JCR Cruise
JR245 / JR246 / JR247

December 21st, 2010 to January 19th, 2011

Western Core Box, the role of krill grazing in Southern Ocean nutrient cycles, and AFI-CGS Individual physiological and behavioural responses of krill to distributional shifts and thermal change

British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Contents

List of Figures

List of Tables

1 Introduction

1.1 Rationale

Cruises JR245, 246 and 247 were amalgamated into one cruise. JR245 was 19 days of the Western Core Box cruise, JR246 was 2 days of Hotspots and JR247 was seven science days for an AFI project (The role of krill grazing in Southern Ocean nutrient cycles). In addition there was an AFI-CGS (Individual physiological and behavioural responses of krill to distributional shifts and thermal change) project undertaken. All three projects were focussed on investigating Antarctic krill (*Euphausia superba*) and it was therefore sensible to combine them into one cruise focused around South Georgia.

1.1.1 JR245 Western Core Box

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 Ecosystem Programme contribution to BAS' national capability. It is comprised of an acoustic grid survey of 8 transects each of 80 km in length, together with associated net and oceanographic sampling and the calibration of the acoustic instrumentation. In addition to the acoustic survey, which covers a wide area but has limited temporal coverage, there are three moorings (one in the Western Core Box and one south and one north of South Georgia) to provide a temporal context. These moorings are typically recovered and redeployed during the WCB survey. Due to the lack of gantry this year the moorings were not recovered or redeployed.

1.1.2 JR247 The role of krill grazing in Southern Ocean nutrient cycles

Even though Antarctic krill are a key species in the Southern Ocean food web and commercially fished for, little is known about their role in biogeochemical cycles. This AFI project will test the hypothesis that Antarctic krill help to promote the drawdown of CO2 from the atmosphere to the deep ocean by enhancing the biological carbon pump. It will address (a) how much carbon, nitrogen, silica and iron are in krill fecal pellets, (b) do the elements dissolve out of the pellets before sinking to depth, (c) do krill accumulate iron in their bodies and (d) how much iron and nitrogen do krill release in dissolved form when feeding.

1.1.3 AFI-CGS Individual physiological and behavioural responses of krill to distributional shifts and thermal change

The physiology of krill is considered to be stenothermal, operating most efficiently within a narrow temperature range of between 0 and 2°C. South Georgia is a krill rich region, but recent reports have indicated there has been a mean increase of 0.9°C in its surface waters over the past 81 years. Trend analyses have also pointed to a significant negative relationship between South Georgia summer temperatures and mean summer density of krill, predicting a decline in the suitability of this area as a future krill habitat. The physiological response of krill to temperature change will be investigated through analysis of aerobic respiration and other indicators of performance.

1.2 Cruise and sampling location design

The key focus of the cruise was to complete the LTMS Western Core Box and catch sufficient live krill for the two AFI projects from sampling locations with different productivity, different bathymetry and different temperatures. Due to the lack of gantry and the reduced size of the net used this season the cruise strategy adopted at the beginning was to leave Stanley and test any net setup after a day's steam. On arrival around South Georgia we dedicated two days to looking for krill and honing the sampling strategy. We would then move on to completing the Western Core Box acoustics before heading eastwards to the east end of the island in search of areas of large krill biomass (as predicted from previous Eastern Core Box cruises). Finally at the end of the cruise an acoustic calibration would be scheduled for Stromness. This strategy was generally adopted for the cruise, except that after 1 night of successful fishing the WCB was started and after the WCB and another night of successful fishing the acoustic calibration was undertaken at Stromness (01/01/2011) and the ship could focus on fishing for krill.

The WCB followed its typical daily strategy of acoustic transects during the day and night time CTDs and target fishing. The AFI krill stations (nominally allocated as Target Fishing stations (TF) had a 24 hour routine (Table 1) starting at 16:00 in locating and fishing krill.

Table 1 - General sampling location design

Instrument	**Time (local)**	**Comment**
K-NET	16:00	Target fishing for krill
Acoustic transect	18:00	Acoustic transect 10 nm long (either up or downwind) passing through the station as the central point
K-NET	19:00	Target fishing for krill
Acoustic transect	00:00	Acoustic transect 10 nm long (either up or downwind) passing through the station as the central point
K-NET	01:00	Target fishing for krill
CTD	04:00	At station central point
GO-FLO shallow	05:30	At station central point (20,35,50,75,100,150)
Acoustic transect	06:30	Acoustic transect 10 nm long (either up or downwind) passing through the station as the central point
SAPS	08:00	SAPs at 20, 50 and 150 m
GO-FLO deep	10:00	If applicable or any repeats for miss-fires
Acoustic transect	11:30	Acoustic transect 10 nm long (either up or downwind) passing through the station as the central point
Relocate	12:30	Relocate to next TF location

TF stations were undertaken on and off shelf all around the north edge of South Georgia. Station locations were chosen based on bathymetry (typically around the shelf edge), productivity (high versus low), temperature (warm west versus cold east) and predominantly weather. In the last week the station location was also selected based on krill size previously caught (we were looking for large krill). On shelf locations were chosen to shelter and continue working in increasing weather.

1.3 PSO Narrative

2010-12-16 16:00:01

Science team depart BAS HQ just as snow starting to settle in Cambridge. Arrive Brize Norton ~ 19:00 and after a tour of the base settled at Gateway house (the Beehive pub supplied reasonable food).

2010-12-17 11:00:00

Depart Brize Norton on aeroplane heading for MPA, Falkland Islands.

2010-12-18 05:30:01

Science team arrived at the JCR, met by Rich the purser. Team knocked off until 13:00 hours for safety briefing and container unpacking. Pete E and crew unpacked the trials cruise container then mobilised the clean container into place. The afternoon was spent unpacking the main bio container. A brilliant effort by all particularly considering the arrival time. Air freight from NOCS (NMF) arrived 18:30 3 SAPs, 1 box of GO-FLOS, 1 box of messengers and Matt Pateys PPE.

2010-12-19 08:00:01

Position: -51.69163 -57.82415
Air Temp: 9.070000, **Sea Temp:** 13.730000, **Depth:** 0.00

Science team commenced unpacking boxes and set up of laboratories. Despite not having a large number of nets to build this year, the mob took time due to extensive laboratory set ups as well as the NMF winch which needed the wire wound on and a new one put on, as well as the clean container air con fixing (thanks to the ship for both). A massive amount was set up in a day, but it was clear more time was required. In addition air freight (UOR sheave) was required before the novel netting set up could be established.

2010-12-20 08:00:00

Position: -51.69162 -57.82415
Air Temp: 7.010000, **Sea Temp:** 14.700000, **Depth:** 0.00

The final piece of air freight (UOR sheave) arrived at 09:00 (phew). At 09:30 a decision was made that it was highly unlikely that either the ship (with respect to organising alternative netting gear) or the science team (cold room, clean lab, prep lab) would be easily ready for an afternoon/evening departure. Therefore sailing was set to Tuesday morning at 09:00. The day was spent setting up equipment and lashing by the science team. The crew devised, rigged and load tested wires for the netting. Additionally at 10:30 a boat drill was undertaken by the ship.

