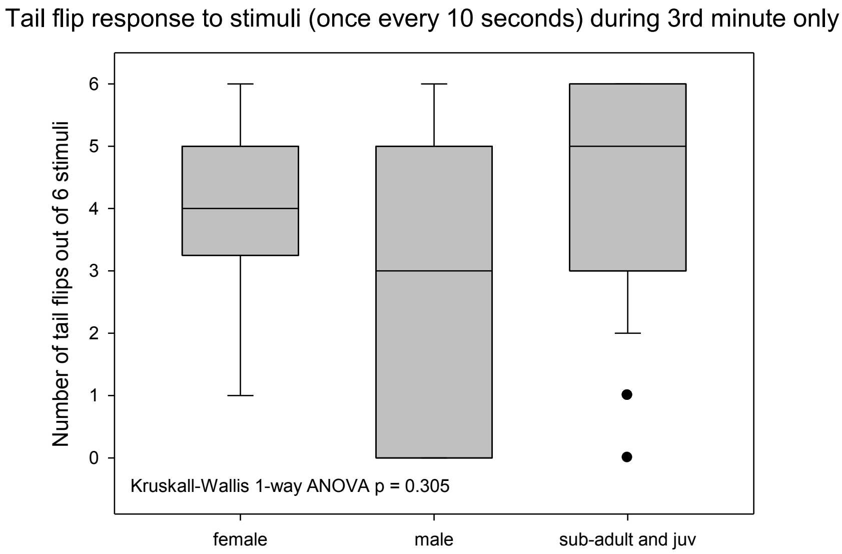


Figure 13: Comparison between sexes and developmental stages in the number of tail flips during the 3rd minute of the experiment

Numbers of krill examined was relatively small (n = 67). The protocol appears to be capable of determining levels of stamina. However, given the level of variability between individuals, analysis much greater numbers would be required (N>200 with at least 50 each of adult males and females) to determine if any significant difference between stages and sexes exists.

8.2 Photography of krill samples

Damien Guihen and Sophie Fielding, BAS

Each krill sample that was used as part of the length frequency sampling was photographed both dorsally and laterally. The photographs were taken for use in the development in a computerised approach to calculating the shape of krill to better inform a krill target strength model.

Krill were arranged on plastic boards in five rows of five, with the exception of Event 91, where only 20 individuals were photographed in irregular rows and Event 147, Net 2, where only rows of four were possible as the krill were large. The boards were royal blue colour, intended to optimize the contrast with the krill bodies.

A Nikon D3X with an attached AF-S Micro Nikkor 60 mm f/2.8G ED lens was mounted level, above the board such that the board was almost filling the field of view (**Error! Reference source not found.**Figure 14). Two magnetically mounted flash guns were positioned low, either side of the board, approximately 1 m apart and connected to the camera. The camera was set in Manual mode with an aperture of F32 and a shutter speed of 1/40 and ISO of 250 and Auto White Balance. Photos measured 6048 × 4032 (24.4 MP).

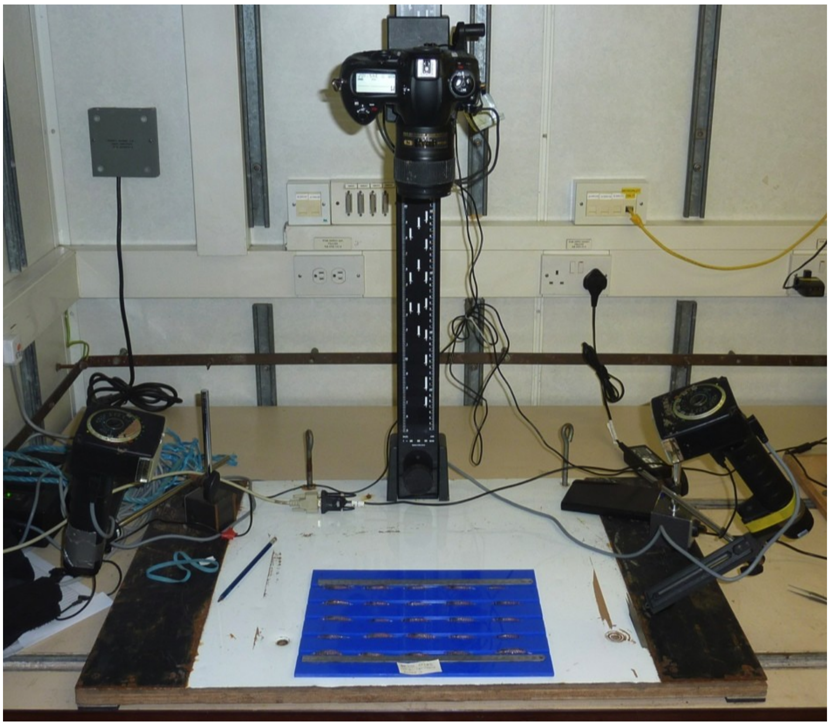


Figure 14: Krill photography setup with magnetically mounted flash guns, camera stand and krill board

The photos (e.g. Figure 15) were downloaded directly from the camera into Apple Aperture, where the raw Nikon NEF files were processed for JPEG export, catalogued and renamed to include the cruise code, event number, net and board numbers and aspect. A summary of the photograph details is included in Table 23.

Figure 15: Example of lateral view of a typical sample board

Table 23: Summary of krill catches photographed

Event	Net	Boards	Individuals
91	2	1	20
104	1	4	100
105	1	4	100
105	2	4	100
119	1	4	100
119	2	4	100
145	1	4	100
145	2	4	100
146	2	4	100
147	2	5	100

8.3 Krill weigh bridge

Sophie Fielding, BAS

The krill weigh bridge was not brought out until late in the cruise, due to other commitments. Initially on testing one of the channels didn't work properly either reading 0 or 1023 counts with no sensitivity between when a weight was off and on the balance. It appeared that one of the resistors was missing from the circuit board. This was replaced by Jules (AME) and then the balance ran, however it performed differently from before. After several checks it was decided that the balance was not performing as required and we were unable to use it this season.

8.4 Krill Speed of Sound

Sophie Fielding, BAS

The speed of sound equipment required to measure the speed of sound (c) through krill involves a Perspex tube of a known length, with a transducer and receiver in the end caps. The transducer is triggered using an electronics box built by Sevi. The receiver is connected to an oscilloscope (that is also connected to the triggering box) and c is measured as the time between the trigger sent and an observation of the first sound wave received by the receiver.

During JR291 Scott Polfrey and Pete Enderlein built end caps for the new speed of sound equipment, incorporating the transducer and receivers that Vsevolod had ordered into moulded end caps (Figure 16). The system was therefore far more robust in terms of repeating the distance of the tube compared with the bungs used previously.

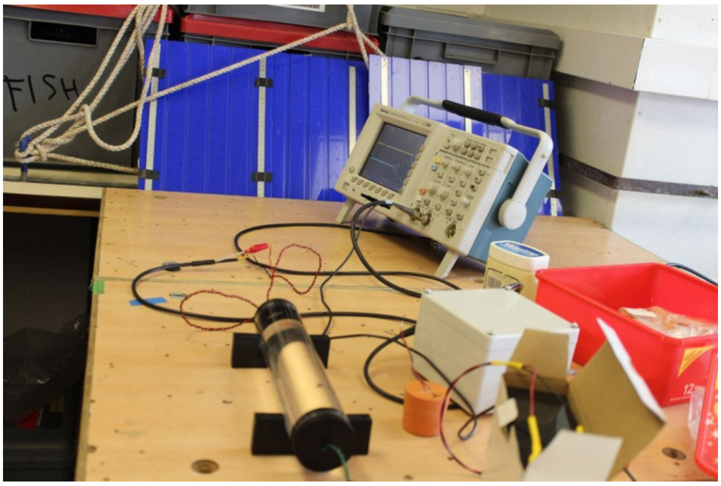


Figure 16: The krill speed of sound setup

The Perspex tube was measured at 22.5 cm, the total volume of water within the tube was 295 ml and it was filled with seawater from the underway that had a salinity of 33.78 PSU and a temperature of 1.58°C (Table 24), and filled with a variety of krill numbers (Figure 17).

Table 24: Sound speed measured with different numbers of krill in tube

Time stamp on oscilloscope	Contents of Perspex tube	Measured response time
08:25	Seawater	134 us
08:34	20 krill	170 us
08:40	50 krill	173 us
08:47	90 krill	173 us

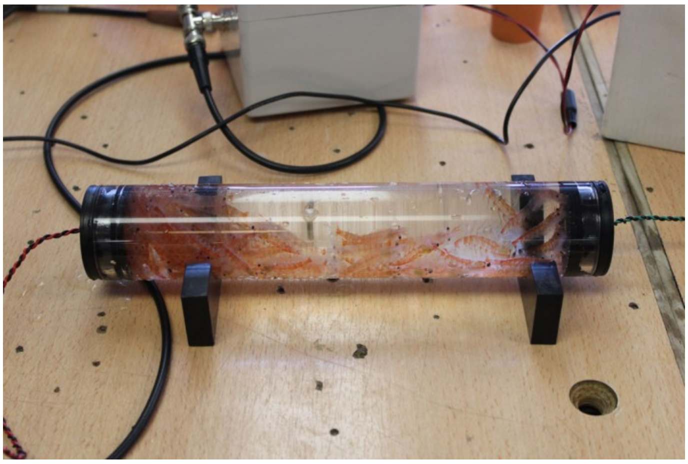


Figure 17: Krill within the speed of sound tube

During the experiment there was substantial variation in the received response at the transducer (Figure 18), which made it very difficult to establish the exact time that a received response was received and questioned whether the transmitted sound pulse was consistent over time.

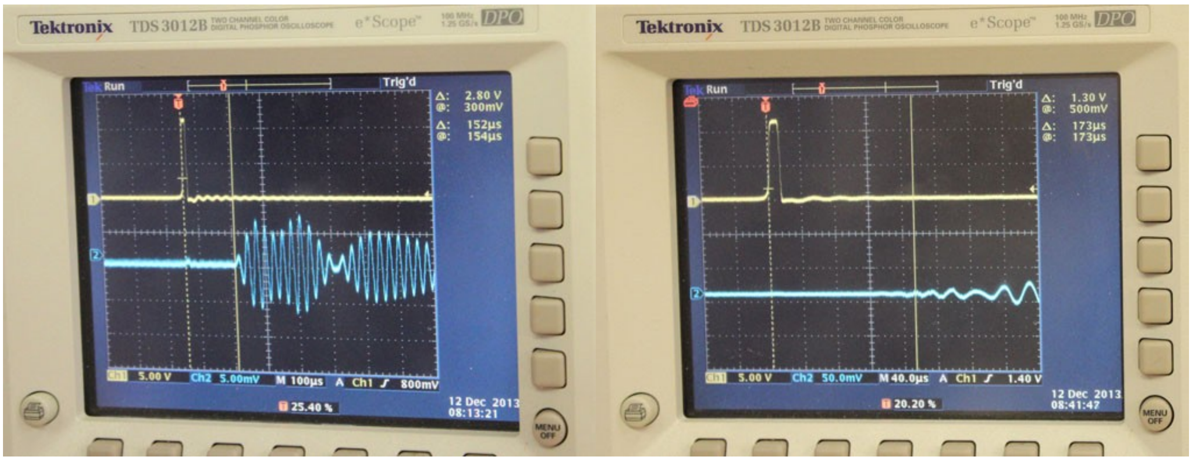


Figure 18: Oscilloscope response to tube filled with water (left) and with krill (right)

One thought was that krill movement could interfere with the signal and make it difficult to differentiate. A smaller tube was used to examine whether packed krill could give a better signal (Figure 19), with the following response on speed of sound (Table 25).

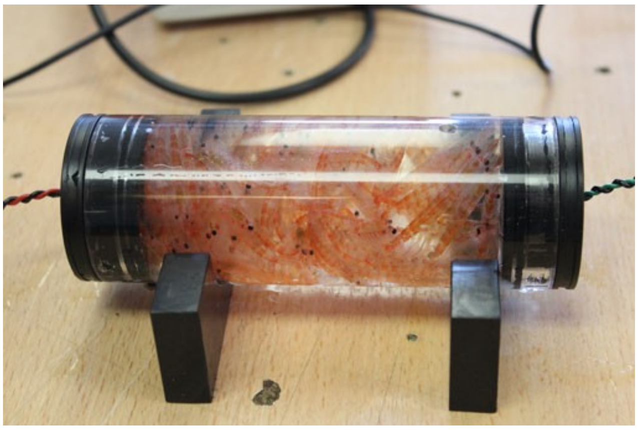


Figure 19: Tube packed with krill

Table 25: Oscilloscope measurements of time of flight from krill packed tube

Time stamp on oscilloscope	Contents of Perspex tube	Measured response time
09:13	Just water (130 ml)	90us
09:20	80 krill (33ml)	100us
09:24	Just water (130 ml)	84us

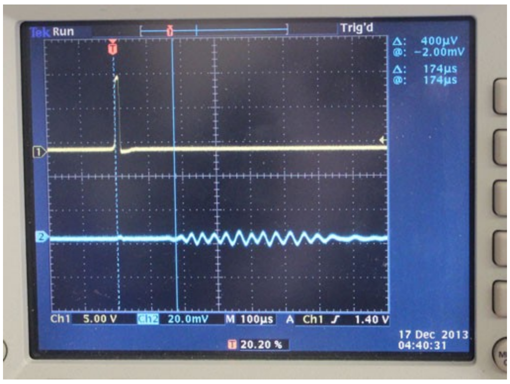
Later this was also attempted with the larger tube, filled with krill and water until totally full. However, it gave contrary results to the first attempt and it became unclear as to the performance of the transducers (Table 26).

Table 26: Second test of time of flight for just water, and then krill

Time stamp on oscilloscope	Contents of Perspex tube	Measured response time
11:00	Water	176us
11:10	235 krill (115 ml)	154us

Finally, to examine the transducer response the sound equipment was filled with water and the system examined after a few minutes to determine whether the transducer saturated and then reduced in performance (Table 27). Initial indications suggest there is a decrease or change in the transducer performance over time that needs further investigation in Cambridge.

Table 27: Oscilloscope image of water left in tube over three minutes

Time	Oscilloscope picture
04:38	
04:40	

9 Pteropod observation and incubation: responses to Ocean Acidification?

Clara Manno, BAS

9.1 Introduction

The delicate aragonitic shells of polar pteropods are potentially vulnerable to decreasing surface ocean pH resulting from increasing atmospheric CO_2 concentrations. Following on from JR274 (Jan/Feb 2013) we are building up field and experimental observations on pteropod species *Limacina helicina, Limacina retroversa* and *Clione pyramidata* found within the Scotia Sea and South Georgia region. Observations on the spatial and vertical abundance and population distribution were made using the underway water supply and net deployments. The occurrence of pteropods and the condition of their shells will be compared with seawater carbonate chemistry. In addition, shipboard incubation of healthy specimens at ambient and reduced pH conditions allow us to observe calcification and behavioural responses to ocean acidification.

9.2 Underway sampling, Bongo and MOCNESS observations

Underway sampling: the uncontaminated seawater supply was sampled with a 125 µm gauze stretched over a 15 cm diameter funnel attached to the outlet hose. The flow rate was ~10 L/min. Sampling was carried out over 2 hour intervals during transit from Stanley to South Georgia and then South Georgia to P2. The gauzes were subsequently stretched onto a frame, rinsed with Milli-Q water with a final rinse of ammonia buffered Milli-Q and examined for pteropods.

Bongo and MOCNESS netting: when only small numbers of pteropods (<20 individuals) were recovered from a deployment if the Bongo or MOCNESS all specimens were collected, rinsed with Milli-Q water and air dried.

9.3 Incubation of pteropods to observe calcification and behavioural responses to lowered pH conditions

Whenever sufficient numbers of pteropods were collected within Bongo and MOCNESS samples specimens were collected and transferred into unfiltered seawater to acclimatise before entering the incubation. After several hours of acclimatisation, actively swimming specimens were transferred into a calcein solution (50 mg/l unfiltered seawater) for one hour. Specimens were subsequently removed from the calcein solution and rinsed three times in unfiltered seawater prior to entering the incubation bottles. Non-active specimens were rinsed in Milli-Q water before being air-dried and stored as initial control specimens. Where sufficient specimens were available, dead animals were also incubated in separate bottles to assess the shell responses of dead and living specimens.

Incubation for calcification observations only were performed in 290 ml BOD bottles. Large, adult specimens of *Limacina helicina* and *Clione Pyramidata* were incubated in 560 ml square-bottles. With the exception of the unfiltered seawater treatment, all incubations were within 0.22 μm filtered seawater. Ambient seawater pH, temperature and salinity were measured. The quantities of HCl and $NaHCO_3$ required to achieve target pCO_2 conditions of 750 and 1000 ppm were calculated using the relationship between these parameters and DIC and TA within this region established on JR274. All treatments were run in triplicate. Incubation bottles were stored in the controlled temperature room at 1.8 to 2.2 deg C and kept in the dark. Temperature, salinity and pH were measured every few days (see Table 28) in addition to visual inspection of animal activity. For behavioural responses, individual specimens were filmed for at least 10 minutes every day in order to capture 15 upward vertical migrations. Two mirrors are used to reflect two orthogonal views of the square incubation bottles into the lens of a single video camera, thus creating distortion-free, three-dimensional images. Software analysis of these videos be performed post-cruise. Parameters such as distance, duration, angle of movement, and overall swimming speed we be measured in addition to ascent speed and wing beat frequency expressed as the number of beats per second.

At the termination of each experiment animals were recovered and assessed as either living, dead or in 'poor state of health' (vital organs seen to move but animal is retreated within shell, shell is in a poor condition/debris attached). Veligers and juveniles were all rinsed in Milli-Q water, air-dried and stored. The soft body of the large adults were removed where possible and immediately stored at -80 C for lipid analysis. Where adult shells were damaged during recovery, these specimens were also collected for lipid analysis. For each bottle pteropod faecal pellets and eggs were collected and stored with formalin for further investigation of behavioural response under different CO_2 condition. One BOD of incubation water for each treatment was collected and fixed with $HgCl_2$ to be returned to the UK for TA and DIC analysis. 30 ml was collected for nutrient analysis.