2010-12-21 08:00:00

Position: -51.69162 -57.82414
Air Temp: 9.360000, **Sea Temp:** 15.120000, **Depth:** 0.00

Departed Stanley at 09:00 on a windy but sunny day after a second load test on the netting rigging. The ship hove too outside of the narrows to stow mooring weights and anything else in less windy situation. Departed the narrows at ~11:00 into slightly lumpy seas, a good test of everyones lashings. A science meeting was held at 13:00 for people to introduce their science, identify priorities, confirm watches and to undertake a tour of the laboratories and introduce relevant safety issues. An AFI-krill meeting was also held at 16:30 to set out sampling strategies. A test station was decided for all equipment, particularly the netting to be undertaken at 13:00 on the 22/12/2010.

2010-12-22 08:00:00

Position: -52.15842 -52.37895
Air Temp: 5.290000, **Sea Temp:** 6.150000, **Depth:** 2384.80

The ship hove too at 08:00 to examine the weather conditions for a test CTD station. A considerable swell was persisting. After settling on station for a while, a CTD was deployed to 300 m at 08:45. This was completed successfully and recovered prior to a boat drill at 10:30. The science watch leaders held a run through meeting regarding responsibilities. At 13:30 the fit of the SAPs to the 6 mm wire was examined followed by a 500 m deployment of the GO-FLOs commencing 14:57 local time. 5 out of the 6 bottles were deployed (one broke on cocking) and one bottle failed to open and close. A trial of the netting system was not undertaken due to the swell. Before departing the test site the iron fish was deployed. The evening was spent fixing the iron fish pump.

2010-12-23 11:35:39

Position: -52.71464 -45.14130
Air Temp: 5.790000, **Sea Temp:** 3.890000, **Depth:** 3302.12

Transition from previous log. The Air Temp field for previous entries was set to an incorrect field. The field has been adjusted and previous entries have had updated air temps.

2010-12-24 20:00:00

Position: -53.67803 -38.45092
Air Temp: 4.250000, **Sea Temp:** 3.540000, **Depth:** 365.47

Arrived at W1.1N at approximately 07:15 and headed southeast towards WPT3 (53 48.05'S, 38 30'W) to arrive on shelf in suitable fishing grounds for 13:00 net trials. Spent afternoon testing the deployment, flying behaviour and recovery of the now named K-NET as well as training people up in the method. Commenced hunting for targets at 16:00 and first target located around 17:00 although did not yield many krill. Finally at the end of an acoustic transect (started at 18:00)a large krill mark was observed. K-NET events 17 to 19 through this mark yielded enough krill for all and fishing ceased at 23:00 hours. TF1 station position was allocated to this mark at 53 42.019'S and 38 12.580'W. Two acoustic transects were run through this mark leading to the start of the physical oceanography measurements at 04:00.

2010-12-25 20:00:21

Position: -53.75123 -38.93378
Air Temp: 4.120000, **Sea Temp:** 3.390000, **Depth:** 437.16

Merry Christmas. After two transects first thing this morning the ship manoeuvred into position to TF1 for the physical oceanography measurements, a CTD followed by shallow GO-FLOs (2 failed), a further acoustic transect across the station followed by the SAPs and a second set of GO-FLOs. The first station was completed at 12:00 and we moved westwards to look for krill for a second TF station towards the beginning of the WCB. At 21:30 we still hadn't found krill. In order to complete the WCB and allow us more krill searching space as well as many scientists wanting breathing space to address experimental procedures it was decided to start the WCB on the morning of the 26th at 06:00. As luck would go, a krill swarm was noted at 22:40, but not successfully fished.

2010-12-26 20:00:38

Position: -53.85951 -39.13024
Air Temp: 3.470000, **Sea Temp:** 3.500000, **Depth:** 255.62

The WCB started at 06:00 with the normal weather of 20-30 knot winds beam on. The first two transects were completed, and followed by a SAPS and GO-FLO deployment at the WCB1.2S CTD station. The evenings activities then returned to the WCB standard, with target fishing followed by the deeper W1.2N CTD station. A large krill swarm was observed at 23:00 and successfully fished with two successive trawls to provide all on board with sufficient krill for their experiments.

2010-12-27 20:00:17

Position: -53.29081 -38.72988
Air Temp: 5.250000, **Sea Temp:** 4.260000, **Depth:** 3340.69

Proceeding with the WCB. Completed deep (1000m) CTD at W1.2N before manoeuvring into position for the start of the acoustic transects at 06:30. These were completed in the usual beam on winds (~20 knots). The deep CTD was undertaken at W2.2N before heading downwind to search for krill targets. At 22:00 a relatively dense target was identified at 50 m and two nets through this yielded sufficient krill for the science team. After the second haul the ship repositioned to the W2.2S CTD station to start at 04:00

2010-12-28 20:00:08

Position: -53.71465 -37.95832
Air Temp: 3.910000, **Sea Temp:** 3.870000, **Depth:** 0.00

The CTD 2.2 S was undertaken followed by the 3.1 and 3.2 acoustic transects. On the shallow shelf of the 3.2 transect at the end a large deep krill swarm was observed just above the seabed. This was marked and we returned to fish it at the end of the transect. At 1730 (LT) we recovered a haul of krill from this mark which had moved upwards to ~50 m depth. We then headed north to deeper waters to find krill further off shelf. No targets were found and at 22:00 (LT) the ship heaved to in increasing winds and swell to remain so overnight.

2010-12-29 20:00:53

Position: -53.40280 -38.89186
Air Temp: 2.610000, **Sea Temp:** 3.860000, **Depth:** 3551.66

Hove too all day. The ship turned at 19:00 (LT) to return to the WCB 3.2N CTD position to be undertaken at 04:00 (30/12/2010) weather permitting.

2010-12-30 20:00:27

Position: -53.16718 -37.81230
Air Temp: 2.200000, **Sea Temp:** 4.170000, **Depth:** 3353.86

The weather has settled and the seas calmed for an 04:00 CTD followed by the acoustic transects W4.1 and W4.2. Just prior to the beginning of the W4.2 transect the SCS crashed spectacularly. There was a slight delay to the transect start whilst instruments were set to internal logging, before commencing the transect. 19:24 marked the end of the Western Core Box and the krill projects resumed. A large krill swarm was spotted at ~19:00 and fished 3 times over the next 3 hours to obtain sufficient krill for all the experiments. Station TF2 was formally identified as 53 29.45'S and 37 42.46'W. After fishing three transects were run through the station prior to the 04:00 CTD

2010-12-31 20:00:03

Position: -53.84469 -36.82762
Air Temp: 3.700000, **Sea Temp:** 2.840000, **Depth:** 257.07

Acoustic transects at TF2 were run overnight before commencing the physics sampling at 04:00. A CTD followed by shallow GO-FLOs, another acoustic transect and then SAPS and the deep GO-FLOs. A final acoustic transect before we headed onto the shelf just north of Stromness. At 20:30 (LT) it became clear that the iron chemists required more time to process samples and would be unable to sample at TF3 the following morning. It appeared to be an opportune moment to head for Stromness to undertake the EK60 calibration. At 21:30 (LT) a krill swarm was located and successfully fished (in increasing weather) to identify TF3. After that the Iron fish was brought in readiness for heading into Stromness.

2011-01-01 20:00:25

Position: -54.09014 -36.60274
Air Temp: 3.360000, **Sea Temp:** 7.600000, **Depth:** 130.42

An 04:00 CTD followed by relocation to Stromness to start the calibration. The vessel stopped with one anchor down and steadied by the DP in Stromness at 08:30. After the shallow calibration CTD the EK60 sphere winches were put in place and the 38kHz sphere located. At 11:45 the ship suffered a brown out and the whole science equipment powered down. Power was recovered quickly, but the computers took longer to reboot. The calibration went smoothly and at 16:00 (LT) the ship left Stromness. However the stabilisers had failed and it became rapidly apparent that in the 30 knot winds and swell that had built up it was no longer fishing weather. The ship hove too and at 21:00 the engineers managed to get the stabilisers online again - to the relief of all.

2011-01-02 20:00:49

Position: -53.73830 -35.50060
Air Temp: 2.740000, **Sea Temp:** 2.900000, **Depth:** 2606.59

At 04:00 the CTD was re run at the TF3 station location, followed by GO-FLOs, an acoustic transect, SAPS and another acoustic transect. This marked the end of TF3 and the ship relocated north east in search of a deep water krill station. Searching for targets recommenced at 16:00 and despite observing some large near surface krill marks, four net hauls retrieved only a poor sample, not sufficient for the experiments. At 23:30 we resumed an acoustic transect in search of larger, more permanent marks.

2011-01-03 20:00:02

Position: -54.12509 -35.44672
Air Temp: 3.090000, **Sea Temp:** 3.690000, **Depth:** 298.84

Although no krill were caught the night before, the morning activities continued with the physical observations of CTD, GO-FLOs and SAPs. All were undertaken over huge krill swarms, whilst the ship was surrounded by whales. Yet the krill remained in the water and not in our nets. At 18:00 the station was abandoned (for krill fishing) and we headed south to find a different krill swarm to target. At 18:45 a krill swarm was identified near surface and successfully fished twice to provide enough krill to mark the station as TF5 at 54 15.31'S and 35 21.29'W. The rest of the evening was spent undertaking acoustic transects across the station to characterise the krill swarms.

2011-01-04 20:00:49

Position: -54.38530 -35.25647
Air Temp: 3.190000, **Sea Temp:** 3.520000, **Depth:** 442.60

The 04:00 CTD took place followed by shallow GO-FLOs. During this time the ship identified a problem with the shaft bearing. The station activities of acoustic transect, SAPs, a single repeat 100m GO-FLO and another transect were completed by 14:30 (LT). The ships personnel then undertook maintenance on the shaft bearing, with the ship drifting south to the next station

2011-01-05 20:00:00

Position: -54.62123 -34.80513
Air Temp: 3.500000, **Sea Temp:** 3.120000, **Depth:** 746.91

The ship resumed normal propulsion power at 05:30 and commenced heading towards the southernmost station. At 09:30 it was decided to head to a deep TF station (TF6) in order to get a reasonable set of iron water samples. These commenced at ~ 12:00 and were followed by two attempts at target fishing. The second net was aborted due to the swell and a decision to head for shallower more sheltered waters was taken.

2011-01-06 20:00:22

Position: -54.59503 -35.49353
Air Temp: 4.600000, **Sea Temp:** 3.540000, **Depth:** 149.71

The ship relocated to a more shallow location for GO-FLOs and SAPS (TF7 54 31.8'S, 35 16.26'W) for 04:00 (LT) in 133m water. At 11:50 (LT) the decision was made to relocate to calmer waters to the west in the shelter of the island due to lumpy swell likely preventing deployment of the light K-NET. Fishing was started early due to the lack of krill that had been caught for the last two days. At ~ 14:00 (LT) a krill swarm was successfully fished and the krill scientists happy to resume their experiments once more. Acoustic transects were run until a repeat net at the now allocated TF8 (54 34.48'S 35 35.29'W. This net caught sub-adults, but still with little in their stomachs. The evening was completed with more acoustic transects run through the station.

2011-01-07 20:00:00

Position: -53.68636 -35.83191
Air Temp: 3.660000, **Sea Temp:** 3.470000, **Depth:** 865.41

The CTD at 04:00 (LT) was followed by GO-FLOS, acoustic transect and SAPS followed by the final acoustic transect to complete the TF8 station by 12:00. The weather forecast indicated bad weather in 2 days time so a decision was made to use a calm window to undertake a deep station to return to the shelf the next day for more shelter. TF9 was located at 53 37.40'S, 36 20.65'W 50 nm north west of TF8. Small swarms with a small dB window (~4 dB) were located but an attempt to fish in daylight brought no return. A large 1 km swarm was successfully fished at 21:30 and the net returned full of adults/subadults with full guts. A second haul on this mark completed the fishing for the night and acoustic transects were run until 04:00 ready for the CTD.

2011-01-08 20:00:31

Position: -54.21839 -35.85420
Air Temp: 1.600000, **Sea Temp:** 3.600000, **Depth:** 239.27

The usual CTD, GO-FLOs, SAPs and acoustic transects were completed at TF9 before heading for shallow waters near St Andrews Bay for a station in anticipation of bad weather (forecasted). TF10 (54 16.16'S 35 52.0'W) commenced with three K-nets on a shallow layer of lowish backscatter. A reasonable crop of krill were caught and fishing ended at midnight.

2011-01-09 20:00:47

Position: -53.90108 -36.75338
Air Temp: 2.990000, **Sea Temp:** 3.660000, **Depth:** 186.55

The early morning CTD was undertaken, without either GO-FLO or SAPS followed by a 3 acoustic transects. The ship then headed to the proposed site for TF11. Fishing commenced at 20:00 (LT) on small but shallow marks. Five hauls were made with limited success. Enough krill were caught to satisfy the experiments but they were hard work in the winning. Fishing ended at 02:00

2011-01-10 20:00:11

Position: -54.09188 -36.26713
Air Temp: 3.500000, **Sea Temp:** 3.760000, **Depth:** 274.09

The CTD commenced at 04:00 followed by GO-FLOs and SAPS. After a final transect at TF11 the ship commenced heading towards the southwest end of the Western Core Box in search of large krill. However after an hours transit a decision was made to turn the ship towards South Georgia in search of calmer waters. The ship spent four hours searching for krill before attempting to fish on the shelf. The first attempt claimed about 20 krill in poor condition, the second net came up with nothing in it as a result of a blown cod-end. After repositioning for a third attempt the swell had picked up considerably and fishing was cancelled for the night. The ship will reposition for 04:00 CTD in the mouth of the channel out of Cumberland Bay.

2011-01-11 20:00:41

Position: -53.95431 -36.61915
Air Temp: 3.350000, **Sea Temp:** 3.790000, **Depth:** 212.46

CTD, GO-FLO and SAPs were run successfully in increasing weather conditions in the morning. Acoustic transects were omitted since no krill was caught last night. After the SAPS with increasing swell the ship heaved to. At approximately 19:30 the ship increased speed and started to head to the WCB area for attempting to fish on large krill caught earlier in the cruise. However the wind continued between 30 and 40 knots and another night without fishing occurred.

2011-01-12 20:00:51

Position: -53.53629 -38.05900
Air Temp: 4.130000, **Sea Temp:** 3.280000, **Depth:** 0.00

The weather finally settled down enough by 13:37 (GMT) to undertake the CTD, followed by GO-FLOs, SAPS and more GO-FLOs to mark the site of TF13 at -53 32.4'S -38 6.54'W. Acoustic transects followed to locate suitable krill swarms and krill were successfully retrieved in Ev 145 for the AFI krill project and Events 147-149 collected large females for the AFI-CGS project

2011-01-13 20:00:51

Position: -53.76755 -39.08033
Air Temp: 2.990000, **Sea Temp:** 3.430000, **Depth:** 309.85

The ship relocated to the site of the largest krill that were caught (Event 34) at the western end of the Western Core Box. The physical measurements of CTD, shallow GO-FLOs and SAPs were undertaken in heavy swell. These were followed by a number of acoustic transects before dusk started and the krill fishing commenced in earnest around 01:00 (GMT). Krill were located first for the AFI project, before a later swarm of large krill was successfully fished for the AFI-CGS, completing a successful last complete station.