Table 28: Pteropod incubations

Exp. #	Specimen source	Start Date	Species	Treatments	Av. Ind. per treatment	Filmed	Incubation period
pH 1	Cumberland Bay Bongos	22/11/13	*L. retroversa* and *L. helicina* (veliger and juvenile)	Unfiltered seawater, filtered seawater, 750 ppm, 1000 ppm	4		12 days
pH 2	Bird Island MOCNESS (test	23/11/13	*L. retroversa* and *L.*	Filtered sea water, 750 ppm, 1000 ppm	5		14 days

	station)		*helicina* (veliger and juvenile)				
pH 3A	P2 mooring MOCNESS	3/12/13	*L. helicina* (veliger and juvenile)	Unfiltered seawater, filtered seawater, 750 ppm, 1000 ppm Dead controls	12		13 days
pH 3B	P2 mooring MOCNESS	3/12/13	*L. helicina* (adult)	Filtered seawater, 750 ppm. 1000 ppm Dead controls	3	✓	8 days
pH 3C	P2 mooring MOCNESS	3/12/13	*C. pyramidata*	Filtered seawater, 750 ppm, 1000 ppm	1	✓	8 days
Growth 1	Cumberland Bay Night Bongos	5/12/13	*L. retroversa* X10	Unfiltered sea water only	-		12 days
pH 4A	P2 mooring Bongos	7/12/13	*L. helicina* (adult)	Filtered sea water, 750 ppm, 1000 ppm	3	✓	8 days
pH 4B	P2 mooring Bongos	8/12/13	*L. helicina* (juveniles and veligers)	Unfiltered seawater, filtered seawater, 750 ppm, 1000 ppm	7		8 days
Growth 2	P3 mooring Bongo	9/12/13	*L. helicina* adult x1, veligers x6, *L. retroversa* x17	Unfiltered sea water only	-		8 days
Growth 3	WCB (morning)	11/12/13	*L. retroversa* x15, veligers x14	Unfiltered sea water only	-		6 days
Growth 4	WCB (evening)	11/12/13	*L. retroversa* x16, veligers x8	Unfiltered sea water only	-		6 days
pH 5	WCB (evening)	11/12/13	*L. helicina* (adult)	1500 ppm	1	✓	7 days

Table 29: pH, temperature and salinity observations at the start and end of incubations

pH 1

		22/11/2013			04/12/2013		
		pH	Salinity	T deC	pH	Salinity	T deC
Treatment	Bottle number						
Unfiltered seawater	65	7.94	33.8	2	7.92	33.8	1.9
	74	7.94	33.8	2	7.91	33.8	1.9
	106	7.94	33.8	1.9	7.92	33.8	1.9
Filtered seawater ambient	67	7.95	33.8	2	7.96	33.8	1.8
	77	7.95	33.8	2	7.96	33.8	1.9
	95	7.95	33.8	1.9	7.95	33.8	1.8
Filtered 750	71	7.74	33.8	2	7.75	33.8	1.8
	80	7.75	33.8	1.9	7.74	33.8	1.9
	101	7.74	33.8	2	7.76	33.8	1.9
Filtered 1000	72	7.57	33.8	2	7.57	33.8	1.8
	81	7.57	33.8	1.9	7.58	33.8	1.8
	84	7.57	33.8	2	7.58	33.8	1.9
Unfiltered no animals	107	7.93	33.8	2	7.91	33.8	1.9

pH 2

		23/11/2013			07/12/2013		
		pH	Salinity	T deC	pH	Salinity	T deC
Treatment	Bottle number						
Filtered seawater ambient	37	8.04	33.7	2.1	8.04	33.7	1.8
	36	8.03	33.7	1.9	8.03	33.7	1.8
	35	8.04	33.7	1.9	8.03	33.7	1.9
Filtered 750	34	7.78	33.7	2	7.78	33.7	1.8
	33	7.77	33.7	2	7.77	33.7	1.8
	31	7.77	33.7	1.9	7.79	33.7	1.8
Filtered 1000	32	7.65	33.7	2	7.65	33.7	1.8
	38	7.64	33.7	1.9	7.66	33.7	1.8
	39	7.65	33.7	2.1	7.64	33.7	1.8

pH 3A

		03/12/2013			16/12/2013		
		pH	Salinity	T deC	pH	Salinity	T deC
Treatment	Bottle number						
Unfiltered Seawater ambient	56	8.06	34.1	2	8.04	34.1	2
	57	8.06	34.1	2	8.05	34.1	2
	58	8.06	34.1	1.9	8.04	34.1	2.1
Filtered seawater ambient	47	8.06	34.1	1.9	8.05	34.1	2.2
	48	8.06	34.1	1.9	8.04	34.1	2.2

	49	8.06	34.1	2	8.05	34.1	2.2
Filtered 750	50	7.84	34.1	2	7.84	34.1	2.1
	51	7.84	34.1	1.9	7.83	34.1	2.2
	52	7.83	34.1	1.9	7.83	34.1	2
Filtered 1000	53	7.65	34.1	2	7.65	34.1	2
	54	7.66	34.1	1.8	7.67	34.1	2.2
	55	7.66	34.1	1.9	7.65	34.1	2.2

pH 3B

		03/12/2013			**11/12/2013**		
		pH	Salinity	T deC	pH	Salinity	T deC
Treatment	Bottle number						
Filtered seawater ambient	E	8.06	34.1	1.9	8.04	34.1	2
Filtered 750	F	7.84	34.1	1.9	7.82	34.1	2
Filtered 1000	G	7.66	34.1	1.9	7.64	34.1	2

pH 3C

		03/12/2013			**15/12/2013**		
		pH	**Salinity**	**T deC**	**pH**	**Salinity**	**T deC**
Treatment	**Bottle number**						
Filtered seawater ambient	**H**	8.06	34.1	2	8.05	34.1	**2.1**
Filtered 750	**I**	7.84	34.1	2	**no**	**no**	**no**
Filtered 1000	**L**	7.66	34.1	2.1	7.63	34.1	**2.2**

pH 4A

		07/12/2013			**16/12/2013**		
		pH	**Salinity**	**T deC**	**pH**	**Salinity**	**T deC**
Treatment	**Bottle number**						
Filtered seawater ambient	**O**	8.04	34.3	2	8.03	34.3	1.9
Filtered 750	**M**	7.85	34.3	2.1	7.85	34.3	**2**
Filtered 1000	**N**	7.67	34.3	2.1	7.65	34.3	**2**

pH 4B

		08/12/2013			**16/12/2013**		
		pH	Salinity	T deC	pH	Salinity	T deC
Treatment	Bottle number						
Unfiltered Seawater ambient	117	8.04	34.3	2.2	8.02	34.3	2
	114	8.04	34.3	2.1	8.03	34.3	2
	113	8.04	34.3	2.1	8.03	34.3	2.1
Filtered seawater ambient	46	8.05	34.3	2.1	8.04	34.3	2.1
	42	8.04	34.3	2.2	8.04	34.3	2.1
	41	8.04	34.3	2.1	8.04	34.3	2.1
Filtered 750	31	7.75	34.3	2.2	7.75	34.3	2.1
	32	7.75	34.3	2.1	7.76	34.3	2.1

	34	7.76	34.3	2.1	7.76	34.3	2
Filtered 1000	35	7.65	34.3	2.1	7.66	34.3	2
	36	7.66	34.3	2.2	7.66	34.3	2.1
	39	7.65	34.3	2.2	7.66	34.3	2.1
Unfiltered SW no animals	14	8.04	34.3	2.2	8.02	34.3	2.1

pH 5

		11/12/2013			**18/12/2013**		
		pH	Salinity	T deC	pH	Salinity	T deC
Treatment	Bottle number						
Unfiltered Seawater ambient	P	7.35	34.1	2.2	7.36	34.3	2

9.4 CTD sampling for carbonate chemistry

Water samples for Total Alkalinity (TA), Total Dissolved Inorganic Carbon (DIC) and nutrients analysis were collected at different depths from the CTD cast in order to determine the carbonate chemistry of the water column. Samples were collected in borosilicate bottles and fixed with $HgCl_2$ to be analysed post cruise. Carbonate saturation states of aragonite will be indirectly calculated from TA and DIC data using the CO2SYS software. At the P2 and P3 mooring stations water samples were collected at night within a 24 hour survey. At P2 and P3 extra water samples were collected for the Particulate Organic Carbon (POC) analysis. POC water sample was filtered on board by a vacuum pump filtration system on GFF filters and then dry at 60 C for 24h before being stored. CTD Water samples for carbonate chemistry analysis were also collected during the 24 hour survey of the upwelling region SU9 in order to characterize the shallower depth of the aragonite lysocline.

Table 30: CTD water samples

Station	**Date**	**Depths**	**Sample**	**TA_DIC**	**Nutrients**	**POC**
JR291002	22/11/2013	243	1.1	x	x	
		150	1.2	x	x	
		100	1.3	x	x	
		75	1.4	x	x	
		60	1.5	x	x	
		45	1.6	x	x	
		15	1.7	x	x	
		5	1.8	x	x	
JR291012	23/11/2013	93	2.1	x	x	
		75	2.2	x	x	
		45	2.3	x	x	
		15	2.4	x	x	
		5	2.5	x	x	
JCR291026	30/11/2013	2000	3.1	x	x	

		1800	3.2	x	x	
		1700	3.3	x	x	
		1600	3.4	x	x	
		1500	3.5	x	x	
		1300	3.6	x	x	
		1000	3.7	x	x	
		600	3.8	x	x	
		500	3.9	x	x	
		300	3.10	x	x	
		200	3.11	x	x	
		100	3.12	x	x	
		80	3.13	x	x	
		50	3.14	x	x	
		25	3.15	x	x	
		5	3.16	x	x	
JCR291033	01/12/2013	2200	4.15	x	x	
		2000	4.14	x	x	
		1800	4.13	x	x	
		1600	4.12	x	x	
		1300	4.11	x	x	
		1000	4.1	x	x	
		700	4.9	x	x	
		500	4.8	x	x	
		300	4.7	x	x	
		200	4.60	x	x	
		150	4.5	x	x	
		80	4.4	x	x	
		50	4.3	x	x	
		25	4.2	x	x	
		5	4.1	x	x	
JCR291037	02/12/2013	3000	5.1	x	x	x
	DARK	2800	5.2	x	x	x
	P2	2400	5.3	x	x	x
		2000	5.4	x	x	x
		1800	5.5	x	x	x
		1600	5.6	x	x	x
		1300	5.7	x	x	x
		1000	5.8	x	x	x
		700	5.9	x	x	x
		600	5.1	x	x	x
		500	5.11	x	x	x
		400	5.12	x	x	x

		300	5.13	x	x	x
		250	5.14	x	x	x
		200	5.15	x	x	x
		170	5.16	x	x	x
		100	5.17	x	x	x
		50	5.18	x	x	x
		30	5.19	x	x	x
		5	5.2	x	x	x
JCR291063	02/12/2013	3000	6.1	x	x	x
	Light	2800	6.2	x	x	x
	P2	2400	6.3	x	x	x
		2000	6.4	x	x	x
		1800	6.5	x	x	x
		1600	6.6	x	x	x
		1300	6.7	x	x	x
		1000	6.8	x	x	x
		700	6.9	x	x	x
		500	6.1	x	x	x
		300	6.11	x	x	x
		250	6.12	x	x	x
		150	6.13	x	x	x
		80	6.14	x	x	x
		50	6.15	x	x	x
		30	6.16	x	x	x
		5	6.17	x	x	x
JCR291070	08/12/2013	3300	7.1	x	x	x
	Light	3000	7.2	x	x	x
	P3	2800	7.3	x	x	x
		2400	7.4	x	x	x
		2000	7.5	x	x	x
		1800	7.6	x	x	x
		1600	7.7	x	x	x
		1300	7.8	x	x	x
		1000	7.9	x	x	x
		700	7.1	x	x	x
		500	7.11	x	x	x
		300	7.12	x	x	x
		150	7.13	x	x	x
		80	7.14	x	x	x
		50	7.15	x	x	x
		30	7.16	x	x	x
		5	7.17	x	x	x

JCR291075	08/12/2013	3300	9.1	x	x	x
	DARK	3000	9.2	x	x	x
	P3	2800	9.3	x	x	x
		2400	9.4	x	x	x
		2000	9.5	x	x	x
		1800	9.6	x	x	x
		1600	9.7	x	x	x
		1300	9.8	x	x	x
		1000	9.9	x	x	x
		700	9.1	x	x	x
		500	9.11	x	x	x
		300	9.12	x	x	x
		150	9.13	x	x	x
		80	9.14	x	x	x
		50	9.15	x	x	x
		30	9.16	x	x	x
		5	9.17	x	x	x
JCR291132	08/12/2013	3300	8.1	x	x	x
	DARK	3000	8.2	x	x	x
	P3	2800	8.3	x	x	x
		2400	8.4	x	x	x
		2000	8.5	x	x	x
		1800	8.6	x	x	x
		1600	8.7	x	x	x
		1300	8.8	x	x	x
		1000	8.9	x	x	x
		700	8.1	x	x	x
		500	8.11	x	x	x
		300	8.12	x	x	x
		150	8.13	x	x	x
		80	8.14	x	x	x
		50	8.15	x	x	x
		30	8.16	x	x	x
		5	8.17	x	x	x
JCR29139	15/12/2013	2000	10.1	x	x	
	UPW	1800	10.2	x	x	
		1600	10.3	x	x	
		1300	10.4	x	x	
		1000	10.5	x	x	
		700	10.6	x	x	
		500	10.7	x	x	
		300	10.8	x	x	

		150	10.9	x	x	
		80	10.10	x	x	
		50	10.11	x	x	
		25	10.12	x	x	
		5	10.13	x	x	
JCR29140	15/12/2013	2000	11.1	x	x	
	UPW	1800	11.2	x	x	
		1600	11.3	x	x	
		1300	11.4	x	x	
		1000	11.5	x	x	
		700	11.6	x	x	
		500	11.7	x	x	
		300	11.8	x	x	
		150	11.9	x	x	
		80	11.10	x	x	
		50	11.1	x	x	
		25	11.12	x	x	
		5	11.13	x	x	
JCR29141	15/12/2013	2000	12.1	x	x	
	UPW	1800	12.2	x	x	
		1600	12.3	x	x	
		1300	12.4	x	x	
		1000	12.5	x	x	
		700	12.6	x	x	
		500	12.7	x	x	
		300	12.8	x	x	
		150	12.9	x	x	
		80	12.1	x	x	
		50	12.11	x	x	
		25	12.12	x	x	
		5	12.13	x	x	
JCR29142	15/12/2013	2000	13.1	x	x	
	UPW	1800	13.2	x	x	
		1600	13.3	x	x	
		1300	13.4	x	x	
		1000	13.5	x	x	
		700	13.6	x	x	
		500	13.7	x	x	
		300	13.8	x	x	
		150	13.9	x	x	
		80	13.10	x	x	
		50	13.11	x	x	

		25	13.12	x	x	
		5	13.13	x	x	

10 Box Coring

Peter Ward and Vicky Peck, BAS

On 22.11.2013 the BAS box corer was used to collect surface sediment samples at a series of 6 stations within Cumberland East Bay, South Georgia (Table 31). The samples were taken where overlying water depths ranged from~25m-250m. Substrate types ranged from fine mud/silt at the deeper stations to a coarser grained material at the shallower sites. The objectives were to investigate whether the sediment contained diapausing eggs of the common neritic copepod species *Drepanopus forcipatus* and to see what other infaunal groups were present. Additionally, the presence of thecosome pteropod shells will also be assessed as a previous cruise (JR274) had suggested they were abundant within the Bay. Initial examination of water immediately overlying the sediment suggested both a lack of copepod eggs and pteropod shells although a more detailed examination of samples will be carried out in Cambridge. Surface samples of mud were preserved in formalin and core samples frozen. To characterise the overlying water column bongo nets were also deployed at each station.

Table 31: Box Core locations within Cumberland East Bay

Date	Time at sea floor (GMT)	JR291 location code	Lat	Long	Water depth (m)	Sub-core recovered (cm)	Bagged surface sample
22/11/2013	13:01:00	CB Station 1	-54.2783	-36.4377	252	26.5	√
22/11/2013	14:50:00	CB Station 2	-54.2895	-36.4398	203	23	√
22/11/2013	16:38:00	CB Station 6	-54.3081	-36.4415	24	10	√
22/11/2013	17:44:00	CB Station 5	-54.3049	-36.442	50	-	√
22/11/2013	19:35:00	CB Station 4	-54.298	-36.4419	103	23	√
22/11/2013	20:58:00	CB Station 3	-54.2948	-36.4413	153	-	√

11 Gear and Moorings

11.1 Gear report

Peter Enderlein & Scott Polfrey, BAS

11.1.1 Down Wire Net Monitor (DWNM) system:

The DWNM was used as usual on the 'Biological Wire'. As the termination was two years old a new electrical and mechanical termination was done. Prior to use, it was load tested to 3.5 tonne. The DWNM system was set up on the RMT8 cross with the various sensors. These worked all well except for the altimeter. Again it was flaky at times and was once replaced with the altimeter from the RMT25 which was not really tested, as most of the following deployments were target fishing in the top 50m of water.

11.1.2 RMT 8 net

The RMT8 was deployed 19 times successfully for target fishing and oblique hauls. It worked very well. On one of the bigger krill hauls the cod ends got tangled together whilst they were being pulled onto the ship, this meant they both had to be pulled on together, there were a few small rips on the older net and these have been fixed. On one occasion the release wire of net 1 got caught on the towing bar. As a result all 4 release bars were hold up on one side. A rope was rigged onto the wire and the whole rig was lowered, this freed the towing bar and it was pulled out of the loop. Finally the other side of the rig was raised, which freed all bars from the side wires where they were jammed. The whole rig was inspected afterwards, but no damage to wires or shackles was found and therefore nothing was changed.

11.1.3 Bongo net

The Bongo net was deployed 41 times. On the 6th deployment during the initial pull out of the wire, the wire got caught on the handrail and by pulling from the winch parted just below the termination. Luckily nobody was injured during the rapid recoil of the wire by the springs. The ship found some spare 5mm wire and the Bongo net was then rebuild using the spare spring unit during the last day of the Bird Island relief. Afterwards it worked fine and no further problems where encountered. Both motion compensation units need a major overhaul and all springs need to be replaced prior any further use.

11.1.4 MOCNESS net

The MOCNESS net was deployed 9 times. The hardware worked fine and by taping the clips on the cod end, none of the cod ends were lost. However the depth sensor was not working properly. The MOCNESS electronics with the build in depth sensor was send back to the manufacture for maintenance and the calibration of the depth sensor. A depth test with attached depth logger near Signy showed that the depth sensor not only has an offset, but also a non linear one, this made it very tricky to estimate the correct depth. This was very frustrating; as the instrument was send to the manufacture for calibration to exactly avoid this situation.

11.2 Mooring cruise report

Peter Enderlein, Scott Polfrey, Gabi Stowasser & Sophie Fielding, BAS

11.2.1 General

During JR291 the P2 and P3 deep sediment trap moorings were successfully recovered. Also the WCB shallow water mooring and the P2 mooring were successfully redeployed. Due to a broken Sediment trap the P3 mooring was not redeployed. The Signy mooring was not found in its deployment position and despite several attempts was not located at all and therefore could not be recovered.

11.2.2 Signy mooring off Inaccessible Islands

The Signy mooring was originally deployed on 28.11.2012 at 12:28 in 688 m water depth at location: 60.57537 S and 46.51749 W. The mooring was deployed weight first, ship heading into the approaching ice.

On the 26th of November the first attempt was made to recover the Signy mooring. The weather condition where not ideal but the decision was made to try to recover the mooring. Despite several attempts with either the ships build in transducer or the stand alone Hydrophone no contact at all could be established with the mooring. Also any attempt to find the mooring on any echo sounder failed. So after more than 3 hours the decision was made to leave the site and try it again when we come back from Signy.

Eventlog of the first attempt to find the Signy mooring:

26 Nov 2013 @ 09:30		*Vessel off D.P, Did not see the mooring on the echo sounders. Vessel proceeding to Signy*	-60.57526, -46.51720
26 Nov 2013 @ 08:55		*No signal from mooring, vessel moving on D.P to see if we can see the mooring on the echo sounders*	-60.57486, -46.50653
26 Nov 2013 @ 08:20		*Hydrophone recovered, no contact with mooring*	-60.57485, -46.50649
26 Nov 2013 @ 08:04		*Hydrophone deployed*	-60.57492, -46.50643
26 Nov 2013 @ 07:46		*Mooring not at the surface,*	-60.57494, -46.50643
26 Nov 2013 @ 07:36	Signy Mooring	*Release signal sent, buoy released*	-60.57490, -46.50649
26 Nov 2013 @ 06:40		*Decided conditions suitable, preparations underway for recovery*	-60.57930, -46.51965
26 Nov 2013 @ 06:15		*Vessel all stopped on D.P, assessing weather for recovery of mooring*	-60.57930, -46.51962
26 Nov 2013		*Vessel on D.P*	-60.57828, -

@ 06:12			46.51877

After the opening of Signy station, we returned to the Signy mooring location in the morning of the 30th of November. In the meantime the deck-box, the build in ships transducer as well the stand alone Hydrophone where tested at Signy to make sure that there is no problem with the on board equipment. These tests where successfully and all the on board equipment was working fine.

We started with an acoustic survey around the deployment position with the swath, EK and EA all switched on. The mooring was not found during the survey, so at 06:00 LT the ship was 200m of the position, in 15 – 20 kn of wind and good visibility. Both mooring releases where pinged several times with the build in transducer, but no contact could be established. At 06:20 on DP the vessel went at 0.5 kn towards the deployment position and 250 m beyond it running the swath, EK and EA. Nothing was found on any echo-sounder. Afterwards the vessel went back to the deployment position to sit on top of the mooring and at 06:35 the next attempt was made to get in contact with the mooring. Both releases where again unsuccessfully pinged. On the EA a thick layer of mud? was visible – may be the releases where buried in there, but if so, where was the rest of the mooring?! At 07:00 250 m south of the deployment position (3rd different position to ping the mooring) the next attempt was made and again both releases where pinged – again with no contact at all. Back at the deployment position at 08:00 local time the decision was made to dredge for the mooring as we had no contact with the releases, despite pinging it from 3 different positions (angles) and could not find it on any of the acoustic systems. Just to make sure nothing had gone wrong on the deck side, the mooring was pinged one more time by using the stand alone hydrophone – again with no answer from the releases. Jon Wattkins was informed of the decision and a message was left on his mobile answering machine. He phoned back shortly afterwards and agreed with the decision to go ahead with the dredging. For the dredging one of the mooring weights of approx. 900kg was used as an anchor and attached to the coring wire via a weak link with a break load of approx. 5 to. The bight in wire was laid 400 to 500 m around the deployment position and a total of 2680m of wire was laid. Afterwards the wire was holed back in, but no change in tension was found nor any visible contact with the mooring was made. At 12:49 the weight was back on deck. The vessel did one more acoustic run through the area to have a final look for the mooring. Nothing was found and therefore at 14:00 LT decision was made to leave the area and to stop any recovery attempts.