2011-01-14 20:00:29

Position: -53.76798 -35.93087
Air Temp: 2.880000, **Sea Temp:** 3.530000, **Depth:** 0.00

The ship headed east towards KEP, to a point approximately 24 miles out. Three bongo nets were undertaken to supply samples for Magnus as well as test the method that we might have relied upon. The net samples were full of Thysonessa but no Antarctic krill. A final K-Net was attempted in developing seas that returned only dead krill due to the swell and at 22:00 (LT) science ceased and the ship hove to ready to sail into KEP

2011-01-15 20:00:20

Position: -54.19910 -36.44128
Air Temp: 6.960000, **Sea Temp:** 7.940000, **Depth:** 265.54

Mike Pinnock and Magnus Johnson took a look at the KEP facilities having used the KEP boats to get in. Due to developing winds (gusts of 50 knots) all other personnel remained onboard. At 16:00 (LT) Mike and Magnus returned with our two passengers Martin Collins and James Jansen and the ship upped anchor and headed out into developing heavy swell towards Stanley.

2011-01-16 20:00:19

Position: -53.29358 -42.44045
Air Temp: 6.410000, **Sea Temp:** 4.150000, **Depth:** 446.85

Heading to Stanley in bumpy weather. The End of Cruise Quiz was held and seemed to be enjoyed by many.

2011-01-17 20:00:03

Position: -52.50161 -49.88152
Air Temp: 6.610000, **Sea Temp:** 5.960000, **Depth:** 3495.10

Heading to Stanley in bumpy weather. The end of cruise dinner was held and enjoyed by all.

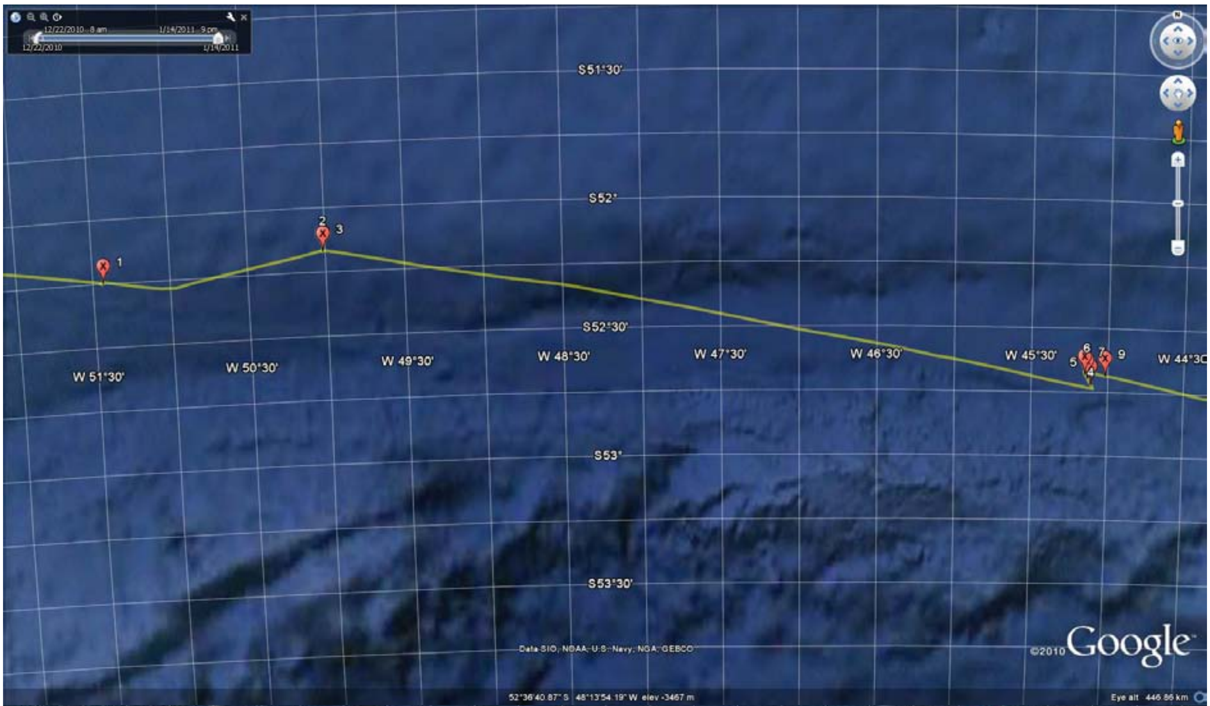
2011-01-18 20:00:50

Position: -52.21579 -54.67152
Air Temp: 5.940000, **Sea Temp:** 11.220000, **Depth:** 1725.62

Heading to Stanley in bumpy weather for arrival in the morning (delayed due to bumpy weather!)

1.4 Cruise Track

The cruise indicates the starting location for each event with a marker.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W 46°30'
W 45°30'
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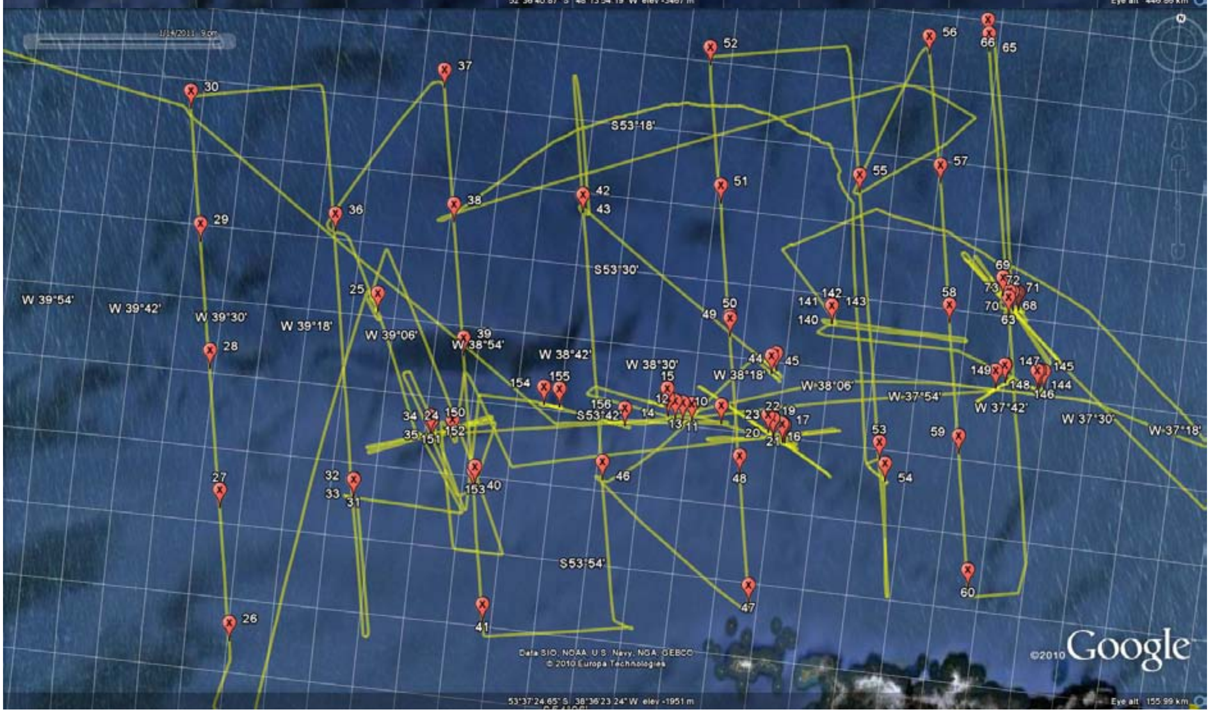
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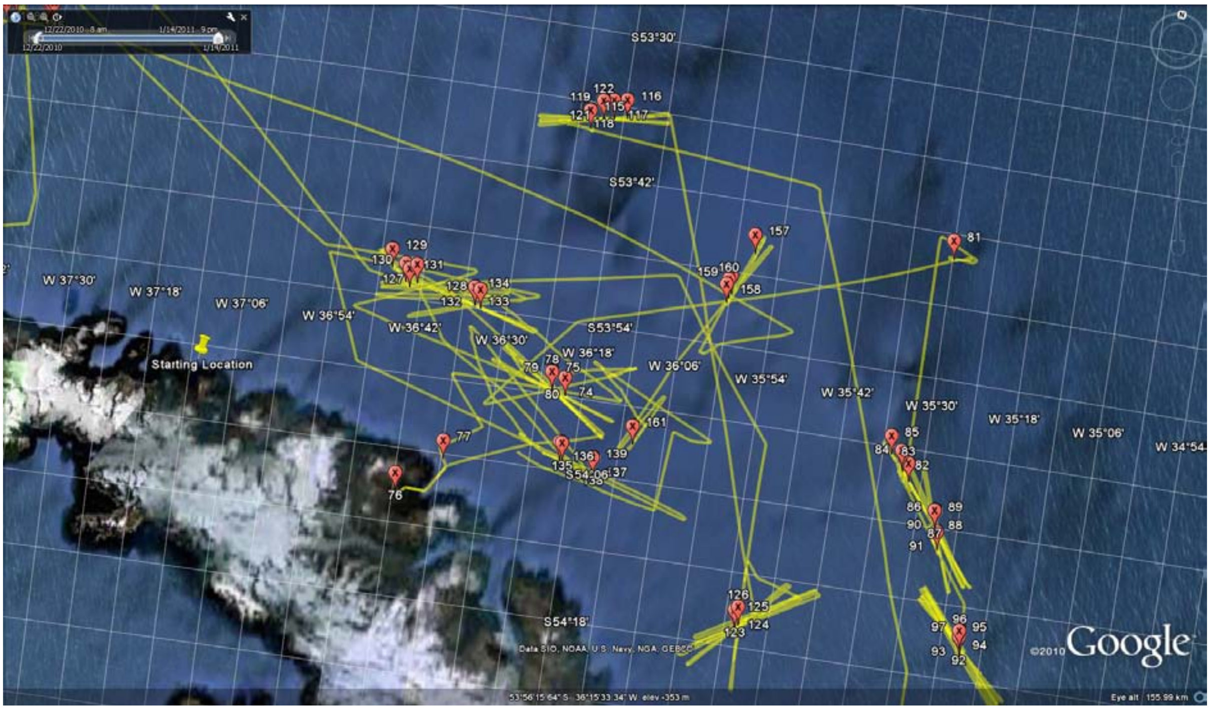
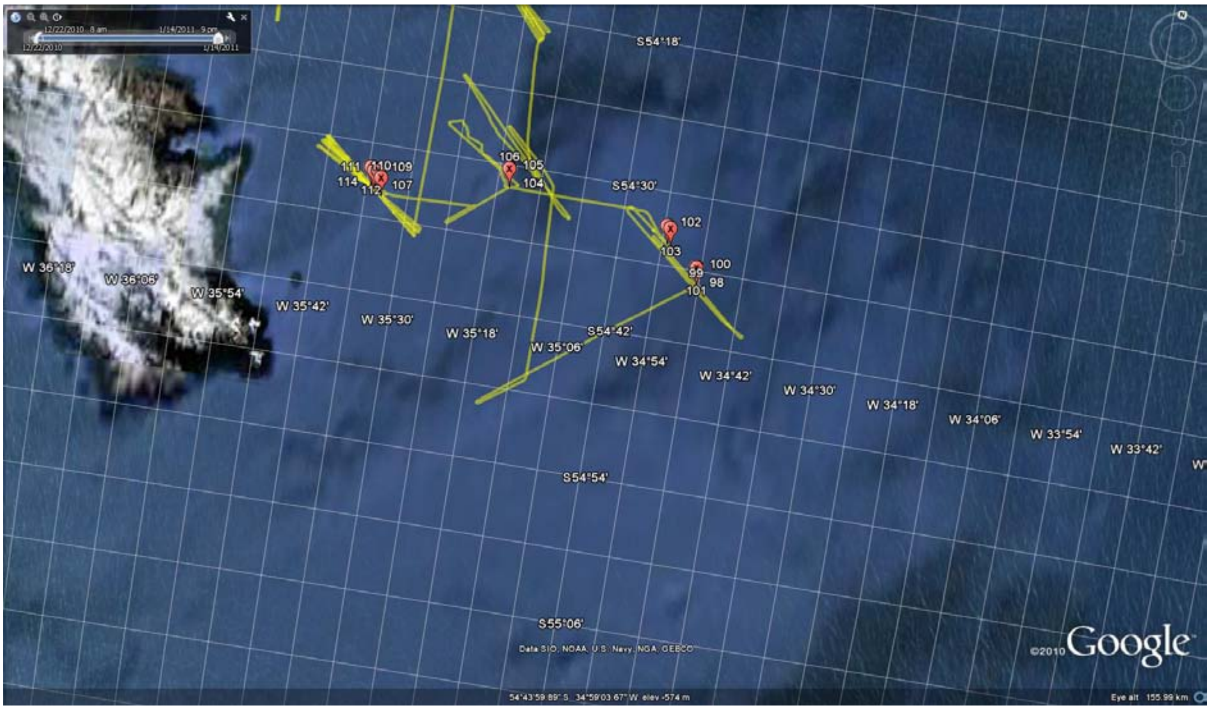




1.5 Scientific Personnel

Sophie Fielding	BAS	PSO
Angus Atkinson	BAS	Krill biogeochemistry
Dave Connor	BAS	Data Management
Peter Enderlein	BAS	Equipment
Natalie Ensor	BAS	Krill fishing
Magnus Johnson	University of Hull	Krill swimming
Jules Klepacki	BAS	AME
Matt Patey	University of Southampton	SAPS

Mike Pinnock	BAS	Board Member/Watch leader
Christian Schlosser	University of Southampton	Iron chemistry
Gabi Stowasser	BAS	Bioenergetics
Geraint Tarling	BAS	Krill respiration
Neil Thompson	University of Hull	Krill swimming
Doug Willis	BAS	ITS