Eventlog of the second attempt to find the Signy mooring:

30 Nov 2013 @ 16:00		*Vessel proceeding to deep water position for science station*	-60.51101, -46.47230
30 Nov 2013	Signy	*Vessel begins run through area with echo sounds*	-60.57753, -

@ 15:28	Mooring		46.52043
30 Nov 2013 @ 15:06	Signy Mooring	*Vessel to make another run through area with echo sounder*	-60.57874, -46.52026
30 Nov 2013 @ 14:49	Signy Mooring	*Weight recovered*	-60.57878, -46.52020
30 Nov 2013 @ 14:35	Signy Mooring	*weight off the seabed*	-60.57876, -46.52020
30 Nov 2013 @ 12:52	Signy Mooring	*Vsl stopped and commence hauling the wire (2680m)*	-60.57875, -46.52015
30 Nov 2013 @ 12:41	Signy Mooring	*Bight in wire made running 400-500m away from mooring*	-60.57617, -46.51561
30 Nov 2013 @ 11:56	Signy Mooring	*Weight on the seabed*	-60.57450, -46.51635
30 Nov 2013 @ 11:30	Signy Mooring	*Weight deployed over the stern on the coring wire*	-60.57452, -46.51637
30 Nov 2013 @ 11:25	Signy Mooring	*Commence dredging operations*	-60.57452, -46.51646
30 Nov 2013 @ 10:40	Signy Mooring	*No response from either release, vsl moving astern and preparing to dredge for mooring.*	-60.57550, -46.51752
30 Nov 2013 @ 08:00	Signy Mooring	*V/L on D.P, completed survey. Vessel trying to communicate and see mooring using EA 600, Swath*	-60.57373, -46.51589
30 Nov 2013 @ 04:48		*Vessel begins grid*	-60.63174, -46.42620

We never had any contact to the releases, could not find it on any of the ships acoustic systems, dredged unsuccessfully for it and did not got anything from the iridium beacon, which should been activated if the mooring would have surfaced. From this it is hard to say, what has happened. If the mooring would have broken loose, we should have got signals from the Iridium beacon and the releases should be still in place talking to us. If the releases are buried in mud or malfunction, we should have found the mooring on the acoustic systems and got it dragged up. It seems that the whole mooring rig is gone, which leave only two explanations: a) An ice berg “hooked” the whole rig and is off with it, the main buoy sitting underneath. b) It has something to do with the recent earthquake in the vicinity as the centre of the earthquake was only approx. 30nm of the mooring location.

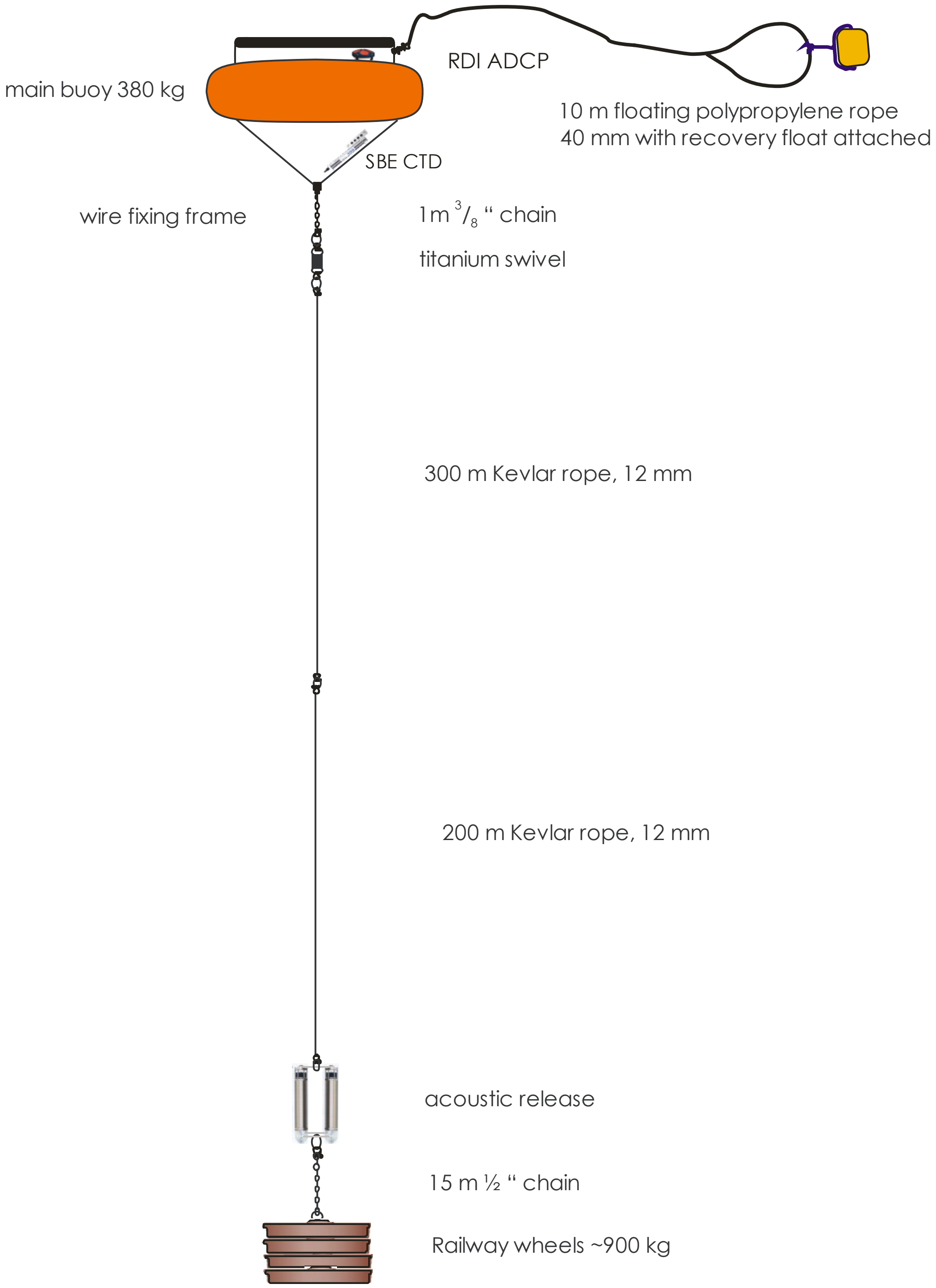
The following beacon and releases are on the mooring:

Iridium satellite beacon: No: 12091770

Release 1: Sn: 1357 ARM: 092C Release: 0955 Diagnostics: 0949

Release 2: Sn: 1358 ARM: 092D Release: 0955 Diagnostics: 0949

Signey mooring (700 m water depth)



11.2.3 3200m sediment trap mooring at P2

Recovery

The P2 mooring was recovered on the 2nd of December. In the beginning release 1022 was pinged, but we did not received any responses. After several attempts with the build in transducer and the stand alone hydrophone, finally the old release 290 gave satisfactory responses and the mooring was released using release 290. The mooring surface within 5 min and was hooked mid ships and the mooring winch rope attached. The whole rig was recovered by using the mooring winch and a stopper rope on a cleat as described in last year's cruise report JR280.

Performance

Both CTD's worked fine throughout the deployment period. The CTD on the main buoy shows that the mooring buoy was sitting between 180m to 688m water depths. The CTD on the mooring line shows that is was sitting between 668m and 1110m. On the 8th of March between 04:45 and 12:00 it was even pushed further down, but because that is beyond the depth sensors capability, no data could be recorded. The ADCP worked fine throughout the deployment period, nothing to report.

The sediment trap rotations worked according to the timetable set for the P2 sediment trap with 15 planned rotations between deployment and recovery. On recovery 1 of the 21 sample bottles fitted to the sediment trap (bottle 8) was lost. All bottles containing sediment (1-7; 9-15) were packed into vermiculate boxes for storage at +4°C for analysis in Cambridge. The ph of the solution contained in the recovered sediment trap bottles was too low for further analysis regarding ocean acidification. Therefore the ph of the mercury-chloride-salt mixture was raised by tripling the percentage of salt in the solution prior to re-deployment of the sediment trap. The current meter underneath the Sediment trap worked well throughout the deployment.

As the release 1022 did not responded to any interrogation command during recovery, it was tested afterwards. Opening the housing did not show any increase of water or any damage to the electronics. After removing the backup battery the release responded again and was intensively tested with the old batteries, new batteries and with and without the backup battery. The release responded always fine and no faults where encountered. It looks like that the electronics had hung up the release for whatever reason and the removal of the backup battery brought it back to life. But it is unclear what caused it in the first instance. This will be followed up with the manufacture.

Redeployment

The mooring was redeployed on the 7th of December 2013. The deployment started at 09:43 GMT with the buoy first. After the deployment of all the equipment the weight was finally released at 11:59 at a depth of **3383m** at **-55.24627S** and **-41.26505W**

Again the mooring was pinged after the deployment to determine its position by triangulation. The ship moved from its position approx. 1 nm first N and then again 1 nm E (Table 32, Figure 20).

Table 32: Position, water depth and acoustic distance for triangulation of P2

Position	Time	Triangulation		Latitude	Longitude
P1	12:28	Depth	3371	-55.24309	-41.26517
		Ping distance	3410		
P2	12:50	Depth	3359	-55.25160	-41.24684
		Ping distance	3575		
P3	13:12	Depth	3388	-55.25697	-41.27444
		Ping distance	3548		

This gave the following triangulation, with a relative position of **55° 14.9 S and 41° 15.9 W** where we believe the 3400m mooring is sitting:

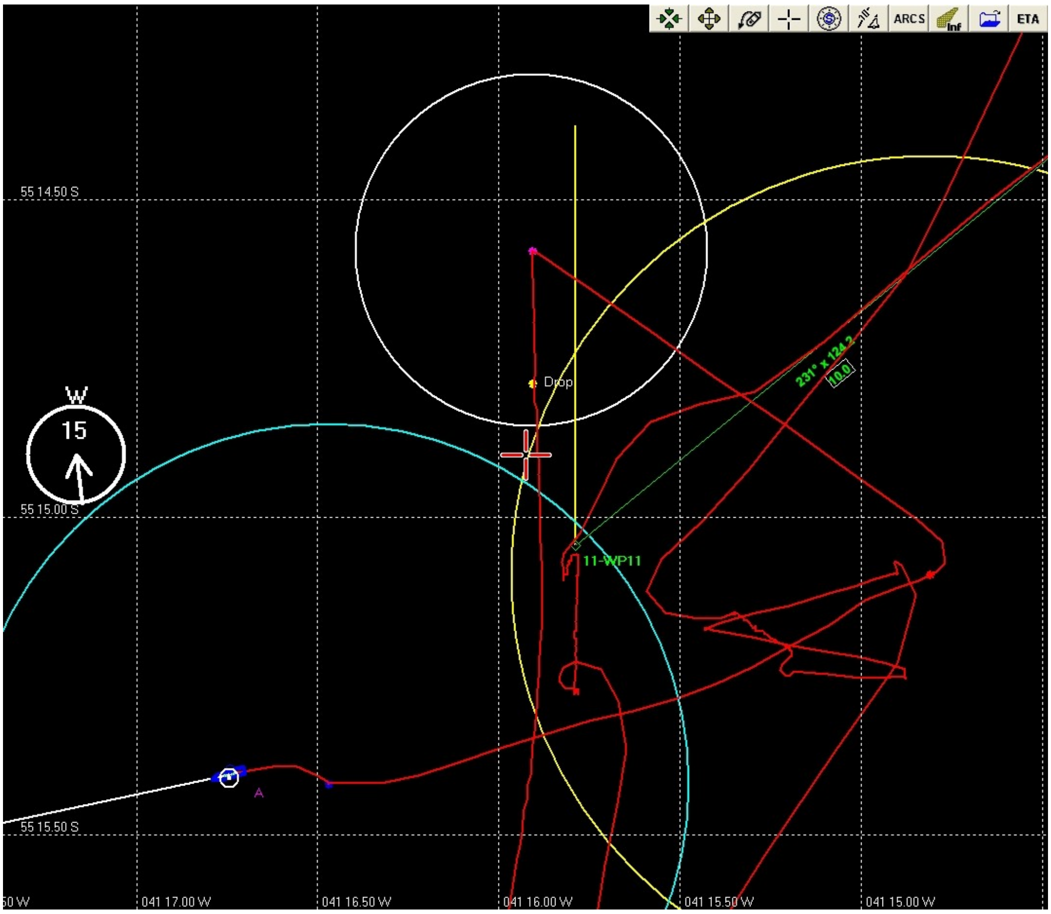


Figure 20: Triangulation of the P2 mooring

Work carried out

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

RT6XX

Transmit type: command only

Code command: B639 (release), B640 (diagnostic)

Enter

FTO=mono 8kHz

Ranging Distance

Enter

Release No: 1219

ARM, Ranging: 0896

Release code: **0896 + 0855**

Release + Pinger: ARM + 0856

Pinger on: ARM + 0847

Pinger of: ARM + 0848

Diagnostic: ARM + 0849

Acoustic releases: 290 + 1219

- new batteries
- tested

Irmasat beacon 12098770

- faulty with corrosion on top PCB board
- batteries removed
- screw inside housing, main housing not pushed in
- taken back to CB HQ, to go back to manufacture

Replaced with ARGOS beacon SN280, ptt 60210

- new batteries
- tested

NOVATEC Combo beacon: U07-029

- new batteries
- tested

CTD 37 SMP 43742: 4852 on main buoy

- data downloaded
- 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
- starttime=081213

CTD 37 SMP 43742: 4855 at estimated 500 m

- data downloaded
- 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
- starttime=081213

ADCP WHS300 – I – UG26: 7522

- data downloaded
- new batteries
- one O-ring replaced
- 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

Schedule Verification

Event 1 of 22 = 12-15-13

Event 2 of 22 = 01-01-14

Event 3 of 22 = 01-15-14

Event 4 of 22 = 02-01-14

Event 5 of 22 = 02-15-14

Event 6 of 22 = 03-01-14

Event 7 of 22 = 04-01-14

Event 8 of 22 = 05-01-14

Event 9 of 22 = 06-01-14

Event 10 of 22 = 07-01-14

Event 11 of 22 = 08-01-14

Event 12 of 22 = 09-01-14

Event 13 of 22 = 10-01-14

Event 14 of 22 = 11-01-14

Event 15 of 22 = 12-01-14

Event 16 of 22 = 12-15-14

Event 17 of 22 = 01-01-15

Event 18 of 22 = 01-15-15

Event 19 of 22 = 02-01-15

Event 20 of 22 = 02-15-15

Event 21 of 22 = 03-01-15

Event 22 of 22 = 04-01-15

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

- data downloaded
- new batteries

Aquadopp current meter deployment settings:

==

Deployment : P2J291

Start at : 08/12/2013 00:00:01

Comment:

Deployed on Jr291 at P2

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) : 10.5

Recorder size (MB) : 89

Recorder free space (MB) : 89.000

Memory required (MB) : 2.1

Vertical vel. prec (cm/s) : 1.4

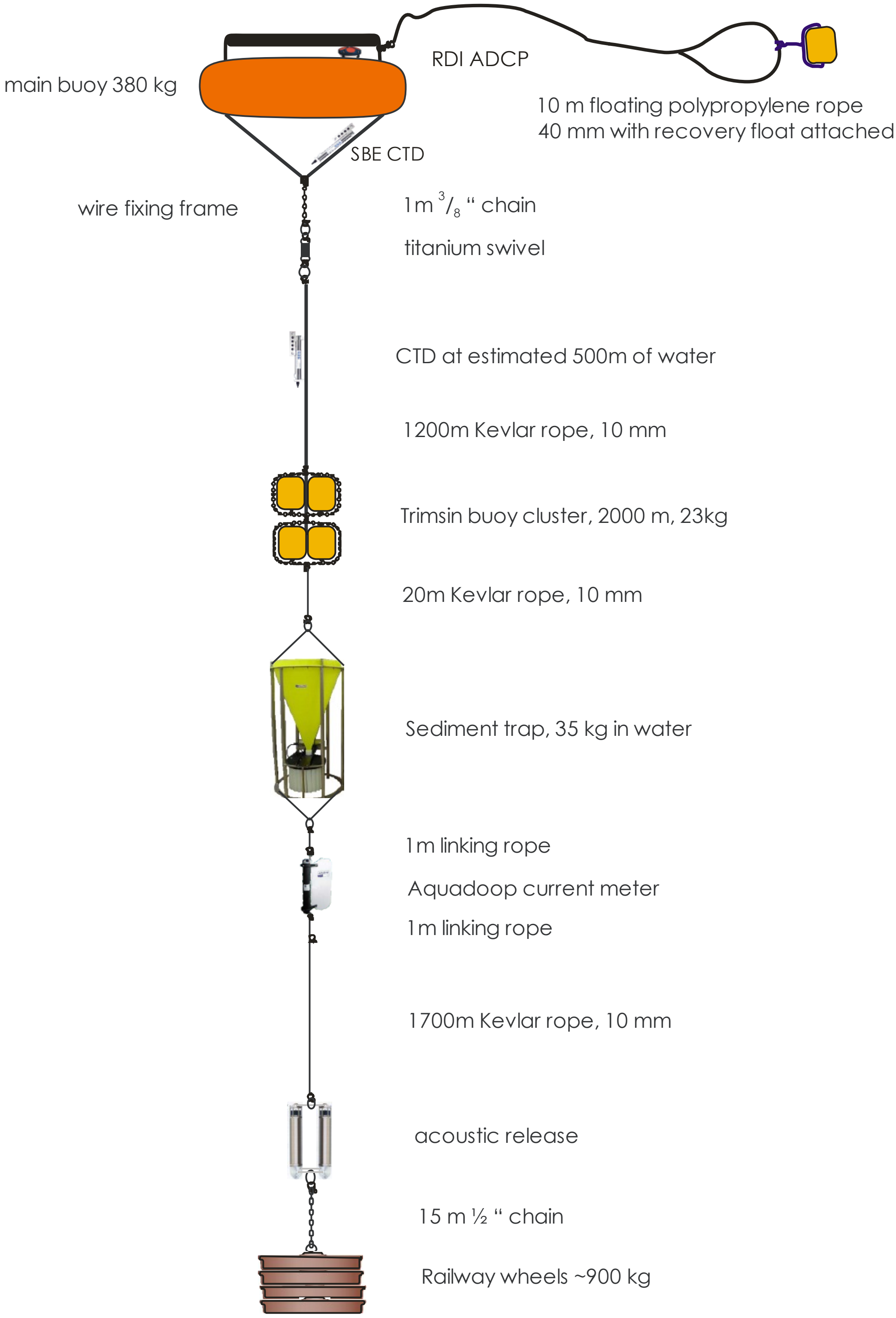
Horizon. vel. prec (cm/s) : 0.9

Aquadopp Version 1.28

Copyright (C) 1997-2004 Nortek AS

==

Sediment trap mooring (3200m water depth)



11.2.4 3700m sediment trap mooring at P3

Recovery

The recovery took place on 08th of December 2013. The acoustic releases responded straight away and after ranging the mooring successfully a few time, the mooring was released and was within 5min at the surface. The mooring was hooked mid ships and the mooring winch rope attached. The whole rig was recovered by using the mooring winch and a stopper rope on a cleat as described in last year's cruise report JR280. This worked very well again and despite the length of the rig, it was a speedy recovery taking just under 2 hours.

Performance

This was a short deployment for the mooring rig, as it was redeployed on the 5th of May. Unfortunately the CTD did not work and collected no data. A test afterwards revealed that the CTD went into a status where it expected an external trigger to collect data. After setting it up correctly, the CTD worked fine again. The ADCP as well as the current meter worked well during the whole time of the deployment. The sediment trap rotations worked according to the timetable set for the P3 sediment trap with 7 planned rotations between deployment and recovery. On recovery 1 of the 21 sample bottles fitted to the sediment trap was lost. However the bottle was part of the set (bottles 8-21) not yet exposed to sedimentation so no sample was lost. All existing bottle contents were transferred to plastic bottles for storage at +4°C for analysis in Cambridge and the sediment trap bottles were washed and will be used on re-deployment.

Redeployment

The mooring was not redeployed, as the Sediment trap did not work properly during the set up. The fault was identified as a broken gear box attached to the motor, which can only be repaired by the manufacture. The ADCP also had several FAILS in its self-tests prior to deployment that have not been seen before. It was viewed that any deployment of the ADCP could potentially result in a lack of data collected. Therefore the decision was made not to redeploy the mooring, as without the sediment trap the P3 mooring had lost its most important scientific instrument and the data gained without the sediment trap would be of small scientific value.

Work carried out

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
- batteries left in instruments

Irmasat beacon 13901110

- new batteries
- tested
- batteries taken out and in mooring crate
- housing not pushed down, the small screw is inside the housing

NOVATEC Combo beacon: *R09-020*

- new batteries
- tested
- batteries taken out and in biscuit box

CTD 37 SMP 29579: *2462 on main buoy*

- data downloaded
- new batteries
- batteries taken out and in biscuit box

CTD 37 4584 to go 500m below

- new batteries
- batteries taken out and in biscuit box

ADCP WHS300 : 15548

- data downloaded
- collar off, in mooring crate
- new battery in mooring crate
- taken back to CB HQ because it needs to go back to manufacture because it failed wide and narrow beamwidth test during setup

Sediment trap: Parflux No: ML11966-02

- faulty, gearbox above motor broken
- motor taken back to CB HQ, has to be send to manufacture for repairs

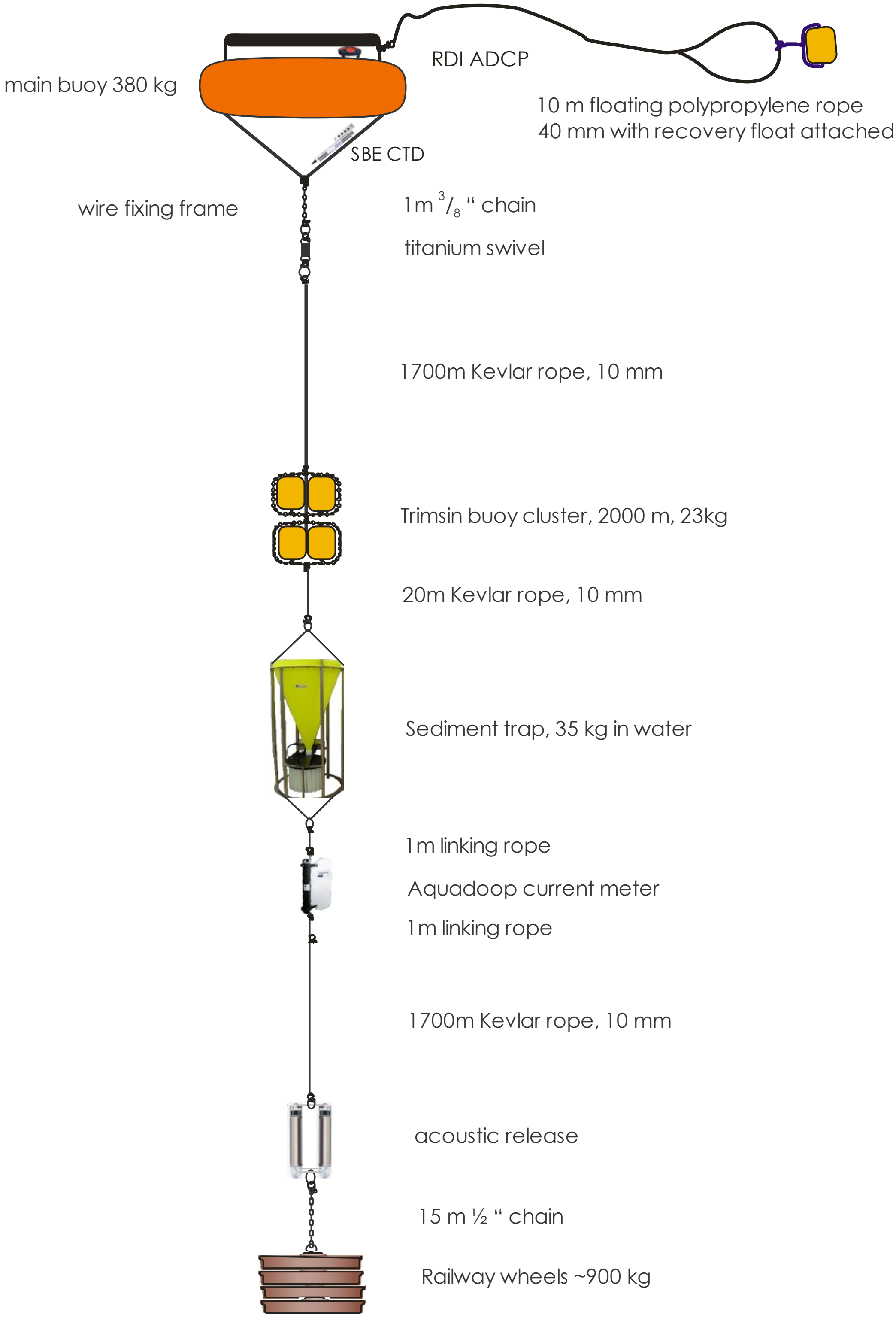
Current meter: Aquadopp No A2L - 1792

- data downloaded
- new batteries
- batteries taken out, in mooring crate
- ropes left on

Hardware whereabouts:

- main buoy: on pallet, stored in FIPASS
- ADCP: in Pelican case, back to CB
- 2* CTD: back to CB
- Combo beacon: in mooring crate, Container
- Iridium beacon: in mooring crate, Container, broken back to CB
- sediment trap: on pallet, stored in FIPAS, motor back to CB
- current meter: in mooring crate, Container
- releases: in mooring crate, Container
- weights: in wooden box, stored in FIPAS

Sediment trap mooring (3700m water depth)



11.2.5 Shallow water WCB mooring:

Recovery and redeployment

The western core box mooring surfaced on the 6 of June this year and was shortly afterwards successfully recovered by the fishery patrol vessel. The whole rig was recovered and stored at FIPASS. During the cruise the mooring was inspected and found in good conditions. The rig was maintained and redeployed on the 6 of December with the buoy first, lifted by the mooring winch. After streaming out the 50m of rope, the anchor was released at 53°48.101S and 37°56.266W.

Performance

The CTD did work well with the main buoy sitting at about 222 m and it showed the surfacing event on the 6th of June between 22:45 and 23:00. The ADCP worked well for the whole time and for the first time in many years the WCP worked properly and gathered proper data. It also showed the surfacing event on the 6th of June.

Work carried out:

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

Acoustic Releases:

Code shallow water mooring:

release:	No: 1022	release code: **1890 + 1855**
release:	No: 1218	release code: **0895 + 0855**

work on mooring:

Acoustic release 1022 & 1218

- new batteries
- tested

NOVATEC Combo beacon: R09-021

- new batteries
- tested

Irmasat beacon 12094770

- new batteries
- tested

WCP

- data downloaded
- New deployment file: wcp_20131206_deployfile.mfawcpl
- Config. File: 55004_20131206.cfg

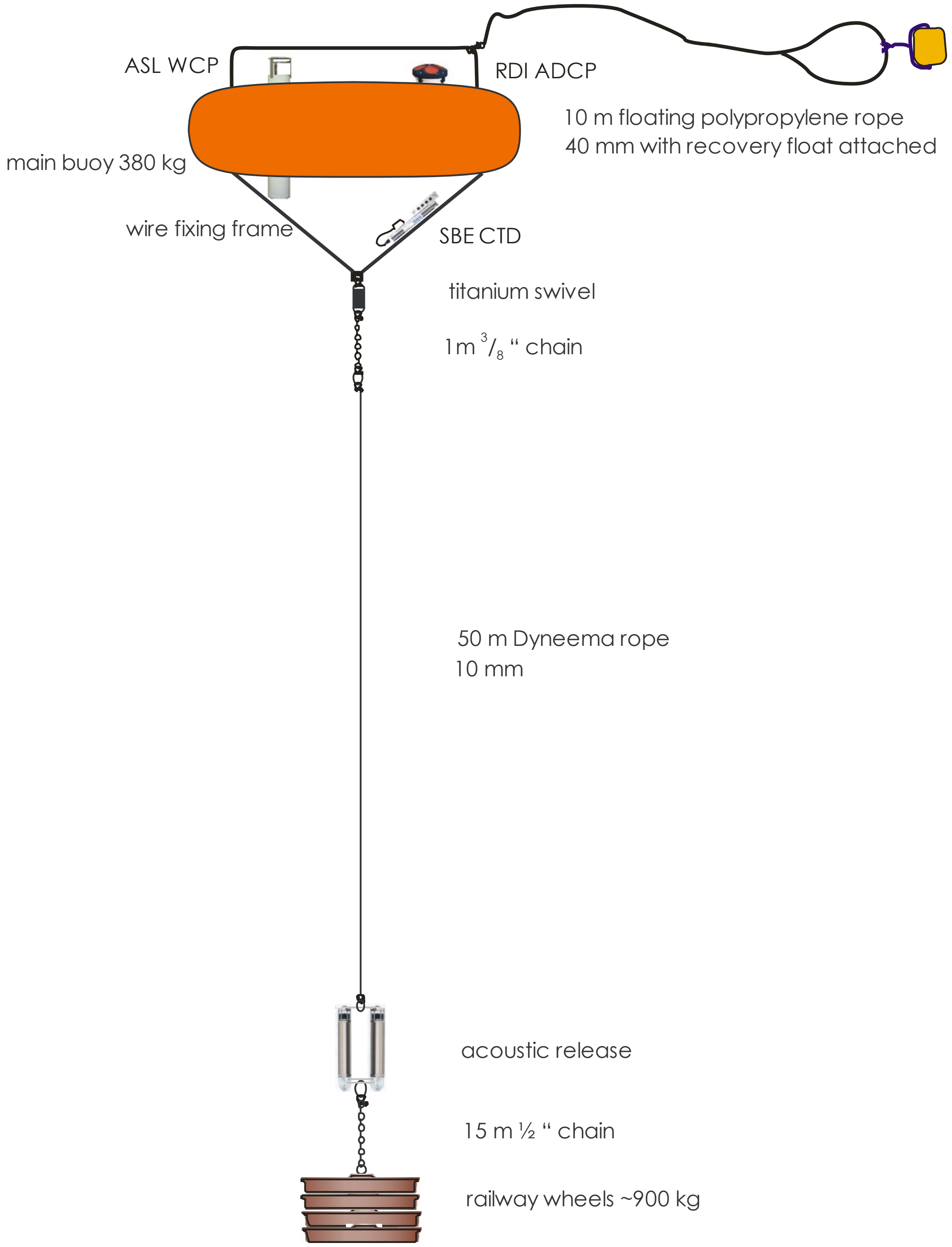
CTD 37 SMP 43742: 2463

- data downloaded
- new batteries
- 1 screw of Conductivity cell guard replaced
- 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: 17275

- data downloaded
- new batteries
- set-up instrument for deployment
- start WinSC for set up instrument
- erase data
- 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

shallow WCB mooring (300m water depth)



12 Data Management Report

Ellen Bazeley-White, BAS

12.1 Cruise Summary

JR291

12th Nov 2013 – 19th Dec 2013

Leg 20131112

PSO – Sophie Fielding

Leg included logistical activities at Bird Island, King Edward Point and Signy Stations.

Cruise focus was the Western Core Box long-term monitoring site, mooring recovery and deployment and biological sampling.

12.2 Information Support and Familiarisation

A presentation was given at the science outreach session on Sat 16th Nov 2013 to emphasise the importance of data and information management, to promote good data documentation, the use of the electronic event logs and L drive and offer general support and access to resources such as previous reports and data. A poster was also displayed in the saloon to advertise resources such as the JCR intranet, wiki and reports written by ship staff such as the daily position log.

Folders were made in the L drive and these were tailored following discussion with the PSO.

Edits were made to update documents or correct links on the JCR wiki site.

ICT staff were informed about event log archive script written by David Connor (PDC) described in section 12.7.2 of the cruise report for JR280 (Nov 2012). It should be noted that the SCS/RVS script is no longer automatically run.

As this was my first cruise I obtained a briefing from Julian Klepacki on the instruments and loggers; it would be useful for data management and scientific staff to have easier access to the AME reports about instrument servicing, calibrations and updates. Access to the intake for the underway water supply was also sought.

The Data Monitoring System (http://www.jcr.nerc-bas.ac.uk/data/) developed by David Connor on JR281 (cruise report sections 12.8.3 to 12.8.5) was viewed, this is presumably work in progress as didn't appear to have links from the JCR web pages.

[Check AME report, Ellen noted:

- Fluorometer - new one was fitted – units are now RFU – Relative Fluorometer Units – once a sample of known RFU is analysed a conversion to fluorescence can be determined, otherwise a standard chlorophyll sample is needed. Previous fluorescence data Julian thinks not reliable.

- Thermometer – new seabird thermometer approx 6m from seawater intake – more scientific than previous thermometer]

12.3 PDC Accounts

A PDC UNIX user account was created and a symbolic link created linking to the ship 'data' area. Event logs can now be created and edited by user 'PDC'.

12.4 Requests and Data Collection

During the cruise the following information resources were supplied:

- CTD profiles for JR280 – Clara Manno
- Cruise report for JR280 – Clara Manno and Sophie Fielding
- Clarification on source of pitch and roll data – Joana de Beja (BODC)
- Research into wave observation data – Alex Tate
- Management of Wave Radar data – Joana de Beja (BODC)

Support was provided to deploy XBTs and prepare the CTD. The GeoTiffs for use with the multibeam echo sounder provided by Elanor Gowland (PDC) were uploaded and the PSO was requested to undertake opportunistic bathymetry to fill in gaps. Support was provided to aid Anna Belcher process CTD data and save it in the appropriate data area.

12.5 Event Logging

Events logs were created and populated for:

- CTD Events
- CTD Bottles
- XBT deployments

Records were kept to document the science stations, transects, equipment and all events. The digital event logs were checked to ensure events were being logged and the correct event numbers, assigned by the bridge, were being used.

12.6 Marine Metadata Project

During the cruise the opportunity was taken to list the cruise reports in the masters collection and send information to the Marine Metadata Project staff back in Cambridge.

Cruise information resources such as web pages were copied for use in Cambridge.

Table 33: Equipment, Event logging and long term data management

Equipment	**Paper log sheets and person responsible**	**Ship digital event log**	**Who has been working with data**	**Folder in /data – these are saved in data/cruise at BAS Cambridge**	**Notes about /data**	**Folders in /work folder – these are saved in data/cruise at BAS Cambridge**	**Notes**	**Samples/ Specimens** **Were they studied onboard, brought back to UK, studied at BAS Cambridge????**	**Long-term management**
ADCP	No - Sophie	ADCP		adcp				N/A	
Bongo Net	???? – Pete Ward, Geraint, Clara, Vicky	Bongo_291	Pete W, Geraint, Clara, Vicky	No	N/A			Yes	
Box Corer	No – Vicky and Pete Ward	N/A	Vicky and Pete Ward	No	N/A	Box cores	Logsheet – codes from BAS core archive. Used to catch copepods.	Yes	
CTD	Yes – Julian and Ellen, Ellen entered into digital event log	CTD_events_291 & CTD_bottles	Clara, Anna, Elena	ctd	Anna processed – see folder "Anna's Processed"		CTD frame sometimes had a LADCP attached	Yes	
Down Wire Net Monitor									

(DWNM)									
EK60	???? - Sophie	EK60		ek60	Contains old calibration spreadsheet	EK60	Contains calibration spreadsheet for 2013	N/A	
EM122	No - Sophie	EM122 log		em122		No	Opportunistic swath	N/A	
ES853	Damien		Damien	No		ES853	Sometimes attached to RMT 8 frame	N/A	
LADCP				ladcp			Attached to CTD for event 97	N/A	
Marine Snow Catcher	Anna	Snow Catcher Deployments	Anna	No	N/A	Snow Catcher	Anna has her own copy of data	Yes	
MOCNESS	y – Geraint?	MOCNESS_291	Pete W, Geraint, Clara, Vicky	mocness	Dates in the .pro files give a date in Feb 2007	MOCNESS catches		Yes	
Moorings	????	No		No	N/A	scientific moorings	NB Mooring spreadsheet for BODC - TBC	Yes	
RMT 8	Yes	RMT8	Sophie, Gabi, Geraint, Damien	DWNM info		Krill		Yes	Krill length frequency added to Krillbase Oracle tables Krill photography saved in

									data/cruise
SAPs	????	????	Fred			SAPS JR 291			
XBTs	No – Sophie, Jeremy, Andy E and Ellen	XBT_291	Collected for core box long-term data series	xbt	First deployment was saved as 0 not 1	No	Vessel slows to 7 Knots for XBT deployment		

Appendix A: ICT Engineer Report

Jeremy Robst and Andy England, BAS

A1.1 SCS Logging system / Data logging

Newleg & ACQ started at 13:14, 12 November 2013 (UTC)

SCS ACQ version : 4.5.1.1063

SIS Version: 3.8.3 Build 89

A1.2 Systems

A1.2.1 UNIX

JRUB Netbackup Weekly backups failed due to tape label mismatch. Media was expired, deleted & relabelled to fix the issue.

A1.2.2 Netware

JRNA rebooted on two occasions cause was identified as a faulty tape drive. Tape drive was swapped and no further reboots occurred.

A1.2.3 Windows

Warning light on SCS1 indicated Memory Module errors, did not prevent host from working so memory module swapped on return to Stanley.

A1.2.4 Network

No problems reported.

A1.3 Event Log

18:11, 16 December 2013 (UTC)

1. Oceanlogger struggling to read Flurometer at times - JZK worked on it, so gaps in data

17:40, 16 December 2013 (UTC)

1. A new virtual machine was built for testing EK60 running on a Vmware guest.

19:16, 15 December 2013 (UTC)

1. SSU crashed at 18:45Z - EK60, ADCP, EA600 stopped pinging
2. Was noticed at 19:13Z & restarted
3. Crashed overnight also

18:15, 15 December 2013 (UTC)

1. SSU crashed at 17:40:29Z - EK60 & ADCP & EA600 stopped pinging

2. Was noticed at 18:10Z & restarted

19:02, 13 December 2013 (UTC)

1. JRUB Netbackup had 4 frozen tapes due to label mismatch
2. Expired, deleted & relabelled media (without verify) to make active again

16:08, 13 December 2013 (UTC)

1. Racked and built the new Vmware hosts esx0 and esx1, as part of the SABRIS project to upgrade server hardware and software.

12:50, 12 December 2013 (UTC)

1. JRNA rebooted again and hung accessing tape drive.
2. JRNA tape drives swapped

11:24, 10 December 2013 (UTC)

1. JRNA rebooted itself but hung failing to access tape drive. Power cycled drive and rebooted JRNA & seems OK

08:54, 10 December 2013 (UTC)

1. Memory Module errors on SCS 1 - working but will swap module in Stanley.

12:01, 9 December 2013 (UTC)

1. dopplerlog turned off for WCB transects

16:54, 8 December 2013 (UTC)

1. XBT machine - setup data dir to u:\data, overlay & calcoeff dirs to u:\data\overlay & u:\data\calcoeff resp

12:00, 4 December 2013 (UTC)

1. EK60 hardware failure (motherboard).
2. Built replacement machine from Viglen PC and documented build steps.
3. Running on spare EK60 until after science is completed.

10:37, 21 November 2013 (UTC)

1. MOCNESS PC setup
2. BIOS modified to enable legacy USB support (Pre windows USB Keyboard/Mouse)
3. Patched into LAN - DNS changed to 10.104.254.253
4. Created mocness directory in /data/cruise/jcr/current chown'd jcrdata:di, chmod'd 775

12:00, 19 November 2013 (UTC)

1. Setup synchronisation script to automatically download a single days data, thus avoiding saturating the satellite link.

15:52, 16 November 2013 (UTC)

1. Partial power failure - 15:41:47 -> 15:52:00 anemometer, ea600, emlog

17:28, 15 November 2013 (UTC)

1. Added jcr-UDB9400 to data lan - 10.104.254.219
2. Setup Seapath 320 TelegramOut13 to Ethernet GPS NMEA unicast to 10.104.254.219 port 12000 - GGA, VTG, HDT

13:14, 12 November 2013 (UTC)

1. newleg & ACQ started

Appendix B: Antarctic Marine Engineering Report

Engineering Technical Section
British
Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Neil French (nefren) is the first point of contact for marine scientific instrumentation – any questions email (nfren@nerc.ac.uk) or phone him (01223 221398); try Rob White (robite 01223 221294) or secondly Steve Bremner (sfbr, 01223 221416) when Neil not available.

Before you leave HQ for cruise support obtain an up to date image of the JCR directories from the M: drive. The database for locating incidentals and spares is now maintained on the JCR by AME and a copy for reference should be sent back to the UK each year. Please contact nefren if you are unfamiliar with this database. A list of spares/stock required should be included at the end of this report. However critical items must be ordered immediately.

A brief cruise report checklist is required for every cruise AME are responsible for supporting. Include pertinent notes on fault history and diagnosis at the end of the report even if you have already discussed via email. This information will be added to the instrumentation database maintained in the UK .

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

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

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

Please leave a copy of the cruise report on the ship in the electronics workshop for the next support engineer and email a copy to nefren, robite & sfbr.