1.5.1 Cruise Photo

1.6 JCR Officers and Crew

Burgan, M Jerry	Master JCR
Beynon, Euan	Chief Offr
Benndorf, Nadine	2nd Offr JCR
Wyles, Spencer	3rd Offr JCR
Summers, John	Deck Offr JCR
Gloistein, Michael	ETO (Comms) JCR
Anderson, Duncan	Chief Engr JCR
Elliott, Thomas	2nd Engr JCR
Stevenson, James	3rd Engr JCR
Umrao, Manoj	4th Engr JCR
Trevett, Douglas	Deck Engr JCR
McManmon, Johnny	ETO JCR
Bird, Daniel	Cadet JCR
Pottinger, Callum	Cadet JCR
Turner, Richard	Cat Off JCR
Peck, David J	Bosun JCR
Bowen, Albert	Bosun's Mate
Wale, Gareth	Motorman JCR
Summers, Jay	Motorman JCR

Chappell, Kelvin	AB JCR
Dale, George	AB JCR
Dunne, John	AB JCR
Huntley, Ashley	Chief Cook JCR
Lee, Jamie	2nd Cook JCR
Mullaney, Clifford	AB JCR
Raper, Ian	AB JCRJones, Lee
Senior Steward JCR	
Greenwood, Nicholas	Steward JCR
Raworth, Graham	Steward JCR
Weirs, Michael	Steward JCR
Colgan, Frances	Doctor JCR

1.7 Acknowledgements

Sophie Fielding PSO

This cruise combined long term time series measurements (WCB) with NERC funded blue skies research (AFI) centred on the seas around South Georgia. Fundamental to all the cruises was the requirement to catch krill. This presented a serious challenge with the loss of the gantry and it is only as a result of the hard work and ingenuity of the Captain Jerry Burgan and his crew (in particular John Summers and Dave Peck) that this cruise was successful with the ability to tow a net from the stern of the ship and know which depth it is at (fundamental to target fishing on krill). Peter Enderlein was also instrumental in getting this capability. We also thank the ship's staff for their hard work throughout the cruise in enabling us to deploy equipment as frequently as possible. The ship suffered a number of mechanical issues and we are grateful to the efforts of the engineers and crew in maintaining the ship at sea. Tribute is also owed to the science support staff, Julian Klepatchi, Doug Willis and Dave Connor, in keeping our instruments working, solving problems and making sure the data was recorded throughout the cruise. Thanks also to Jez Evans who managed to rescue the NMF equipment from a trip on the RRS James Cook and redirect them to the JCR for this cruise. Finally thanks are due to the scientists on board who displayed a positive, hard working attitude throughout the cruise vital to its success. This cruise was part of the LTMS Ecosystems programme component of PSPE and NERC Antarctic Funding Initiative.

1.8 Cruise activities summary

A list of event locations can be found in Appendix B.

<u>Test Station (Events 1 to 14, 22 – 24/12/2010)</u>

The test station actually occurred over a number of days as gear became ready to test and as weather permitted. First the CTD (22/12/2010), followed by GO-FLO washing (22/12/2010) and then science started with the deployment of the iron fish at 19:26 (GMT) 22/12/2010. The krill net (hereafter K-NET) was tested the next day in calmer seas (23/12/2010). A number of deployment and recovery methods were tested and finalised on using people to deploy and the gilsen winch to recover. As the seas picked up a little, net testing finished and the SAPS was deployed to test filtration times. A second set of net testing, this time with the net monitor CTD attached was undertaken early afternoon on the 24/12/2010 before deployment and recovery methods were finalised and testing finished at 18:21 (GMT) 24/12/2010.

<u>TF1 (Events 15 to 23, 24 - 25/12/2010)</u>

The krill were abundant and some dense swarms were identified on the echosounder so target fishing commenced in earnest around 16:00. A number of krill targets were seen and an attempt at fishing undertaken at 17:00, followed by an acoustic transect. This identified a large swarm that was fished successfully and TF1 was identified as 53°42.019’S 38°12.580’W. Acoustic transects were run through the night before a CTD, GO-FLO and SAPs were performed from 07:00 (GMT) onwards. A frustrating next night of few krill targets and a desire by some of the science personnel to refine their experiments led to the decision to commence the Western Core Box in the morning.

WCB (Events 26 – 65, 26/12/2010 – 30/12/2010)

An early morning start to the WCB, commencing from the southern end of 1.1. All science was undertaken successfully and fishing overnight yielded sufficient krill for the AFI projects as well as for the WCB length frequency requirements. On the night of the 29/12/2010 the wind picked up and after a CTD and one K-NET the ship hove to for the whole of the 30/12/2010, before commencing the last CTD and last WCB transects (4.1 and 4.2) on the 30/12/2010.

TF2 (Events 66 – 73, 30 - 31/12/2010)

A large krill swarm was observed at 22:00 (GMT) and fished 3 times over 3 hours to supply all projects with krill, identifying TF2 at 53°29.45’S 37°42.46’W. Acoustic transects were run overnight before commencing the physical oceanography measurements at 04:00 (CTD, GO-FLO, SAPS). A final acoustic transect completed the station before heading south on to the shelf near Stromness for the next proposed station.

TF3 (Events 74 – 80, 31/12/2010 – 02/01/2011)

A krill swarm was successfully located and fished which identified TF3 as 53° 59.63’S 36° 22.24’W, but it also became apparent that the iron chemists required some time to confirm presence or absence of contamination and refine techniques. At 23:30 (GMT) a decision was made to head into Stromness to undertake an acoustic calibration whilst the opportunity existed. This was completed on 01/01/2011 immediately after the ship had suffered a brown out (14:45 GMT) whilst at anchor. An impact of this was the loss of the stabilising system and when the ship set sail from Stromness she rolled heavily in the swell. It was obvious that fishing was not possible in the current conditions. The stabilisers were fixed at 23:30 (GMT) and the ship moved to the site of TF3 to undertake the physical oceanography measurements (CTD, GO-FLO and SAPS) as well as acoustic transects.

TF4 (Events 81 – 91, 02 – 03/01/2011)

The ship headed north east to find waters for a deep station. After passing over some dense deep krill marks extensive efforts were made to fish them (events 81 to 85) with no success. At 05:00 (GMT) attempts were ended and the ship located to the site of the marks to undertake CTD, GO-FLO and SAPS at the now allocated site of TF4 54° 06.04’S 35° 27.30’W. An additional CTD was undertaken (Event 90) opportunistically through a dense krill swarm to investigate the physical oceanography within a swarm. A final attempt (after a transect) at fishing the dense deep layers was undertaken before admitting defeat and ending krill fishing at TF4. The ship commenced heading south in search of new fishing grounds.

TF5 (Events 92 – 97, 03 – 04/01/2011)

Forty five minutes after end TF4 whilst heading south a large krill swarm was spotted and fished successfully (Events 92, 93) identifying the position of TF5 as 54° 15.31’S 35° 21.29’W. The stations activities of CTD, GO-FLO and SAPS were completed on the morning of the 04/01/2011. During this time the ship identified a problem with the propeller shaft bearings. After completing the station activities the ship drifted whilst maintenance was undertaken. Normal propulsion power was resumed on the morning (08:30 GMT) of 05/01/2011.

TF6 (Events 98 – 103, 05 – 06/01/2011)

It was decided that TF6 would be a deep station so the ship headed off shelf at the east end of the island to 54° 37.27’S 34° 48.31’W. The CTD, GO-FLO and SAPS were undertaken and two nets attempted. The second net was aborted due to increasing swell. The ship relocated to shallower waters in order to undertake physical oceanography measurements in the morning in suitable shelter.

TF7 (Events 104 – 106, 06/01/2011)

The ship relocated to the shallow site of TF7 at 54° 31.85'S 35° 16.26'W to undertake CTD, GO-FLO and SAPS. At 14:40 (GMT) it was decided to move even closer to the island to shelter from swell that prevented fishing the K-NET.