Cruise:JR291 Start date:11/10/2013 Finish date:19/12/2013

Name of AME engineer: Julian Klepacki

Name of principle scientist (PSO): Sophie Fielding

LAB Instruments

Instrument	S/N Used	Comments
AutoSal		
Scintillation counter		
Magnetometer STCM1	Y	Display failed on power-up. Replacement fitted.
XBT	Y	

ACOUSTIC

Instrument	S/N Used	Comments
ADCP	Y	
Hydrophone		
EM122	Y	
TOPAS		
EK60	Y	Main processor PC failed, ICT rebuilt machine
SSU	Y	
USBL	Y	Tracking DWNM, See notes
10kHz IOS pinger		
Benthos 12kHz pinger S/N 1316 + bracket		
Benthos 12kHz pinger S/N 1317 + bracket		
MORS 10kHz		

transponder		
Benthos UDB9000		
Hull Transducer	Y	Mooring work, See Notes

OCEANLOGGER

Instrument	S/N Used	Comments
Barometer1(UIC)	#V145002	
Barometer1(UIC)	#V145003	
Foremast Sensors		
Air humidity & temp1	#60599569	
Air humidity & temp2	#60599557	
TIR1 sensor (pyranometer)	#112993	
TIR2 sensor (pyranometer)	#112992	
PAR1 sensor	#110127	
PAR2 sensor	#110126	
Prep Lab		
Thermosalinograph SBE45	#4524698-0018	
Transmissometer C-STAR	CST-396DR	
Fluorometer	Y	
Flow meter	#11950	
Uncontaminated seawater temp	Y	
SBE35 Seawater Temp	#	To be Fitted stanley call + modified OL vi
SBE35 Seawater Temp	#	To be Fitted stanley call + modified OL vi

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

Instrument	S/N Used	Comments
CTD PC	Y	CTD PC1
Deck unit 1 SBE11plus	#-0458	
Underwater unit SBE9plus	#-0707	
Temp1 sensor SBE3plus	#03P4472	
Temp2 sensor SBE3plus	#03P2366	
Cond1 sensor SBE 4C	#04C2222	

Cond2 sensor SBE 4C	#04C2289	
Pump1 SBE5T	#4488	
Pump 2 SBE5T	#3415	
Standards Thermometer SBE35	#3527735-0024	
Transmissometer C-Star	CST-846DR	
Fluorometer Aquatraka Mk3	#088-216	
Oxygen sensor SBE43	#2290	
PAR sensor	#7235	
Altimeter PA200	#244740	No signal, constant at 100m; cast #003, stn026
Altimeter PA200	#163162	Fitted 01/12/13, replaces #244740, works o.k
CTD swivel+ linkage	#196111	
Carousel + 24 Bottle Pylon	#0636	
Notes on any other part of CTD e.g. faulty cables, wire drum slip ring, bottles, swivel, frame, tubing etc		Megohm testing sea-cable does not fail, but gives worryingly low values of resistance, but works fine. A number of deep casts performed ~4k and no errors etc.

LADCP

Instrument	**S/N Used**	**Comments**
300KHz WH Monitor	15060	
300KHz WH Monitor		
Battery Pack	Y	
Charger	Y	
Cables	Y	A comms cable into chem-lab appears faulty
AME Laptop (BBTalk)	Y	

MISC

Instrument	**S/N Used**	**Comments**
NMEA Server	Y	Fitted display repeater for UIC + workshop displays, See Notes

LabView Server	Y	See notes
DWNM PC (acoustic st'n)	Y	

AME UNSUPPORTED INSTRUMENTS BUT LOGGED

Instrument	Working ?	Comments
EA600	Y	
Anemometer	Y	
Gyro	Y	
DopplerLog	Y	
EMLog	Y	
Seapath 320+	Y	

End of Cruise Procedure

At the end of the cruise, please ensure that:

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

- you clean all the fans listed below every cruise or every month, whichever is the longer.

Please clean the intake fans on the following machines:

Instrument	Cleaned?
Oceanlogger	N
EM122, TOPAS, NEPTUNE UPSs	N
Seatex Seapath	N
EM122 Tween Deck	N
TOPAS Tween Deck	N

Additional notes and recommendations for change / future work

MCal

The Benthos UDB9000 PC has now got installed some software for mooring-calibration: MCal. This software effectively allows the ranging and locating of moorings with a graphical interface showing where the mooring is located with respect to the ship. It has some NMEA strings fed into the PC via UDP connection and a serial comms connection to the UDB9000 modem to interface with. This instrument is setup, but has not been used. Some trial time would be good to learn how to use it. AME needs devices (release/transponder) to communicate with it.

Ocean Logger

Configured new sbe38 temperature sensors to RS485 comms, each with their individual ID and tested on the bench with a nudam + Advantech converters, all working. This will allow the two sensors to be simply patched into the existing wiring for the industrial pt100 sensor, using two of it's wires as the rs485 bus. A simple 'polling' instruction added to the O.L software and it should be up and running.

Stanley call fit sensors and mod program!

LADCP

Discovered an intermittent faulty power cable on one of the comms cables in the chemical lab whilst checking battery charge; no voltage measurement on dvm from battery. Faulty cable indicated by RED tape on ends of cable. Fault-finding was a little frustrating with those connectors, deep contacts and intermittent fault. Recalling some Impulse-Pigtails in the workshop drawer, pair of test cables were made. One male and one female, so all aspects can be easily tested; comms-cable and star-cable. They are simply breakout for power and 232 comms loop-back (Tx/Rx). These should always be put away and kept safe in the LADCP zargi box when not in use.

DWNM

DWNM UWU had been modified with a DCDC converter to supply power to an echosounder. This had been fitted directly to the sea-cable input within the DWNM housing. This was incorrect/problematic and likely causing impedance mismatch and was reducing data-modulation (3Vpp A.M on ~60V D.C offset) from 3Vpp to ~500mVpp. Resulting in comms between deck-unit and UWU to fail. It worked under test-cable (v.short) conditions, but not actual sea-cable (v.long). It was removed and reconnected across D2, this effectively places the converter after one of the smoothing/blocking inductors (L2). It also places the new converter within the same control circuitry as all the other converters. So they only come on after supply voltage has reached appropriate level. Modulation levels are now unaffected and unit operates correctly.

Hull Transducer

Attempting to recover moorings the old PES hull transducer was used with an IXSEA deck-box facilitated with the 'breakout' BNC connectors 'J' and 'H' on the rear of the Acoustic-Station by the EA600. An initial response was considered erroneous, likely some interpretation from other acoustic noise source? No response was obtained from using the IXSEA 'dunker' transducer. In order to get confidence in the system some tests were performed; An acoustic-release was lowered off the aft to approximately 50m depth. Ranging and diagnostics were performed through the deck-box and dunker over the starboard side by the w.b. annexe. Comms was then repeated within the UIC using the breakout bnc connectors. Connector 'H' returned occasional diagnostics failures, connector 'J' succeeded every time to range and interrogate the release.

On actual mooring recovery, 'J' appeared temperamental and 'H' was successful in communicating and releasing the mooring. I believe the connectors, J, H etc are all good and problems were with conditions/releases etc. The retrieved release was put on the next CTD and tested at full depth ~3km, comms was established every time on both 'J' and 'H' BNC connectors.

All that can be done to the hull transducer is measure the impedance of each element to see how they compare to expected values. This was done previously, some time ago and correlated well with documented impedances from old PES manuals. Except element 'C' which measured significantly different to others that I concluded it was faulty and not to be used. I re-measured the impedances using voltage-vector principles. I got some unexpected results, but I think it was due to the resistor value I used (too low). All the impedances, though calculated out unexpected, were all the same, except element 'C'. Indicative that there wasn't any connection problems etc.

A spare correct connector for the IXSEA Deck-Box was located and fitted, this eliminated the DIY-pins previously made and used. On deep mooring redeployment(s) hull transducer was used again on both connectors 'J' and 'H'. This time comms was established every time with repeated depths/diagnostics. Also listening to the comms; after the initial transmission 'doink' noise you could hear the reply as a series of faint, but distinctive 'clicks'. 100% confidence in the UIC hull-transducer break-outs. If it doesn't work, it is not due to these connections.

NMEAserver

The NMEAserver 1U PC has dual graphics capability with a single digital DVI and VGA outputs. The DVI output needs a DVI monitor attached to get dual capability. If you connect a VGA monitor through an adaptor, the PC won't see the DVI monitor and you won't get dual-capabilities. At present the PC has VGA output fed into a video-splitter, one of the dual output then goes into a kvm and can be directed to the AME workshop for ease of working on the PC, code changes etc. The other mirrors the display to a monitor fitted to the top of the cabinet for general display into the UIC. If this UIC monitor is replaced with a DVI monitor, the dual capabilities can be implemented and the video-splitter can be removed to simplify the cabinet internals somewhat.

LView Virtual Server

ICT have set up a virtual machine for running the LView Web-based programs in an attempt to solve the ongoing problem of distributing instrumentation over ships LAN with labview. A historical 'memory leak' problem with LView has been resolved with a newer version, but the LView Server PC still crashes when it is enabled as a Web Server.

The *NavMet* data display labview program has been updated to read the scs data more efficiently. Previously it simply read the *raw* files off the scs, this was placing a significant load on the server as reported by ICT. The program was changed to capture relative data from the broadcast over the network. This has removed the loading previously seen, but the machine still crashed when web-enabled. The new latest version of the VI on the machine is *NavMetWeb2013TCP.vi.*

A set of programs have been created for the virtual machine. Main program captures the data broadcast, checks validity and extracts most recent values. These values are then written to global variables for the other programs to simply display. This has minimal and by utilising a single data-capture it is easy to change, add or modify parameters

Implemented programs are found in *C:\LViewVIs\GLOBAL*, on the virtua machine. They are also backed up on the AME *projects* folder. Also included is brief documentation describing programs and operation. Links have been added to the JCR homepage and programs have been running for many days without any problems with continuous monitoring on a couple of remote machines.

USBL

USBL was used to track the RMT8 and MOCNESS fishing net. Stable tracking was achieved over a period of the deployment: Steady tracking from deployment-start to cable-out of ~1km. Then racking became unreliable with majority erroneous depth and tracking. Once cable-hauling started, steady tracking was resumed. On two instances of steady tracking I took the transponder depth and distance from rear of the ship and calculated the expected cable-length (root of squared-sum). This correlated very close to the CLAM cable-out, so I was confident it was right.

It seems likely that once the cable-out becomes a given distance vibrations are experienced significant enough to impede transponder tracking. The transponder is fitted to the bio-cable just above the swivel. Once hauling is started the cable-out is tighter and likely those vibrations damped or reduced significantly enough to obtain tracking again.

If the USBL transponder is to be used on towed structures reliably, I think appropriate mounting of the transponder needs to be implemented; solid mounting onto to structure itself pointing toward the hull of the vessel. Cable-mounted transponder only good for relatively 'close' work (~700m) astern or during hauling for greater distances if applicable.

A default *Jobfile* has been created and is stored in:

C:\Program Files\Sonardyne\Pharos\Library\Job Templates\JCR_Default.jcf.

Also *Fusion Advance* has been setup so that when a new job is created it automatically selects the JCR default template. It's set up for the ship and WSM6 (Red transponder) simple enough to add the other WSM (yellow) one if required. Use the job-wizard for easy project management, just don't mess with the default template! If *Reports* are required and no output is seen on NCU port 5A (LED 5A), even though viewing *comms* in software actually shows gga data. Try deleting the report(s) and re-adding it, configuring respectively etc. This solved a no-report-output condition even though all was configured correctly and *on* and data could be seen at the port through *show-comms*.

Support Engineer: Julian Klepacki Date: 16th December 2013.

Appendix C: Event Log

Table 34: Event log

Date	Event Num	Latitude	Longitude	Event
22/11/2013 11:00		-54.27784	-36.44077	Vsl on DP
22/11/2013 11:07	1	-54.27797	-36.43904	Commence deploying bongo net
22/11/2013 11:11	1	-54.27802	-36.4389	Bongo net deployed
22/11/2013 11:17	1	-54.27816	-36.43838	Bongo net at 200m
22/11/2013 11:26	1	-54.27834	-36.43777	Bongo net clear of the water
22/11/2013 11:30	1	-54.27832	-36.43774	Bongo net fully recovered inboard
22/11/2013 11:33	2	-54.27833	-36.43774	Commence deploying CTD
22/11/2013 11:38	2	-54.27833	-36.43773	CTD in the water
22/11/2013 11:42	2	-54.27831	-36.43772	CTD veering to approx 240m
22/11/2013 11:48	2	-54.27832	-36.43772	CTD stopped at 243m
22/11/2013 12:12	2	-54.27834	-36.43768	CTD recovered to deck
22/11/2013 12:50	3	-54.2783	-36.43771	Commence deploying box corer
22/11/2013 12:52	3	-54.27835	-36.43774	Box corer in the water
22/11/2013 13:01	3	-54.27833	-36.43774	Corer on the seabed
22/11/2013 13:04	3	-54.27835	-36.43774	Corer clear of the seabed
22/11/2013 13:21	3	-54.27829	-36.43773	Box corer recovered to deck
22/11/2013 13:28		-54.27846	-36.4378	Vsl moving ahead to next station on DP
22/11/2013 14:00		-54.28943	-36.43976	Vsl stopped in position
22/11/2013 14:04	4	-54.28949	-36.43977	Commence deploying bongo net
22/11/2013 14:09	4	-54.28949	-36.4398	Bongo net at 150m
22/11/2013 14:21	4	-54.28948	-36.43979	Bongo net recovered on deck
22/11/2013 14:42	5	-54.2895	-36.43979	Box corer in the water
22/11/2013 14:50	5	-54.28948	-36.43979	Box corer on the bottom

22/11/2013 14:54	5	-54.28949	-36.4398	Box corer clear of the seabed
22/11/2013 15:01	5	-54.28948	-36.43979	Box corer recovered to deck
22/11/2013 15:05		-54.28949	-36.43981	Vessel moving to the next station (150m)
22/11/2013 15:15		-54.29089	-36.4401	Vessel proceeding directly to shallowest station due to current
22/11/2013 15:44		-54.3081	-36.4415	Vessel on station at shallowest station 25m
22/11/2013 15:56	6	-54.30808	-36.4415	Bongo net deployed
22/11/2013 15:59	6	-54.30806	-36.44153	Bongo net at 11m
22/11/2013 16:06	6	-54.30803	-36.44152	Bongo net recovered
22/11/2013 16:19	7	-54.30806	-36.44153	Box corer in the water
22/11/2013 16:22	7	-54.30807	-36.44152	Box corer on the bottom
22/11/2013 16:27	7	-54.30808	-36.44152	Box corer clear of the seabed
22/11/2013 16:31	7	-54.30808	-36.44153	Box corer recovered
22/11/2013 16:35	8	-54.30809	-36.44152	Box corer in the water
22/11/2013 16:38	8	-54.3081	-36.4415	Box corer on the bottom
22/11/2013 16:42	8	-54.3081	-36.44151	Box corer clear of the seabed
22/11/2013 16:47	8	-54.3081	-36.44151	Box corer recovered to deck
22/11/2013 16:50		-54.3081	-36.44151	Vessel moving to next station 50m
22/11/2013 17:11		-54.3049	-36.44204	Vessel on station at 50m
22/11/2013 17:20	9	-54.3049	-36.44203	Bongo net deployed
22/11/2013 17:22	9	-54.30488	-36.44204	Bongo net at 35m
22/11/2013 17:30	9	-54.30491	-36.44205	Bongo net recovered on deck
22/11/2013 17:40	10	-54.3049	-36.44206	Box corer in the water
22/11/2013 17:44	10	-54.3049	-36.44205	Box corer on the bottom
22/11/2013 17:46	10	-54.3049	-36.44205	Box corer clear of the seabed
22/11/2013 17:51	10	-54.3049	-36.44205	Box corer recovered to deck
22/11/2013 17:55		-54.30489	-36.44204	Vessel off station
22/11/2013 18:18		-54.29802	-36.44188	Vessel stopped at 102m UKC and clear to deploy nets.
22/11/2013 18:22	11	-54.298	-36.44187	Bong nets deployed

22/11/2013 18:25		-54.29801	-36.44191	Bongo stopped at 85m
22/11/2013 18:47		-54.29801	-36.44192	Bongo nets recovered.
22/11/2013 18:57	12	-54.298	-36.44193	CTD deployed.
22/11/2013 19:00		-54.29801	-36.44193	Veering CTD to 90m
22/11/2013 19:02		-54.298	-36.44193	CTD stopped at 93m
22/11/2013 19:16		-54.29804	-36.44192	CTD recovered on deck.
22/11/2013 19:29	13	-54.29802	-36.44189	Box corer in the water
22/11/2013 19:35		-54.29802	-36.44189	Box corer on the bottom
22/11/2013 19:39		-54.29803	-36.44188	Box corer clear of the seabed
22/11/2013 19:46		-54.29802	-36.44189	Box corer recovered to deck
22/11/2013 19:50		-54.29802	-36.44188	Vessel off station moving to next site.
22/11/2013 20:01		-54.2948	-36.44129	Vessel all stopped on D.P. 151m UKC
22/11/2013 20:09	14	-54.29481	-36.44127	Commence deploying bongo net
22/11/2013 20:10		-54.2948	-36.44127	Veering Bongo net to 135m
22/11/2013 20:14		-54.29481	-36.44127	Wire out 135m
22/11/2013 20:27		-54.29482	-36.44128	Bongo net clear of the water
22/11/2013 20:29		-54.29482	-36.44128	Bongo net recovered on deck
22/11/2013 20:49	15	-54.29481	-36.44125	Commence deploying box corer
22/11/2013 20:51		-54.29481	-36.44125	Box corer deployed
22/11/2013 20:58		-54.2948	-36.44127	Box corer on the seabed
22/11/2013 21:02		-54.29481	-36.44127	Box corer clear of the seabed
22/11/2013 21:08		-54.29482	-36.44125	Box corer clear of the water
22/11/2013 21:10		-54.29481	-36.44127	Box corer recovered to deck
22/11/2013 21:15		-54.29482	-36.44126	Vessel moving to the next station (250m)
22/11/2013 21:30		-54.27796	-36.43914	Vessel stopped at 252m UKC and clear to deploy nets.
22/11/2013 21:45		-54.27771	-36.43883	Bongo net wire parted when preparing to deploy. Gantry stowed
23/11/2013 18:42		-54.11793	-38.30686	Commence slow down
23/11/2013 18:50		-54.11796	-38.30697	Vessel on station on DP

23/11/2013 18:53	16	-54.11797	-38.30696	Bongo net in the water
23/11/2013 18:57	16	-54.11797	-38.30697	Bongo net recovered
23/11/2013 19:22		-54.11801	-38.30697	Vessel moving off station for Mockness deployment
23/11/2013 19:28		-54.11667	-38.30753	Vessel moving at 2 knots
23/11/2013 19:32	17	-54.11437	-38.30935	Mockness deployed
23/11/2013 19:39	17	-54.11043	-38.31219	Mockness at 100m
23/11/2013 19:42	17	-54.10889	-38.31322	Mockness at 150m
23/11/2013 20:00	17	-54.09977	-38.31999	Commence hauling MOCNESS
23/11/2013 20:04	17	-54.09777	-38.32161	Mocness at the surface
23/11/2013 20:09	17	-54.09517	-38.32364	Mocness recovered on deck
23/11/2013 20:36	18	-54.08394	-38.34048	Commence deploying RMT 8
23/11/2013 20:41	18	-54.08059	-38.34336	RMT 8 deployed
23/11/2013 20:48	18	-54.07623	-38.34766	Hauling RMT 8
23/11/2013 20:51	18	-54.07471	-38.34922	RMT 8 at the surface
23/11/2013 20:56	18	-54.07218	-38.35179	RMT 8 recovered on deck
23/11/2013 21:07	19	-54.06936	-38.35474	Commence deploying RMT 8
23/11/2013 21:13	19	-54.06544	-38.35846	RMT 8 deployed
23/11/2013 21:18	19	-54.05625	-38.36722	Commence hauling net for recovery
23/11/2013 21:21	19	-54.06067	-38.36306	RMT 8 at the surface
23/11/2013 21:26	19	-54.05767	-38.36591	RMT 8 recovered on deck
23/11/2013 21:30		-54.05631	-38.36716	Vessel all stopped on D.P
23/11/2013 21:49	20	-54.05625	-38.36721	Commence deploying Snow Catcher
23/11/2013 21:51	20	-54.05625	-38.36722	Snow catcher deployed
23/11/2013 21:56	20	-54.05626	-38.36721	Snow catcher clear of water
23/11/2013 21:57	20	-54.05626	-38.36721	Snow catcher recovered on deck
23/11/2013 22:06		-54.05624	-38.36724	Vsl off DP
23/11/2013 22:12		-54.05873	-38.37181	Deck all secure
24/11/2013 10:36		-55.24941	-41.2757	Vsl on DP and assessing conditions for P2 mooring