TF8 (Events 107 – 114, 06/01/2011 – 07/01/2011)

At 17:00 (GMT) a krill swarm was successfully fished and TF8 was identified as 54 34.48'S 35 35.29'W. Acoustic transects were run before a second set of nets were undertaken in an attempt to catch krill with full guts. In the morning the CTD, GO-FLOs and SAPS were undertaken completing a successful station.

TF9 (Events 115 – 122, 07 – 08/01/2011)

Weather forecasts indicated a blow in two days time so the calm window was used to occupy a deep station to the north east of South Georgia – TF9 53° 37.40'S 36° 20.65'W. A large 1 km swarm was successfully fished at 00:30 (GMT 08/01/2011) to identify TF9 and the suite of CTD, GO-FLOs and SAPs undertaken in the morning.

TF10 (Events 123-126, 08 – 09/01/2011)

The shallow waters just north of St Andrews Bay were chosen for a shallow site whilst sheltering from forecasted bad weather. TF10 54° 16.16'S 35° 52.0'W was fished three times on a shallow layer generating a reasonable crop of krill. TF10 was completed by a CTD in the morning, whilst GO-FLO and SAPs were not undertaken because the iron team had an overload of samples. The bad weather didn't appear to materialise!

TF11 (Events 127 – 134, 09 - 10/01/2011)

Fishing commenced at 23:00 (GMT) on small shallow marks. Five nets were required to satisfy the krill requirements. TF11 was identified as 53° 53.78'S 36° 34.42'W and finished on the morning of the 10/01/2011 with CTD, GO-FLO and SAPS. After a last transect the ship headed towards the Western Core Box area in search of large krill to satisfy the AFI-CGS requirements. However after an hours transit it became obvious that weather would prevent fishing off shelf and the ship sought shelter of shallower waters. After 4 hours of searching two hauls were made, the first yielded 20 krill, the second a broken cod-end. After mending the weather had significantly worsened and the ship hove to. The ship repositioned to the mouth of Cumberland Bay for shallow CTDs in shelter.

TF12 (Events 135 – 139, 10 – 11/01/2011)

CTD, GO-FLO and SAPs were undertaken successfully at TF12 53° 32.40'S 36° 14.99'W in increasing weather conditions after a night of no fishing. After the SAPS cast the ship hove to with the increasing swell. At 22:30 (GMT) the ship picked up speed and started to head out to the Western Core Box in search of big krill a comfortable course at slow speed was chosen in mounting seas. The night of the 11/01/2011 passed without fishing due to the weather and science resumed on the 12/01/2011.

TF13 (Events 140 – 149, 12-13/01/2011)

The ship relocated to the site for TF13 53° 32.4'S 38° 04.54'W commencing with CTD, GO-FLO and SAPs whilst the swell reduced a little. Fishing finally commenced around 23:00 (GMT) when the swell had lowered more and to the east of TF13 (to further shelter the fishing). A 300 m swarm was located and fished three times (one incorrectly) to provide enough krill for the AFI experiments, finishing off TF13. About 1 hour later as the ship relocated towards the site of TF14 (the position of Event 34 where the largest krill were sampled) a 1 km swarm of lower backscatter but more significantly a lower dB difference was spotted and successfully fished three times to provide large krill for the AFI-CGS experiments.

TF14 (Events 150 – 154, 13-14/01/2011)

The last station was chosen in an attempt to again find large krill for the AFI-CGS project. The ship headed west to the site of Event 34 where the largest krill had previously been fished. The location of TF14 was identified as 53° 45.3'S 38° 59.0'W and the CTD, GO-FLOs and SAPs were undertaken prior to fishing. Acoustic transects were run after the physical measurements in an attempt to locate fishable swarms. After 9 hours of searching a decision was made to commence heading east towards KEP and almost immediately a krill swarm was located and fished – this completed TF14 for the AFI krill project. An hour later a large swarm of small dB difference was located and the large krill necessary for the AFI-CGS project were onboard. After heading east to north of KEP three Bongos were undertaken to see how this sampling strategy would have worked if it was the main strategy (badly!) and a last K-net caught dead krill in increasing seas before the ship headed towards KEP to pick up passengers and then to Stanley.

2 Physical Oceanograhy

Hugh Venables

2.1 Underway Navigational Data

Hugh Venables

2.1.1 Instrumentation and data collection

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

- Ashtec ADU2 GPS: antenna 1 used to determine the ship's position; antennae 2-4 used to determine pitch, roll and yaw.
- Ashtec GLONASS GG24 (accurate to ≈15m)
- Sperry Mk 37 Model D Gyrocompass
- Seatex GPS (Seapath 200)

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.

2.1.2 Processing

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

Unix

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

get_sim500 Invokes the *listit* command to retrieve 24 hours of EA600 data. Data are saved as *sim500.NNN*.

Matlab

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

- *load_daily_gpsash*: reads in text file *gpsash.NNN* and writes data to Matlab structure array. Data are flagged, such that any variable with flag $\neq 50$ are poor, and thus discarded. Output is *gpsash/gpsashNNN.mat*.
- *load_daily_gpsglos*: reads in text file *gpsglos.NNN* and writes data to Matlab structure array. Data are flagged, such that any variable with flag $\neq 50$ are poor, and thus discarded. Output is *gpsglos/gpsglosNNN.mat*.

- *load_daily_gyro*: reads in text file *gyro.NNN* and writes data to Matlab structure array. Data are flagged, such that any variable with flag ≠ 50 are poor, and thus discarded. Output is *gyro/gyroNNN.mat*.
- *load_daily_seatex*: reads in text file *seatex.NNN* and writes data to Matlab structure array. Data are flagged, such that any variable with flag ≠ 50 are poor, and thus discarded. Output is *seatex/seatexNNN.mat*.
- *load_daily_tsshrp*: reads in text file *tsshrp.NNN* and writes data to Matlab structure array. Data are flagged, such that any variable with flag ≠ 50 are poor, and thus discarded. Output is *tsshrp/tsshrpNNN.mat*.

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

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

code2mstar[stream]245 Reads the .mat files from *load_daily* into mstar format. This technique was used as an alternative to the full mstar underway data processing (see JR239 cruise report for details of this). After this step all files are in the expected format and merge with other data such as CTD casts as expected.

loadsim500 Reads in *sim500.NNN* and stores data in Matlab structure array. Saves *sim500_NNN.mat*

cleansim500 Loads *sim500_NNN.mat* and sets values ≤0 to NaNs, then uses 1D linear interpolation to fill data gaps. Data are then despiked by calling *dspike* and data gaps are filled by linear interpolation. Data are then cleaned using an interactive editor and gaps filled by linear interpolation. Output is *sim500_NNNclean.mat*.

scatter_depth Loads *sim500_NNNclean.mat* and calculates 1 minute averages to make plotting easier, then loads 1 minute average latitude and longitude data from *oceanlog_navNNN_1minave.mat* (see Oceanlogger section) and plots 1 minute average depth data. Output is *sim500_NNN_1minave.mat*.

plot_sim500_all Reads in *sim500_NNN_1minave.mat* for all jdays and GEBCO bathymetry data. Plots 1 minute average depth data along entire cruise track.