24/11/2013 11:06	21	-55.24888	-41.2767	Vsl moving 1000m astern and preparing decks for mooring ops
24/11/2013 12:25	21	-55.25723	-41.27127	Hydrophone deployed
24/11/2013 12:34	21	-55.25724	-41.27133	Hydrophone recovered
24/11/2013 12:46	21	-55.25125	-41.27658	Hydrophone redeployed
24/11/2013 12:55	21	-55.25122	-41.27662	Hydrophone recovered
24/11/2013 13:07	21	-55.25064	-41.27666	Vsl moving on DP to attempt to find mooring
24/11/2013 13:30	21	-55.24503	-41.26352	Mooring ranged at (7171.4) 6322m
24/11/2013 13:36	21	-55.24638	-41.26177	Vsl off DP and moving for second range
24/11/2013 13:54	21	-55.2564	-41.2376	Vsl on DP
24/11/2013 14:24		-55.25625	-41.23677	Vessel proceeding to Signy
26/11/2013 06:12		-60.57828	-46.51877	Vessel on D.P
26/11/2013 06:15		-60.5793	-46.51962	Vessel all stopped on D.P
26/11/2013 06:40		-60.5793	-46.51965	Decided conditiions suitable
26/11/2013 07:36	Signy Mooring	-60.5749	-46.50649	Release signal sent
26/11/2013 07:46		-60.57494	-46.50643	Mooring not at the surface
26/11/2013 08:04		-60.57492	-46.50643	Hydrophone deployed
26/11/2013 08:20		-60.57485	-46.50649	Hydrophone recovered
26/11/2013 08:55		-60.57486	-46.50653	No signal from mooring
26/11/2013 09:30		-60.57526	-46.5172	Vessel off D.P
26/11/2013 22:44		-60.7009	-45.57347	VSL on DP for hydrophone testing
26/11/2013 22:48		-60.70043	-45.57437	Release Deployed
26/11/2013 22:50		-60.70042	-45.57449	Hydrophone deployed
26/11/2013 22:53		-60.70043	-45.57452	Hydrophone recovered
26/11/2013 22:56		-60.70043	-45.5745	Release recovered
26/11/2013 22:57		-60.70042	-45.57448	First test successful
26/11/2013 23:09		-60.70041	-45.57454	Release recovered
26/11/2013 23:12		-60.70042	-45.57448	Test completed & vsl off DP
30/11/2013 04:48		-60.63174	-46.4262	Vessel begins grid

30/11/2013 08:00	Signy Mooring	-60.57373	-46.51589	V/L on D.P
30/11/2013 10:40	Signy Mooring	-60.5755	-46.51752	No response from either release
30/11/2013 11:25	Signy Mooring	-60.57452	-46.51646	Commence dredging operations
30/11/2013 11:30	Signy Mooring	-60.57452	-46.51637	Weight deployed over the stern on the coring wire
30/11/2013 11:56	Signy Mooring	-60.5745	-46.51635	Weight on the seabed
30/11/2013 12:41	Signy Mooring	-60.57617	-46.51561	Bight in wire made running 400-500m away from mooring
30/11/2013 12:52	Signy Mooring	-60.57875	-46.52015	Vsl stopped and commence hauling the wire (2680m)
30/11/2013 14:35	Signy Mooring	-60.57876	-46.5202	weight off the seabed
30/11/2013 14:49	Signy Mooring	-60.57878	-46.5202	Weight recovered
30/11/2013 15:06	Signy Mooring	-60.57874	-46.52026	Vessel to make another run through area with echo sounder
30/11/2013 15:28	Signy Mooring	-60.57753	-46.52043	Vessel begins run through area with echo sounds
30/11/2013 16:00		-60.51101	-46.4723	Vessel proceeding to deep water position for science station
30/11/2013 18:00		-60.27324	-46.17202	Vessel on DP
30/11/2013 18:04	22	-60.27324	-46.17163	Mocness deployed
30/11/2013 18:19	22	-60.2732	-46.17163	Hauling MOCNESS wire out 250m
30/11/2013 18:33	22	-60.27319	-46.17157	Mocness at the surface
30/11/2013 18:34	22	-60.27318	-46.17158	Mocness recovered on deck
30/11/2013 18:44	23	-60.27318	-46.17157	Commence deploying bongo net
30/11/2013 18:47	23	-60.27318	-46.17156	Bongo net deployed
30/11/2013 18:53	23	-60.27318	-46.17158	Bongo net at 200m
30/11/2013 19:15	23	-60.27317	-46.17159	Bongo net clear of the water
30/11/2013 19:17	23	-60.27316	-46.1716	Bongo net recovered on deck
30/11/2013 19:21	24	-60.27318	-46.1716	Commence deploying bongo net
30/11/2013 19:23	24	-60.27318	-46.17158	Bongo net deployed
30/11/2013 19:29	24	-60.27318	-46.1716	Bongo net at 200m
30/11/2013 19:42	24	-60.2732	-46.17156	Bongo net clear of the water
30/11/2013 19:45	24	-60.2732	-46.17158	Bongo net recovered on deck
30/11/2013 19:53		-60.27321	-46.17072	Vessel off D.P

30/11/2013 19:58	25	-60.27216	-46.17424	Vessel Hdg 310 x 2knots
30/11/2013 20:02	25	-60.27067	-46.17729	Mocness deployed
30/11/2013 21:07	25	-60.24235	-46.24044	Wire out 1927m
30/11/2013 22:34	25	-60.21223	-46.32336	Mocness at the surface
30/11/2013 22:39	25	-60.21048	-46.32905	Mocness recovered on deck
30/11/2013 22:48		-60.20911	-46.33501	Vsl on DP
30/11/2013 23:05	26	-60.20909	-46.33504	Deploying the CTD
30/11/2013 23:08	26	-60.2091	-46.33504	CTD in the water
30/11/2013 23:12	26	-60.20909	-46.33503	CTD veering to approx 2300m (EA600 2333m)
30/11/2013 23:52	26	-60.20911	-46.33504	CTD all stopped at 2190m
01/12/2013 01:02	26	-60.20908	-46.33505	CTD recovered on deck
01/12/2013 01:40	27	-60.2091	-46.33497	Deploying the snowcatcher
01/12/2013 01:44	27	-60.2091	-46.33499	Snow catcher in the water
01/12/2013 01:45	27	-60.20911	-46.33497	Snow catcher deployed to 60m
01/12/2013 01:55	27	-60.20911	-46.33497	Snow catcher recovered on deck
01/12/2013 02:16	28	-60.20908	-46.33499	Snow catcher deployed
01/12/2013 02:21	28	-60.20911	-46.335	snow catcher stopped at 160m
01/12/2013 02:33	28	-60.20911	-46.33503	Snow catcher recovered on deck
01/12/2013 02:54	29	-60.2091	-46.33503	Start deploying SAPS
01/12/2013 03:04	29	-60.2091	-46.33501	First pump in the water
01/12/2013 03:18	29	-60.2091	-46.33503	240m of cable out
01/12/2013 03:24	29	-60.20911	-46.33505	340m of cable out
01/12/2013 03:26	29	-60.20911	-46.33505	SAPS deployed to 400m
01/12/2013 05:05	29	-60.20911	-46.33501	Commence heaving on SAPS
01/12/2013 05:09	29	-60.20912	-46.33503	First pump recovered
01/12/2013 05:15	29	-60.20912	-46.33501	Second pump recovered
01/12/2013 05:24	29	-60.2091	-46.33499	Third pump recovered
01/12/2013 05:26	29	-60.20911	-46.33501	Weight recovered

01/12/2013 05:41		-60.2091	-46.335	Deck secure Vessel off DP
01/12/2013 05:48		-60.20319	-46.33186	F.A.O.P
01/12/2013 07:46	30	-59.9189	-46.01592	Vessel Hdg 250 x 2knots
01/12/2013 07:51	30	-59.91994	-46.01993	Commence deploying Mocness
01/12/2013 07:57	30	-59.92139	-46.02548	Mocness deployed
01/12/2013 08:23	30	-59.9278	-46.04108	Wire off the shackle
01/12/2013 08:29	30	-59.9295	-46.04237	Mocness at the surface
01/12/2013 08:34	30	-59.92972	-46.04363	Mocness recovered on deck
01/12/2013 08:44		-59.92974	-46.0438	Inspected Bio Wire no signs of damage.
01/12/2013 08:52		-59.92974	-46.0438	Vessel off D.P
01/12/2013 08:55	31	-59.93009	-46.04493	Vessel Hdg 250 x 2knots
01/12/2013 09:04	31	-59.93238	-46.05499	Mocness deployed
01/12/2013 10:06	31	-59.94685	-46.11399	Mocness deployed to 1710m
01/12/2013 11:26	31	-59.96481	-46.17363	Mocness at the surface
01/12/2013 11:29	31	-59.96548	-46.17645	Mocness recovered on deck
01/12/2013 11:30		-59.9657	-46.17745	Vsl on DP
01/12/2013 11:55	32	-59.96227	-46.16	Commence deploying bongo net
01/12/2013 11:58	32	-59.96226	-46.15997	Bongo net veering to 200m.
01/12/2013 12:04	32	-59.96227	-46.15995	Bongo net at 200m
01/12/2013 12:16	32	-59.96232	-46.1598	Bongo net clear of the water
01/12/2013 12:19	32	-59.96236	-46.1597	Bongo net recovered on deck
01/12/2013 12:32	33	-59.96234	-46.1597	Commence deploying CTD
01/12/2013 12:35	33	-59.96233	-46.15971	CTD in the water
01/12/2013 12:39	33	-59.96235	-46.15971	CTD veering to approx 2200m (EA600 4843m)
01/12/2013 12:56	34	-59.96231	-46.1597	Commence deploying Snow Catcher
01/12/2013 12:58	34	-59.96231	-46.1597	Snow catcher deployed to 70m
01/12/2013 13:03	34	-59.96232	-46.15972	Snow catcher recovered on deck
01/12/2013 13:17	33	-59.96234	-46.15971	CTD all stopped at 2200m

01/12/2013 13:30	35	-59.96231	-46.15974	Deploying the snowcatcher
01/12/2013 13:32	35	-59.9623	-46.15971	Snow catcher in the water
01/12/2013 13:37	35	-59.9623	-46.15972	Snow catcher deployed to 170m
01/12/2013 13:44	35	-59.96231	-46.15975	Snow catcher recovered on deck
01/12/2013 14:22	33	-59.96234	-46.15968	CTD recovered
01/12/2013 14:35		-59.96232	-46.15968	Off DP proceeding
01/12/2013 14:42		-59.96063	-46.16314	F.A.O.P
02/12/2013 16:18	P2 mooring	-55.25146	-41.24826	Vessel on DP
02/12/2013 16:30	P2 mooring	-55.25146	-41.24827	range of 834m calculated
02/12/2013 16:36	P2 mooring	-55.25146	-41.24829	Attempt to be made using the over the side hydrophone
02/12/2013 16:38	P2 mooring	-55.25146	-41.24827	Hydrophone in the water
02/12/2013 16:46	P2 mooring	-55.25144	-41.24826	Hydrophone out of the water
02/12/2013 16:56	P2 mooring	-55.25295	-41.25707	Vessel stopped
02/12/2013 16:57	P2 mooring	-55.25296	-41.25707	Transducer in the water
02/12/2013 17:01	P2 mooring	-55.25292	-41.25708	Transducer clear of the water
02/12/2013 17:10	P2 mooring	-55.25293	-41.25708	Second range puts vessel on top of mooring
02/12/2013 17:21	P2 mooring	-55.25428	-41.24783	Vessel stopped
02/12/2013 17:24	P2 mooring	-55.25425	-41.24783	Buoy sighted on the surface
02/12/2013 17:37	P2 mooring	-55.25381	-41.25345	Pickup buoy grappled
02/12/2013 17:38	P2 mooring	-55.25372	-41.25329	Line on winch
02/12/2013 17:42	P2 mooring	-55.25358	-41.2532	Buoy on board
02/12/2013 17:59	P2 mooring	-55.25316	-41.25424	500m CTD recovered
02/12/2013 18:21	P2 mooring	-55.25256	-41.25576	Trimson buoy cluster recovered on deck
02/12/2013 18:35	P2 mooring	-55.2526	-41.25577	Sediment trap and current meter recovered on deck
02/12/2013 19:04	P2 mooring	-55.25259	-41.25577	Accoustic release recovered on deck. P2 fully recovered. Stern ramp closed
02/12/2013 19:13		-55.25259	-41.2558	Vessel off D.P
02/12/2013 19:47	36	-55.20323	-41.23014	Vessel Hdg 290 x 2knots
02/12/2013 19:53	36	-55.20288	-41.23489	Mocness deployed

02/12/2013 20:45	36	-55.20027	-41.27353	Wire out 1444m
02/12/2013 21:56	36	-55.1923	-41.33682	Mocness at the surface
02/12/2013 22:00	36	-55.19166	-41.3405	Mocness recovered on deck
02/12/2013 22:02		-55.19145	-41.34194	Vsl on DP
02/12/2013 22:24	37	-55.19153	-41.34198	Deploying the CTD
02/12/2013 22:29	37	-55.19152	-41.342	CTD in the water
02/12/2013 22:32	37	-55.19153	-41.34199	CTD veering to approx 3000m (EA600 3316m)
02/12/2013 22:47	38	-55.19153	-41.34203	Deploying the snowcatcher
02/12/2013 22:48	38	-55.19153	-41.34201	Snow catcher in the water
02/12/2013 22:52	38	-55.19154	-41.34201	Snow catcher deployed to 70m
02/12/2013 23:00	38	-55.19153	-41.34199	Snow catcher recovered on deck
02/12/2013 23:24	37	-55.19153	-41.34198	CTD all stopped at 3000m
02/12/2013 23:37	39	-55.19153	-41.34201	Deploying the snowcatcher
02/12/2013 23:39	39	-55.19155	-41.34204	Snow catcher in the water
02/12/2013 23:45	39	-55.19156	-41.342	Snow catcher deployed to 170m
02/12/2013 23:59	39	-55.19153	-41.342	Snow catcher recovered on deck
03/12/2013 00:53	37	-55.19152	-41.34201	CTD recovered on deck
03/12/2013 01:12		-55.19154	-41.342	Vsl off DP
03/12/2013 01:20	40	-55.19129	-41.34553	Commence deploying Mocness
03/12/2013 01:23	40	-55.19104	-41.34856	Wire at the bottom of the swivel twisted
03/12/2013 01:32	40	-55.19046	-41.35642	Resuming mocness deployment
03/12/2013 01:37	40	-55.19014	-41.36086	Mocness in the water
03/12/2013 02:47	40	-55.18668	-41.42877	Mocness stopped at 1887m starting to haul
03/12/2013 04:21	40	-55.185	-41.51576	Frame recovered
03/12/2013 04:23	40	-55.18499	-41.51781	Mocness net recovered
03/12/2013 04:29		-55.18486	-41.52155	Vessel stopped on DP
03/12/2013 04:38		-55.18482	-41.52154	Informed that we need to relocate back to orginial CTD position
03/12/2013 05:51		-55.19184	-41.34218	On DP

03/12/2013 05:59	41	-55.19139	-41.34212	CTD deployed
03/12/2013 06:09	41	-55.19139	-41.34217	Wire out 200m
03/12/2013 06:22	41	-55.19145	-41.34215	CTD clear of the water
03/12/2013 06:26	41	-55.19146	-41.34217	CTD recovered
03/12/2013 06:38	42	-55.19142	-41.34219	Commence deploying SAPS
03/12/2013 06:45	42	-55.19143	-41.34218	1st pump connected and deployed
03/12/2013 06:58	42	-55.19142	-41.34218	2nd pump connected
03/12/2013 07:03	42	-55.19141	-41.34215	3rd pump connected
03/12/2013 07:09	42	-55.19143	-41.34217	All stopped veering
03/12/2013 08:37	42	-55.19142	-41.34217	Commence hauling for recovery
03/12/2013 08:43	42	-55.1914	-41.34216	1st pump disconnected
03/12/2013 08:50	42	-55.19141	-41.34217	2nd pump disconnected
03/12/2013 09:00	42	-55.19141	-41.34219	3rd pump disconnected
03/12/2013 14:17	43	-55.19372	-41.33876	Bongo net deployed
03/12/2013 14:21	43	-55.1937	-41.3387	Hauling bongo net from 50m
03/12/2013 14:26	43	-55.19382	-41.33842	Bongo net recovered
03/12/2013 14:32	44	-55.19381	-41.33842	Bongo deployed
03/12/2013 14:38	44	-55.19426	-41.33744	Bongo at 200m hauling
03/12/2013 14:50	44	-55.19522	-41.33477	Bongo net recovered
03/12/2013 14:57	45	-55.19523	-41.3348	Bongo deployed
03/12/2013 15:03	45	-55.19551	-41.33414	Bongo at 200m hauling
03/12/2013 15:16	45	-55.19611	-41.33208	Bongo net recovered
03/12/2013 15:30	46	-55.19616	-41.33213	Snow catcher deployed
03/12/2013 15:34	46	-55.19617	-41.33213	Snow catcher at 100m
03/12/2013 15:39	46	-55.19617	-41.33214	Snow catcher recovered
03/12/2013 15:48	47	-55.19616	-41.33207	Snow catcher deployed
03/12/2013 15:54	47	-55.19619	-41.33213	Snow catcher at 200m
03/12/2013 16:03	47	-55.19626	-41.33201	Snow catcher recovered

03/12/2013 16:10		-55.19627	-41.33212	Vessel waiting for snow catchers to settle before proceeding
03/12/2013 18:30		-55.20904	-41.36321	Snow catcher fully drained and secure
03/12/2013 18:46		-55.21678	-41.36158	Vessel off D.P
03/12/2013 18:53		-55.22274	-41.35724	Decks all secure
04/12/2013 17:06	48	-54.15968	-36.69427	CTD deployed
04/12/2013 17:11	48	-54.15963	-36.69443	CTD stopped at 76m
04/12/2013 17:15	48	-54.15957	-36.69455	CTD recovered
04/12/2013 17:43		-54.15949	-36.69467	JR1 launched for assist ES853 acoustic calibration
04/12/2013 17:55		-54.15944	-36.69505	Donut deployed forward on 20t crane.
04/12/2013 20:02		-54.15944	-36.69506	JR1 recovered
04/12/2013 20:23		-54.15946	-36.69507	Completed ES853 acoustic calibration
04/12/2013 20:28		-54.15947	-36.69508	Donut recovered on deck
05/12/2013 00:00		-54.15939	-36.69506	Sphere deployed for EK60 calibration
05/12/2013 01:25		-54.15939	-36.69513	Sphere fouled under the hull waiting for daylight to recover it a continue with the calibration.
05/12/2013 10:00		-54.1594	-36.69509	Continuing to recover sphere
05/12/2013 10:30		-54.15939	-36.69505	Sphere recovered
05/12/2013 12:45		-54.15936	-36.69508	Sphere being redeployed for calibration
05/12/2013 15:03		-54.15936	-36.69511	Calibration complete
05/12/2013 19:58	49	-54.29867	-36.39706	Commence deploying RMT 8
05/12/2013 20:04	49	-54.29792	-36.4045	RMT 8 deployed
05/12/2013 20:12	49	-54.29625	-36.41408	Wire out 120m
05/12/2013 20:15	49	-54.29553	-36.41759	Commence hauling RMT 8
05/12/2013 20:21	49	-54.294	-36.42367	RMT 8 at the surface
05/12/2013 20:26	49	-54.29283	-36.42875	RMT 8 recovered on deck
05/12/2013 20:41	50	-54.29894	-36.39914	Commence deploying RMT 8
05/12/2013 20:45	50	-54.29829	-36.40352	RMT 8 deployed
05/12/2013 20:52	50	-54.29652	-36.41235	Wire out 112m
05/12/2013 21:00	50	-54.29429	-36.41985	RMT 8 at the surface

05/12/2013 21:05	50	-54.2928	-36.42359	RMT 8 recovered on deck
05/12/2013 21:18	51	-54.2996	-36.39941	Commence deploying RMT 8
05/12/2013 21:23	51	-54.29873	-36.40494	RMT 8 deployed
05/12/2013 21:30	51	-54.29699	-36.41408	Wire out 118m
05/12/2013 21:34	51	-54.2959	-36.4191	Commence hauling RMT 8
05/12/2013 21:43	51	-54.29328	-36.42945	RMT 8 at the surface
05/12/2013 21:48	51	-54.2919	-36.43496	RMT 8 recovered on deck
05/12/2013 22:18		-54.27826	-36.4375	Vsl on DP
05/12/2013 23:01	52	-54.27827	-36.43753	Commence deploying bongo net
05/12/2013 23:09	52	-54.27829	-36.43751	Bongo net in the water
05/12/2013 23:16	52	-54.27829	-36.43753	Bongo net at 200m
05/12/2013 23:28	52	-54.27825	-36.43752	Bongo net at the surface
05/12/2013 23:36	52	-54.27832	-36.43757	Bongo recovered to deck
05/12/2013 23:52	53	-54.28091	-36.4508	Commence deploying bongo net
05/12/2013 23:56	53	-54.28105	-36.45135	Bongo net in the water
06/12/2013 00:02	53	-54.28102	-36.45136	Bongo net at 150m
06/12/2013 00:10	53	-54.28101	-36.45138	Bongo net at the surface
06/12/2013 00:17	53	-54.28102	-36.45138	Bongo recovered to deck
06/12/2013 00:32	54	-54.28353	-36.46439	Commence deploying bongo net
06/12/2013 00:36	54	-54.28353	-36.46442	Bongo net in the water
06/12/2013 00:40	54	-54.28351	-36.46444	Bongo net at 100m
06/12/2013 00:46	54	-54.28352	-36.46443	Bongo net at the surface
06/12/2013 00:54	54	-54.28356	-36.46444	Bongo recovered to deck
06/12/2013 01:15	55	-54.28649	-36.4788	Commence deploying bongo net
06/12/2013 01:18	55	-54.28648	-36.47878	Bongo net in the water
06/12/2013 01:20	55	-54.28648	-36.4788	Bongo net at 50m
06/12/2013 01:23	55	-54.28649	-36.47881	Bongo net at the surface
06/12/2013 01:29	56	-54.28647	-36.47883	Deploying the bongo net

06/12/2013 01:31	56	-54.28647	-36.47881	Bongo net in the water
06/12/2013 01:32	56	-54.28646	-36.47882	Bongo net at 50m
06/12/2013 01:35	56	-54.28646	-36.4788	Bongo net at the surface
06/12/2013 01:42	56	-54.28647	-36.47878	Bongo nets recovered to deck
06/12/2013 02:00		-54.28637	-36.47653	Vsl off DP to move to deeper water
06/12/2013 10:02		-53.77779	-37.91018	Commence slow down for station
06/12/2013 10:10	57	-53.77944	-37.91856	Sonardyne pole fully extended and commence deploying RMT8
06/12/2013 10:15	57	-53.78191	-37.92201	RMT 8 deployed
06/12/2013 10:30	57	-53.78955	-37.93226	RMT 8 stopped at 283m
06/12/2013 10:35	57	-53.7923	-37.93604	Commence hauling RMT 8
06/12/2013 11:07	57	-53.80814	-37.95929	RMT 8 at the surface
06/12/2013 11:11	57	-53.81039	-37.9629	RMT 8 recovered on deck
06/12/2013 11:13		-53.81157	-37.96475	Proceeding to mooring site for CTD
06/12/2013 11:36		-53.80105	-37.93717	Vsl on DP
06/12/2013 11:42	57	-53.80174	-37.93784	Sonardyne pole recovered
06/12/2013 11:49	58	-53.80388	-37.8983	Commence deploying CTD
06/12/2013 11:55	58	-53.80178	-37.93788	CTD in the water
06/12/2013 11:57	58	-53.80179	-37.93787	CTD veering to approx 310m (EA600 324m)
06/12/2013 12:04	58	-53.80178	-37.93786	CTD stopped at 305m
06/12/2013 12:15	58	-53.80175	-37.93783	CTD recovered on deck
06/12/2013 12:23	59	-53.80174	-37.93783	Deploying the bongo net
06/12/2013 12:25	59	-53.80172	-37.93785	Bongo net in the water
06/12/2013 12:31	59	-53.80172	-37.93783	Bongo net at 200m
06/12/2013 12:42	59	-53.80172	-37.93782	Bongo net at the surface
06/12/2013 12:45	59	-53.80174	-37.93786	Bongo nets recovered to deck
06/12/2013 13:25	West Core Box Mooring	-53.8016	-37.93745	Bulwark lowered and commence deploying mooring
06/12/2013 13:30	West Core Box	-53.80169	-37.93767	Main bouy in the water and moving astern.

	Mooring			
06/12/2013 13:32	West Core Box Mooring	-53.80176	-37.93784	50m of line run out and stopped of attaching release
06/12/2013 13:43	West Core Box Mooring	-53.80185	-37.93803	Deploying railway wheels
06/12/2013 13:45	West Core Box Mooring	-53.80189	-37.93813	Weight and acoustic releases over the wall
06/12/2013 13:46	West Core Box Mooring	-53.80191	-37.93821	Weight released (VSL HDG 235)
06/12/2013 15:50		-53.80193	-37.93831	Off DP heading to P2
06/12/2013 16:00		-53.80937	-37.96714	F.A.O.P
07/12/2013 07:00		-55.25112	-41.26366	Vessel on D.P
07/12/2013 07:02	60	-55.25149	-41.26356	Commence deploying bongo net
07/12/2013 07:06	60	-55.25146	-41.26349	Bongo deployed
07/12/2013 07:12	60	-55.25122	-41.26335	Wire out 200m
07/12/2013 07:22	60	-55.25124	-41.26338	Bongo net clear of the water
07/12/2013 07:23	60	-55.25124	-41.26338	Bongo net recovered
07/12/2013 07:28	61	-55.25103	-41.26316	Bongo deployed
07/12/2013 07:34	61	-55.25147	-41.26309	Wire out 200m
07/12/2013 07:43	61	-55.25224	-41.26309	Bongo net clear of the water
07/12/2013 07:44	61	-55.25232	-41.26311	Bongo net recovered
07/12/2013 07:47	62	-55.25258	-41.26312	Bongo deployed
07/12/2013 07:54	62	-55.25316	-41.26315	Wire out 200m
07/12/2013 08:01	62	-55.25373	-41.26314	Bongo net clear of the water
07/12/2013 08:05	62	-55.25412	-41.26315	Bongo net recovered on deck and gantry stowed
07/12/2013 09:13	P2 mooring deployment	-55.25398	-41.26378	Vessel off D.P
07/12/2013 09:35	P2 mooring deployment	-55.28269	-41.27248	V/L on D.P
07/12/2013 09:43	P2 mooring	-55.28264	-41.27246	Commence deploying P2 mooring

	deployment			
07/12/2013 09:47	P2 mooring deployment	-55.28243	-41.27238	Main buoy in the water
07/12/2013 10:10	P2 mooring deployment	-55.27569	-41.27052	Attaching CTD at 500m wire length
07/12/2013 10:28	P2 mooring deployment	-55.26976	-41.26882	Attaching trimsin bouy cluster at 1200m wire lenght
07/12/2013 10:36	P2 mooring deployment	-55.26867	-41.26851	Sediment trap attached and lowering into the water
07/12/2013 10:38	P2 mooring deployment	-55.26832	-41.26843	Veering 1700m section of wire
07/12/2013 11:24	P2 mooring deployment	-55.25359	-41.26484	Attaching release unit and weight
07/12/2013 11:30	P2 mooring deployment	-55.25282	-41.26471	Mooring ready to be released moving ahead to deployment position.
07/12/2013 11:56	P2 mooring deployment	-55.24666	-41.26504	50m to go lifting weight over the side
07/12/2013 11:59	P2 mooring deployment	-55.24627	-41.26505	Weight released (VSL HDG 015)
07/12/2013 12:17	P2 mooring deployment	-55.2431	-41.2652	Commence pinging mooring
07/12/2013 12:28	P2 mooring deployment	-55.24309	-41.26517	Mooring Pinged at 3410m Water depth 3371m Range 514m
07/12/2013 12:50	P2 mooring deployment	-55.2516	-41.24684	Mooring Pinged at 3575m Water depth 3359m Range 1223m
07/12/2013 13:12	P2 mooring deployment	-55.25697	-41.27444	Mooring Pinged at 3548m Water depth 3388m Range 1053m
07/12/2013 13:15	P2 mooring deployment	-55.25698	-41.27445	Mooring position 55 14.9(S) 041 15.9(W) moving away for CTD
07/12/2013 13:37	63	-55.25864	-41.29488	Deploying the CTD
07/12/2013 13:40	63	-55.25863	-41.29487	CTD in the water
07/12/2013 13:44	63	-55.25863	-41.29488	CTD veering to approx 3460m (EA600 3471m)
07/12/2013 13:57	64	-55.25863	-41.2949	Deploying Snow Catcher

07/12/2013 14:08	64	-55.25862	-41.2949	Snow catcher deployed
07/12/2013 14:12	64	-55.25863	-41.29489	Snow catcher at 100m
07/12/2013 14:18	64	-55.25862	-41.2949	Snow catcher recovered
07/12/2013 14:45	63	-55.25864	-41.29491	CTD stopped at 3419
07/12/2013 14:57	65	-55.25862	-41.2949	Snow catcher deployed
07/12/2013 15:07	65	-55.25862	-41.29493	Snow catcher at 200m
07/12/2013 15:17	65	-55.2586	-41.29495	Snow catcher recovered
07/12/2013 16:11	63	-55.25864	-41.29491	CTD recovered
07/12/2013 16:26	66	-55.25865	-41.29493	Deploying SAPS
07/12/2013 16:28	66	-55.25865	-41.29494	Weight in the water
07/12/2013 16:31	66	-55.25864	-41.29494	First pump in the water
07/12/2013 16:41	66	-55.25865	-41.29493	Second pump in the water
07/12/2013 16:46	66	-55.25863	-41.29493	Third pump in the water
07/12/2013 16:50	66	-55.25864	-41.29493	SAPS stopped at 400m
07/12/2013 18:28	66	-55.25863	-41.29496	Commence hauling on SAPS for recovery
07/12/2013 18:33	66	-55.25862	-41.29493	1st pump disconnected
07/12/2013 18:37	66	-55.25863	-41.29495	2nd pump disconnected
07/12/2013 18:44	66	-55.25868	-41.29495	3rd pump disconnected
07/12/2013 18:47	66	-55.25864	-41.29493	SAPS fully recovered
07/12/2013 18:53	67	-55.25863	-41.29492	Commence deploying bongo net
07/12/2013 18:59	67	-55.25862	-41.29493	Bongo deployed
07/12/2013 19:04	67	-55.25862	-41.29494	Wire out 200m
07/12/2013 19:14	67	-55.25863	-41.29494	Bongo net clear of the water
07/12/2013 19:18	68	-55.25865	-41.29495	Bongo deployed
07/12/2013 19:24	68	-55.25866	-41.29493	Wire out 200m
07/12/2013 19:35	68	-55.25865	-41.29495	Bongo net clear of the water
07/12/2013 19:40	69	-55.25863	-41.29492	Bongo deployed
07/12/2013 19:46	69	-55.25864	-41.29492	Wire out 200m

07/12/2013 19:54	69	-55.25862	-41.29494	Bongo net clear of the water
07/12/2013 19:58	69	-55.25864	-41.29495	Bongo fully recovered on deck and gantry stowed
07/12/2013 20:03	69	-55.25864	-41.29494	Vessel off D.P
08/12/2013 09:10	P3 mooring recovery	-52.77339	-40.14453	V/L on D.P
08/12/2013 09:13	P3 mooring recovery	-52.77282	-40.14469	Vessel all stopped on D.P
08/12/2013 09:18	P3 mooring recovery	-52.77283	-40.14474	Mooring ranged at 343m
08/12/2013 09:20	P3 mooring recovery	-52.77281	-40.14472	Release signal sent
08/12/2013 09:22	P3 mooring recovery	-52.7728	-40.14473	Mooring sighted at the surface
08/12/2013 09:33	P3 mooring recovery	-52.7685	-40.15079	V/L on D.P
08/12/2013 09:39	P3 mooring recovery	-52.7684	-40.15277	Mooring grappled
08/12/2013 09:41	P3 mooring recovery	-52.76816	-40.15281	Connected mooring to recovery line
08/12/2013 09:45	P3 mooring recovery	-52.76826	-40.15318	Main buoy recovered on deck
08/12/2013 09:51	P3 mooring recovery	-52.76842	-40.15369	Main buoy disconnected
08/12/2013 10:00	P3 mooring recovery	-52.76869	-40.15444	Commence hauling
08/12/2013 10:42	P3 mooring recovery	-52.76932	-40.15614	Finishing hauling first 1700m section of line recovering Trimsin bouy set
08/12/2013 10:57	P3 mooring recovery	-52.76932	-40.15611	Water finished draining from sediment trap
08/12/2013 11:02	P3 mooring recovery	-52.76933	-40.15614	Sediment trap and current meter recovered on deck
08/12/2013 11:38	P3 mooring recovery	-52.76928	-40.15612	Release recovered
08/12/2013 11:53	P3 mooring	-52.7693	-40.15609	Aft deck secure

	recovery			
08/12/2013 12:09	70	-52.7693	-40.15613	Deploying CTD
08/12/2013 12:13	70	-52.76928	-40.15607	CTD in the water
08/12/2013 12:16	70	-52.7693	-40.15614	CTD veering to approx 3780m (EA600 3789m)
08/12/2013 13:22	70	-52.76932	-40.15614	CTD stopped at 3735m
08/12/2013 14:53	70	-52.76923	-40.15617	CTD recovered
08/12/2013 15:23	71	-52.76929	-40.15612	SAPS weight in the water
08/12/2013 15:26	71	-52.76931	-40.15613	First SAPS pump in the water
08/12/2013 15:35	71	-52.76928	-40.15607	Second SAPS pump in the water
08/12/2013 15:42	71	-52.7693	-40.15613	Third SAPS pump in the water
08/12/2013 15:46	71	-52.7693	-40.15609	SAPS stopped at 400m
08/12/2013 17:19	71	-52.76924	-40.15608	Commence recovery of SAPS
08/12/2013 17:24	71	-52.76931	-40.15612	First SAPS pump recovered
08/12/2013 17:28	71	-52.7693	-40.15613	Second SAPS pump recovered
08/12/2013 17:37	71	-52.76928	-40.15613	Third SAPS pump recovered
08/12/2013 17:38	71	-52.76929	-40.15613	Weight recovered
08/12/2013 17:57	72	-52.76928	-40.15614	Bongo deployed
08/12/2013 18:04	72	-52.76928	-40.15616	Wire out 200m
08/12/2013 18:14	72	-52.76862	-40.15624	Bongo net clear of the water
08/12/2013 18:18	73	-52.76847	-40.15619	Bongo deployed
08/12/2013 18:25	73	-52.76774	-40.15637	Wire out 200m
08/12/2013 18:34	73	-52.76687	-40.15687	Bongo net clear of the water
08/12/2013 18:39	74	-52.76648	-40.15709	Bongo deployed
08/12/2013 18:45	74	-52.76619	-40.15711	Wire out 200m
08/12/2013 18:57	74	-52.76557	-40.1573	Bongo recovered on deck
08/12/2013 22:38	75	-52.76558	-40.15724	Deploying CTD
08/12/2013 22:44	75	-52.76557	-40.15729	CTD in the water
08/12/2013 22:49	75	-52.76563	-40.15729	CTD veering to approx 3770m (EA600 3788m)

08/12/2013 23:54	75	-52.76558	-40.15728	CTD stopped at 3724m
09/12/2013 01:21	75	-52.76557	-40.15725	CTD recovered on deck
09/12/2013 01:33		-52.76553	-40.15724	Gantry and deck all secure
09/12/2013 02:18		-52.76828	-40.14327	F.A.O.P
09/12/2013 08:00	76	-53.34447	-39.60283	Start WCB transect 1.1
09/12/2013 09:08	77	-53.52296	-39.54991	Vessel slowed to 7 knots
09/12/2013 09:15		-53.53708	-39.54558	Increase speed to 10 knots
09/12/2013 10:16	78	-53.70056	-39.49758	XBT Deployed (speed reduced to 7knts for deployment)
09/12/2013 11:23	79	-53.87629	-39.44505	XBT Deployed (speed reduced to 7knts for deployment)
09/12/2013 12:31		-54.05342	-39.39217	End WCB transect 1.1
09/12/2013 12:33	80	-54.05705	-39.39066	XBT Deployed (speed reduced to 7knts for deployment)
09/12/2013 13:40		-54.02412	-39.08767	Start WCB transect 1.2
09/12/2013 18:00		-53.31594	-39.30405	End of transect 1.2
09/12/2013 19:03		-53.45674	-39.2152	V/L turned into weather and assessing conditions for RMT 8
09/12/2013 19:39		-53.47112	-39.22724	Determined conditions not suitable for net
09/12/2013 19:59		-53.49235	-39.25114	Vessel all stopped on D.P
09/12/2013 20:07	81	-53.4927	-39.25116	Commence deploying CTD
09/12/2013 20:12	81	-53.49271	-39.25108	CTD in the water
09/12/2013 20:16	81	-53.49279	-39.25101	CTD veering
09/12/2013 20:37	81	-53.49294	-39.25093	Wire out 1000m
09/12/2013 20:58	81	-53.49292	-39.25092	CTD clear of the water
09/12/2013 21:01	81	-53.49292	-39.25089	CTD recovered on deck
09/12/2013 21:08	81	-53.49293	-39.25091	Gantry and deck all secure
09/12/2013 23:24		-53.84539	-39.1427	Vsl on DP
09/12/2013 23:33	82	-53.84565	-39.14337	Deploying CTD
09/12/2013 23:38	82	-53.84584	-39.14369	CTD in the water
09/12/2013 23:41	82	-53.84591	-39.14381	CTD veering to approx 270m (EA600 290m)
09/12/2013 23:47	82	-53.8459	-39.14392	CTD stopped at 260m

10/12/2013 00:02	82	-53.84588	-39.14393	CTD recovered on deck
10/12/2013 00:18		-53.84706	-39.14657	Vsl off DP and heading to start of next transect (2.1)
10/12/2013 06:05		-54.00098	-38.80342	Vessel on D.P
10/12/2013 06:12		-54.00124	-38.80221	Decession made weather not suitable for Bongo's
10/12/2013 07:47		-54.00501	-38.80612	Vessel off D.P
10/12/2013 08:00	83	-53.99542	-38.81615	Start WCB transect 2.1
10/12/2013 08:04		-53.98749	-38.81917	Increase speed to 10 knots
10/12/2013 09:08	84	-53.81846	-38.87442	XBT Deployed (speed reduced to 7knts for deployment)
10/12/2013 09:11		-53.8128	-38.87605	Increase speed to 10 knots
10/12/2013 10:15	85	-53.63932	-38.92948	XBT Deployed (speed reduced to 7knts for deployment)
10/12/2013 11:22	86	-53.46417	-38.98387	XBT Deployed (speed reduced to 7knts for deployment)
10/12/2013 12:29	87	-53.28764	-39.03811	End WCB transect 2.1
10/12/2013 13:40		-53.25313	-38.75096	Start WCB transect 2.2
10/12/2013 18:00		-53.96196	-38.52643	End of transect
10/12/2013 19:21		-53.78473	-38.58382	Vessel on D.P
10/12/2013 19:23	88	-53.78451	-38.58397	Commence deploying CTD
10/12/2013 19:29	88	-53.7848	-38.58391	CTD in the water
10/12/2013 19:31	88	-53.78491	-38.58394	CTD veering
10/12/2013 19:35	88	-53.78501	-38.58391	Wire out 188m
10/12/2013 19:41	88	-53.78499	-38.58394	CTD clear of the water
10/12/2013 19:44	88	-53.78499	-38.58394	CTD recovered on deck
10/12/2013 19:48	89	-53.78498	-38.58392	Commence deploying bongo net
10/12/2013 19:52	89	-53.785	-38.5839	Bongo deployed
10/12/2013 19:55	89	-53.785	-38.58392	Wire out 150m
10/12/2013 20:01	89	-53.78511	-38.58419	Bongo net clear of the water
10/12/2013 20:04	89	-53.78514	-38.58421	Bongo net recovered on deck and gantry stowed
10/12/2013 20:15		-53.78513	-38.58419	Vessel off D.P
10/12/2013 20:18	90	-53.78561	-38.58519	Commence deploying RMT 8

10/12/2013 20:24	90	-53.78798	-38.59178	RMT 8 deployed
10/12/2013 20:53	90	-53.7982	-38.61957	Wire out 308m
10/12/2013 20:55	90	-53.79911	-38.62172	Commence hauling RMT 8
10/12/2013 21:23	90	-53.8122	-38.65262	RMT 8 at the surface
10/12/2013 21:28	90	-53.81453	-38.65753	RMT 8 recovered on deck
10/12/2013 21:37		-53.8171	-38.66628	RMT 8 and deck all secure
10/12/2013 23:25	91	-53.72621	-38.58463	Commence turn for target.
10/12/2013 23:37	91	-53.7264	-38.58569	Deploying RMT 8
10/12/2013 23:39	91	-53.72602	-38.5875	RMT 8 in the water
10/12/2013 23:46	91	-53.72417	-38.59465	RMT 8 stopped at 70m
11/12/2013 00:04	91	-53.7201	-38.61468	RMT 8 recovered on deck
11/12/2013 00:21		-53.72067	-38.61437	Resume heading downwind for target fishing
11/12/2013 00:54	92	-53.74017	-38.52432	Commence turn for target.
11/12/2013 01:06	92	-53.74136	-38.52355	Deploying RMT 8
11/12/2013 01:08	92	-53.74081	-38.52564	RMT 8 in the water
11/12/2013 01:15	92	-53.73853	-38.53285	RMT 8 stopped at 43m
11/12/2013 01:32	92	-53.73477	-38.55264	RMT 8 recovered on deck
11/12/2013 01:40		-53.73382	-38.56185	Deck all secure
11/12/2013 03:31	93	-53.47235	-38.68892	Clear to deploy RMT8
11/12/2013 03:34	93	-53.47031	-38.68895	RMT8 deployed
11/12/2013 04:44	93	-53.43553	-38.66158	RMT8 recovered
11/12/2013 05:20	94	-53.43215	-38.69503	On station on DP
11/12/2013 05:27	94	-53.43212	-38.69495	CTD deployed
11/12/2013 05:32	94	-53.43214	-38.69496	CTD on the way to 1000m
11/12/2013 05:52	94	-53.43222	-38.69498	CTD at 1000m
11/12/2013 06:11	94	-53.43218	-38.69506	CTD clear of the water
11/12/2013 06:14	94	-53.43219	-38.69503	CTD recovered on deck
11/12/2013 06:25	95	-53.43218	-38.69503	Commence deploying bongo net

11/12/2013 06:29	95	-53.43213	-38.69499	Bongo deployed
11/12/2013 06:44	95	-53.43186	-38.69661	Bongo net clear of the water
11/12/2013 06:48	95	-53.43175	-38.69697	Bongo net recovered on deck and gantry stowed
11/12/2013 06:53		-53.43175	-38.69712	Gantry and deck all secure
11/12/2013 08:30	96	-53.21853	-38.44883	Start WCB transect 3.1
11/12/2013 08:37		-53.23187	-38.44528	Increase speed to 10 knots
11/12/2013 09:40	97	-53.39802	-38.39245	XBT Deployed (speed reduced to 7knts for deployment)
11/12/2013 09:46		-53.40915	-38.3886	Increase speed to 10 knots
11/12/2013 10:49	98	-53.57461	-38.33565	XBT Deployed (speed reduced to 7knts for deployment)
11/12/2013 11:56	99	-53.75017	-38.27794	XBT Deployed (speed reduced to 7knts for deployment)
11/12/2013 13:02	100	-53.92723	-38.22056	End WCB transect 3.1
11/12/2013 14:03		-53.89548	-37.90679	Start of transect
11/12/2013 18:28		-53.18439	-38.14032	End WCB transect 3.2
11/12/2013 19:38	101	-53.33634	-38.03982	Commence deploying RMT 8
11/12/2013 19:42	101	-53.33872	-38.04355	RMT 8 in the water
11/12/2013 19:44	101	-53.33977	-38.04533	RMT 8 deployed
11/12/2013 20:13	101	-53.35487	-38.0695	Wire out 394m
11/12/2013 20:38	101	-53.36769	-38.09066	RMT 8 at the surface
11/12/2013 20:41	101	-53.3693	-38.09307	RMT 8 recovered on deck
11/12/2013 20:48		-53.37213	-38.09745	Deck all secure
11/12/2013 21:02		-53.36063	-38.08073	Vessel on D.P
11/12/2013 21:05	102	-53.361	-38.08183	Commence deploying bongo net
11/12/2013 21:10	102	-53.36101	-38.08235	Bongo deployed
11/12/2013 21:18	102	-53.36101	-38.08245	Wire out 200m
11/12/2013 21:26	102	-53.36126	-38.08225	Bongo net clear of the water
11/12/2013 21:42	103	-53.36099	-38.0829	Commence deploying CTD
11/12/2013 21:53	103	-53.361	-38.0829	CTD in the water
11/12/2013 21:56	103	-53.36102	-38.08291	CTD veering

11/12/2013 22:15	103	-53.36099	-38.08293	CTD stopped at 1000m
11/12/2013 22:38	103	-53.36101	-38.08293	CTD recovered to deck
11/12/2013 22:48		-53.36102	-38.08295	Vsl off DP
12/12/2013 00:37		-53.63391	-37.9926	VSL running downwind for target fishing
12/12/2013 01:27		-53.61124	-37.91807	VSL running upwind for target fishing
12/12/2013 01:42		-53.63125	-37.94362	Turning to investigate target.
12/12/2013 02:08	104	-53.61096	-37.91538	Commence turn for target.
12/12/2013 02:29	104	-53.60902	-37.91154	RMT8 deployed
12/12/2013 02:54	104	-53.62178	-37.93042	RMT8 recovered
12/12/2013 03:23	105	-53.68967	-37.91188	Turning for target
12/12/2013 03:42	105	-53.68163	-37.90374	RMT8 deployed
12/12/2013 04:08	105	-53.67422	-37.927	RMT8 recovered
12/12/2013 04:24	106	-53.67732	-37.94299	RMT8 deployed
12/12/2013 04:56	106	-53.68886	-37.97399	RMT8 recovered
12/12/2013 05:28		-53.71369	-37.96543	On station on DP
12/12/2013 05:35	107	-53.71369	-37.96546	CTD deployed
12/12/2013 05:39	107	-53.71373	-37.96545	CTD on the way to 120m
12/12/2013 05:42	107	-53.71373	-37.96546	CTD stopped at 120m
12/12/2013 05:48	107	-53.71377	-37.96545	CTD recovered
12/12/2013 06:00	108	-53.71375	-37.96545	Commence deploying bongo net
12/12/2013 06:03	108	-53.71376	-37.96545	Bongo deployed
12/12/2013 06:07	108	-53.71374	-37.96546	Wire out 100m
12/12/2013 06:12	108	-53.71373	-37.96544	Bongo net clear of the water
12/12/2013 06:16	108	-53.71374	-37.96546	Bongo net recovered on deck and gantry stowed
12/12/2013 06:22		-53.71371	-37.96545	Gantry and deck all secure
12/12/2013 08:05	109	-53.8716	-37.72922	Start WCB transect 4.1
12/12/2013 08:07		-53.86755	-37.72998	Increase speed to 10 knots
12/12/2013 09:12	110	-53.69394	-37.78851	XBT Deployed (speed reduced to 7knts for deployment)

12/12/2013 09:15		-53.68852	-37.78952	Increase speed to 10 knots
12/12/2013 10:19	111	-53.51741	-37.84723	XBT Deployed (speed reduced to 7knts for deployment)
12/12/2013 11:28	112	-53.33558	-37.90403	XBT Deployed (speed reduced to 7knts for deployment)
12/12/2013 12:42	113	-53.15154	-37.96823	End WCB transect 4.1
12/12/2013 13:13	114	-53.14828	-37.83179	Start WCB transect 4.2
12/12/2013 14:19		-53.31671	-37.77573	Slowing for XBT
12/12/2013 14:23	115	-53.32413	-37.7731	XBT deployed
12/12/2013 14:28		-53.33548	-37.76989	Back at 10 knots after XBT deployment
12/12/2013 15:25		-53.49049	-37.7169	Slowing down for XBT
12/12/2013 15:30	116	-53.50045	-37.71342	XBT deployed
12/12/2013 15:30		-53.50045	-37.71342	Back at 10 knots after XBT deployment
12/12/2013 15:35		-53.51233	-37.70941	Vessel at 10 knots
12/12/2013 15:43		-53.53381	-37.70241	Back at 10 knots after XBT deployment
12/12/2013 16:33		-53.6677	-37.65705	Slowing down for XBT
12/12/2013 16:38	117	-53.67722	-37.65352	XBT deployed
12/12/2013 16:41		-53.68737	-37.65026	Speeding back up after XBT deployment
12/12/2013 17:45	118	-53.85127	-37.5941	XBT deployed
12/12/2013 19:24	119	-53.86134	-37.81617	Commence deploying RMT 8
12/12/2013 19:28	119	-53.86	-37.82017	RMT 8 deployed
12/12/2013 19:34	119	-53.8579	-37.82682	Wire out 62m
12/12/2013 19:37	119	-53.85696	-37.82999	RMT 8 at the surface
12/12/2013 19:41	119	-53.85577	-37.83447	RMT 8 recovered on deck
12/12/2013 19:47		-53.85364	-37.84201	Deck all secure
13/12/2013 00:30		-53.84591	-39.14296	Vsl on DP
13/12/2013 00:40	120	-53.84599	-39.14185	Deploying the bongo net
13/12/2013 00:46	120	-53.8459	-39.1423	Bongo net in the water
13/12/2013 00:53	120	-53.84592	-39.14306	Bongo net at 200m
13/12/2013 01:03	120	-53.84644	-39.1442	Bongo net recovered on deck

13/12/2013 01:18		-53.84582	-39.14535	Vsl off DP
13/12/2013 01:20	121	-53.8449	-39.14653	Commence deploying RMT 8
13/12/2013 01:23	121	-53.84351	-39.14835	RMT 8 in the water
13/12/2013 01:50	121	-53.8285	-39.16778	RMT 8 stopped at 395m
13/12/2013 02:25	121	-53.80908	-39.1922	RMT8 recovered
13/12/2013 04:00		-53.87806	-39.11446	Abandon target fishing proceeding to P3 mooring
13/12/2013 12:06		-52.76887	-40.15422	Vsl on DP
13/12/2013 12:13	122	-52.76889	-40.15493	Deploying CTD
13/12/2013 12:15	122	-52.76888	-40.15499	CTD in the water
13/12/2013 12:18	122	-52.76888	-40.15499	CTD veering to approx 2000m (EA600 3788m)
13/12/2013 12:45	123	-52.76887	-40.15499	Deploying Snow Catcher
13/12/2013 12:49	123	-52.76888	-40.15499	Snow catcher at 100m
13/12/2013 12:50	123	-52.76888	-40.15499	Commence hauling Snowcatcher
13/12/2013 12:52	122	-52.76888	-40.155	CTD stopped at 2000m
13/12/2013 12:55	123	-52.76888	-40.15499	Snow catcher recovered on deck
13/12/2013 13:23	124	-52.76887	-40.15501	Deploying Snow Catcher
13/12/2013 13:30	124	-52.76887	-40.15501	Snow catcher at 200m
13/12/2013 13:32	124	-52.76888	-40.15502	Commence hauling Snowcatcher
13/12/2013 13:39	124	-52.76887	-40.15499	Snow catcher recovered on deck (did not fire so redeploying)
13/12/2013 13:46	122	-52.76886	-40.15501	CTD recovered on deck
13/12/2013 13:49	125	-52.76885	-40.155	Deploying Snow Catcher
13/12/2013 13:56	125	-52.76887	-40.15501	Snow catcher at 200m
13/12/2013 14:05	125	-52.76885	-40.15495	Snow catcher recovered
13/12/2013 14:26	126	-52.76883	-40.15497	Bongo deployed
13/12/2013 14:31	126	-52.76894	-40.15499	Bongo at 200m hauling
13/12/2013 14:42	126	-52.76962	-40.15493	Bongo recovered
13/12/2013 14:46	127	-52.76963	-40.15494	Bongo deployed
13/12/2013 14:51	127	-52.76984	-40.15497	Bongo at 200m hauling

13/12/2013 15:02	127	-52.77012	-40.15494	Bongo recovered
13/12/2013 16:24		-52.77017	-40.15488	P3 mooring deployment delayed due to equipment problems
13/12/2013 16:41		-52.77017	-40.15491	Off DP
13/12/2013 16:51	128	-52.76924	-40.16421	Mocnes deployed
13/12/2013 18:12	128	-52.7563	-40.25255	Wire out 2260m
13/12/2013 20:02	128	-52.72536	-40.3742	Mocness at the surface
13/12/2013 20:06	128	-52.7244	-40.37785	Mocness recovered on deck
13/12/2013 20:12	128	-52.72313	-40.38198	Mocness and deck all secure
13/12/2013 21:12		-52.76836	-40.15398	Vessel on D.P
13/12/2013 21:18	129	-52.76874	-40.15462	Commence deploying SAPS
13/12/2013 21:33	129	-52.769	-40.15513	1st pump connected and deployed
13/12/2013 21:43	129	-52.76899	-40.15512	2nd pump connected
13/12/2013 21:48	129	-52.76896	-40.15517	3rd pump connected
13/12/2013 21:52	129	-52.76897	-40.15515	Wire out 405m
13/12/2013 23:31	129	-52.76896	-40.15511	Commence recovery of SAPS
13/12/2013 23:36	129	-52.76897	-40.15513	3rd pump disconnected
13/12/2013 23:41	129	-52.76897	-40.1551	2nd pump disconnected
13/12/2013 23:49	129	-52.76897	-40.15514	1st pump disconnected
13/12/2013 23:51	129	-52.76897	-40.15515	SAPS fully recovered
14/12/2013 00:00		-52.76896	-40.15515	Vsl off DP
14/12/2013 00:07	130	-52.76684	-40.16009	Commence deploying Mocness
14/12/2013 00:11	130	-52.76536	-40.16249	Mocness in the water
14/12/2013 00:16	130	-52.76337	-40.16499	Sonardyne pole fully extended
14/12/2013 01:15	130	-52.73897	-40.1961	Mocness deployed to 18220m
14/12/2013 02:53	130	-52.76939	-40.15309	Mocness recovered on deck
14/12/2013 03:00		-52.69852	-40.26228	Vessel relocating to P3 position
14/12/2013 04:12		-52.76925	-40.15269	On station on DP
14/12/2013 04:13	131	-52.76925	-40.15269	Bongo deployed

14/12/2013 04:20	131	-52.76949	-40.15331	Bongo at 200m
14/12/2013 04:29	131	-52.7695	-40.15325	Bongo recovered
14/12/2013 05:02	132	-52.76925	-40.15397	CTD deployed
14/12/2013 05:19	133	-52.76924	-40.15398	Snow catcher deployed
14/12/2013 05:24	133	-52.76926	-40.15399	Snow catcher at 80m
14/12/2013 05:29	133	-52.76928	-40.15403	Snow catcher recovered on deck (did not fire so redeploying)
14/12/2013 05:47	134	-52.76929	-40.15401	Snow catcher redeployed
14/12/2013 05:52	134	-52.76928	-40.154	Snow catcher at 80m
14/12/2013 05:57	134	-52.76929	-40.15401	Snow catcher recovered
14/12/2013 06:10	132	-52.76926	-40.15399	Wire out 3728m
14/12/2013 06:29	135	-52.76929	-40.15403	Commence deploying Snow Catcher
14/12/2013 06:33	135	-52.76929	-40.15403	Snow catcher deployed
14/12/2013 06:40	135	-52.76927	-40.15403	Snow catcher at 180m
14/12/2013 06:53	135	-52.76927	-40.15404	Snow catcher clear of water
14/12/2013 06:56	135	-52.76927	-40.154	Snow catcher recovered on deck
14/12/2013 07:35	132	-52.7693	-40.15403	CTD clear of the water
14/12/2013 07:39	132	-52.76931	-40.15403	CTD recovered on deck
14/12/2013 07:48		-52.76927	-40.15402	Vessel off D.P
14/12/2013 07:50	136	-52.76893	-40.15443	Commence deploying Mocness
14/12/2013 07:56	136	-52.76665	-40.15863	Mocness in the water
14/12/2013 09:07	136	-52.7384	-40.19929	Wire out 1979m
14/12/2013 10:45	136	-52.69319	-40.25778	MOCNESS at the surface
14/12/2013 10:49	136	-52.69117	-40.26106	MOCNESS recovered on deck
14/12/2013 10:51	136	-52.69016	-40.26253	Sonardyne pole recovered
14/12/2013 10:54		-52.68868	-40.26466	Vsl on DP
14/12/2013 10:58	137	-52.68804	-40.26515	Deploying the bongo net
14/12/2013 11:00	137	-52.68805	-40.26516	Bongo net in the water
14/12/2013 11:08	137	-52.68808	-40.26522	Bongo net at 200m

14/12/2013 11:16	137	-52.68804	-40.26517	Bongo net recovered
14/12/2013 11:20	138	-52.688	-40.26502	Deploying the bongo net
14/12/2013 11:21	138	-52.688	-40.26502	Bongo net in the water
14/12/2013 11:27	138	-52.68808	-40.26479	Bongo net at 200m
14/12/2013 11:40	138	-52.6883	-40.26347	Bongo net recovered on deck and gantry stowed
14/12/2013 12:18		-52.68826	-40.26344	Deck secure Vessel off DP
14/12/2013 18:13		-53.5277	-39.21196	Vessel turned into weather to assess it for RMT 8
14/12/2013 18:30		-53.52591	-39.21272	Decession made weather not suitable for RMT 8
15/12/2013 02:42		-52.62657	-39.11103	On station on DP at upwelling site
15/12/2013 03:10		-52.62663	-39.11177	Awaiting day light to begin CTD at upwelling site
15/12/2013 05:13	139	-52.6266	-39.11204	CTD deployed
15/12/2013 05:53	139	-52.62665	-39.11207	CTD stopped at 2000m
15/12/2013 06:41	139	-52.62664	-39.11208	CTD clear of the water
15/12/2013 06:44	139	-52.62664	-39.11208	CTD recovered on deck
15/12/2013 06:53		-52.62598	-39.11409	Gantry and deck all secure
15/12/2013 07:55		-52.53285	-39.26906	V/L on D.P
15/12/2013 08:00	140	-52.53282	-39.26915	Commence deploying CTD
15/12/2013 08:03	140	-52.53271	-39.26917	CTD in the water
15/12/2013 08:06	140	-52.53261	-39.26929	CTD veering
15/12/2013 08:40	140	-52.53248	-39.26929	Wire out 1995m
15/12/2013 09:26	140	-52.5325	-39.26936	CTD clear of the water
15/12/2013 09:28	140	-52.53254	-39.26935	CTD recovered on deck
15/12/2013 09:35		-52.53363	-39.26953	Gantry and deck all secure
15/12/2013 10:30		-52.66544	-39.28712	Vsl on DP
15/12/2013 10:34	141	-52.66546	-39.28776	Deploying CTD
15/12/2013 10:40	141	-52.6653	-39.2881	CTD in the water
15/12/2013 10:45	141	-52.66523	-39.28823	CTD veering to approx 1995m (EA600 3756m)
15/12/2013 11:19	141	-52.66527	-39.28824	CTD stopped at 1995m

15/12/2013 12:06	141	-52.66526	-39.28822	CTD recovered on deck
15/12/2013 12:12		-52.66529	-39.28827	Vsl off DP
15/12/2013 13:06		-52.76124	-39.13635	Vsl on DP
15/12/2013 13:13	142	-52.76104	-39.13609	Deploying CTD
15/12/2013 13:16	142	-52.7609	-39.13598	CTD in the water
15/12/2013 13:19	142	-52.76078	-39.13577	CTD veering to approx 2000m (EA600 3743m)
15/12/2013 13:55	142	-52.76047	-39.13535	CTD stopped at 2000m
15/12/2013 14:42	142	-52.7604	-39.13532	CTD recovered
15/12/2013 14:57	143	-52.76044	-39.13534	Bongo deployed
15/12/2013 15:01	143	-52.76044	-39.13534	Bongo at 200m
15/12/2013 15:13	143	-52.76046	-39.13535	Bongo net recovered
15/12/2013 15:17	144	-52.76048	-39.13536	Bongo deployed
15/12/2013 15:22	144	-52.76047	-39.13539	Bongo at 200m
15/12/2013 15:35	144	-52.76047	-39.13534	Bongo recovered
15/12/2013 15:42		-52.76074	-39.13543	Off DP
15/12/2013 15:48		-52.7643	-39.13634	F.A.O.P
15/12/2013 20:20		-53.55156	-38.65601	Vessel turning and heading down wind
15/12/2013 20:38		-53.56674	-38.68232	Increase speed to 6 knots to identify targets. RMT 8 ready on deck
15/12/2013 23:22		-53.76097	-39.01043	Commence turn for target.
15/12/2013 23:36	145	-53.763	-39.01305	Deploying RMT 8
15/12/2013 23:39	145	-53.76145	-39.01118	RMT 8 in the water
15/12/2013 23:52	145	-53.75532	-39.00128	RMT 8 stopped at 52m
15/12/2013 23:59	145	-53.75176	-38.99559	RMT 8 at the surface
16/12/2013 00:04	145	-53.74912	-38.99134	RMT 8 recovered on deck
16/12/2013 00:13		-53.74387	-38.98308	RMT 8 and deck all secure
16/12/2013 01:26		-53.74225	-38.67636	Turning to investigate target.
16/12/2013 01:48		-53.75172	-38.7109	Commence turn for target.
16/12/2013 02:02	146	-53.75517	-38.71144	Deploying RMT 8

16/12/2013 02:06	146	-53.75178	-38.7113	RMT 8 in the water
16/12/2013 02:39	146	-53.69389	-38.84824	RMT8 recovered
16/12/2013 03:17	147	-53.7448	-38.71085	RMT8 deployed
16/12/2013 03:34	147	-53.72488	-38.70979	RMT8 recovered
16/12/2013 04:00		-53.70854	-38.71791	Deck secure proceeding to Stanley