2.1.3 Problems encountered

The *listit* command in the scs system crashed due to unexpected characters in ashtech. A fix to *listit* was made and the scripts were pointed to this new version (the original *listit* was left unaltered), but the underlying issue in the raw to compress step will also be addressed. See the Data Management section for more details.

2.2 Underway Oceanlogger and Meteorogical Data

Hugh Venables

2.3.1 Instrumentation and data collection

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

Oceanlogger

SeaBird Electronics SBE45 CTD
Turner Designs 10-AU Fluorometer

Meteorological data

Photosynthetically Active Radiation (PAR) 1, Parlite Quanum Sensor, Kipp & Zonen
Photosynthetically Active Radiation (PAR) 2, Parlite Quanum Sensor, Kipp & Zonen
Transmissometer 1, Proto1 SPLite, Kipp & Zonen
Transmissometer 2, Proto1 SPLite, Kipp & Zonen
Air temperature/humidity 1, Chilled Mirror Hygrometer MBW, PM-20251/1, Temperature Sensor Pt100, PM-20252/1
Anemometer (this logs wind speed relative to the ship. At this time there is no datastream for true wind, but this can be calculated from relative wind and navigational data, if required).

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

2.2.2 Processing

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

Unix

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

Matlab

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

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

Mstar

Code2mstarOceanlog1min245

Converts the .mat *oceanlog_navNNN_1minave.mat* to *oceanlog_navNNN_1minave.nc* mstar netCDF files. These are of the form that would be produced using the complete mstar processing (as in JR239) so can be merged as before with CTD and salinity files for calibration of underway SST and salinity.

Temperature Calibration

CTD temperature at 7m was found for each cast and merged with oceanlogger data for calibration of the SST data. This sensor, due for replacement before next season, has previously been found to be offset by a temperature in the range ±0.3ºC. The offset (CTD minus oceanlogger) was found to be in the range (-0.01, 0.14) with no trend through the cruise and a mean of 0.081ºC.

2.2.4 Salinity samples

Throughout the cruise, water samples were collected for salinity analysis in order to calibrate the underway conductivity sensor. The water samples were collected in 200ml medicine bottles. Standard procedure was to rinse the bottle three times, before filling it to just below the neck to allow room for expansion during warming and to facilitate mixing of the bottle's contents prior to analysis. The rim of each bottle was wiped dry with a tissue, then a plastic seal inserted and the screw cap replaced. Ongoing crates of salt samples were kept in the salinometer lab and allowed to equilibrate with ambient conditions for at least 24 hours prior to analysis.

The samples were analysed on one of the shipboard Guildline 8400B Autosal salinometers (s/n 68959), which had been standardised at the beginning of the cruise using Ocean Scientific International Ltd (OSIL) P151-series standard seawater. Prior to, and following, analysis of each water sample crate, a new bottle of standard seawater was analysed to ensure that the salinometer remained stable and in order to derive a calibration offset. In between batches of salinity analysis, the salinometer was flushed, and filled with, milliq. To avoid dilution of the first standard the salinometer was first flushed several times with standard seawater left over from previous analyses before analysing the first standard of each run.

Standard procedure was to invert each sample bottle a few times in order to mix the contents but avoid the introduction of a large number of air bubbles into the sample. The salinometer cell was then flushed three times with the sample, prior to taking the first reading. The cell was then flushed and refilled for two subsequent readings.

Once analysed, the conductivity ratios were entered by hand into an Excel spreadsheet, *jr245_master.xls*, converted to salinities and transferred to the Unix system. They were then used to investigate a conductivity offset for the underway sensor.

2.2.5 Salinity calibration

The Mstar script *msal_ocl* reads the data from a csv file into a mstar netCDF file. *ocl_00_botmerge* then merges this data with the oceanlogger data and calculates salinity offsets. This, combined with comparison with CTD7m data, yields an offset of the oceanlogger salinity being too high. The offset starts at -0.013 at jday 354, reducing to -0.024 at jday 364 and then staying constant.

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

Hugh Venables

2.3.1 Introduction

A 75 kHz RD Instruments Ocean Surveyor (OS75) ADCP was used during this cruise. This has also been used on JR139 (Stansfield 2006), JR161 (Hawker 2006), JR165 (Shoosmith/Renner 2007) and JR193 (McCarthy and Venables 2007), JR177, JR200 and JR218 (Venables) and JR239 (Renner). The OS75 is capable of profiling to deeper levels in the water column than the previous 150kHz ADCP and can also be configured to run in either narrowband or broadband modes.

2.3.2 Instrumentation

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 seachest 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.
During the trials cruise, it was noted that the OS75 causes interference with most of the other acoustic instruments on JCR, including the EM120 swath bathymetry system. To circumvent this, the ADCP pinging was synchronised with the other acoustic instruments using the SSU, however this acts to reduce the pingrate. As noted by Dr. Sophie Fielding, when in deep water the swath can take 20 to 30 seconds from ping to end of listening, as a result this means the ADCP only pings once every 25 or so seconds. A further problem is that the ADCP appears to "time out" every other ping when it has to wait a long time between pings (i.e when running in deep water alongside the EM120). This results in it rebooting and waking the ADCP instrument up every other ping, which simply exacerbates the problem. A fix is promised by BAS AME, but requires a firmware upgrade from RDI which is not presently available. To circumvent these problems, the swath was not used during the cruise. The EK60 was set as master through the SSU and the single-beam echosounder (EA600) and OS75 were set as slaves.

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.

2.3.3 Configuration

The OS75 was controlled using Version 1.42 of the RDI VmDas software. The OS75 ran in two modes during JR245: narrowband with bottom-tracking on and narrowband with bottom-tracking off. Sixteen, thirty-two or fifty 16 meter bins were used depending on the water depth. 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). The full configuration files for each of the modes used are given at the end of this section.

2.3.4 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.

2.3.5 Post-processing of data

OS75 data were processed on JR245 using Matlab code originated by IFM Kiel. This was adapted by Dr. Mark Inall, Dr. Deb Shoosmith, Angelika Renner, Mark Brandon and Hugh Venables for use with the JCR system. The master file for the processing is “OS75_JCR _jr245.m”, which calls a lengthy sequence of routines to execute the following steps. Angelika Renner made changes to the main program following JR165, to calibrate narrowband and broadband data separately. These changes are adopted, though no broadband data has been collected. Further improvements to the code, to deal with bugs and special cases have been made during the cruises listed above.

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

2) Remove missing data and data with bad navigation

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

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

5) Derive ship velocity from Seapath navigation data

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

7) Average data into ensembles of pre-defined length (120 seconds for
JR245). The version of the function average_pings.m was the one modified for JR193 from that used during JR165. These changes were modified on JR177 to cope with a change of year.

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

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

10) Determine absolute velocities from either bottom-track ship velocity or Seapath GPS (usually the latter).

11) Plots the eastward and northward velocities. Details of this plotting were tidied during JR193 and JR177. In particular, code was added to deal with plotting files that spanned the new year. There is still an issue that for short files too many times are plotted on the x axis, causing them to overlap.

2.3.6 Output Files

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

1) JR245_00A_00000B_raw.mat, where A is the highest number of the user-incremented files. This is the number that VmDas increments every time logging is stopped and restarted. The version number is B, which increments with the .ENX files, when they reach 10Mb. This contains structured arrays “c” (ensembled-averaged data), and “b” (absolute velocities)

2) JR245_00A_00000Bd_att.mat, where A and B are as above. This contains the ship’s attitude data.

3) JR245_00A_00000B_sgl_ping.mat, where A is as above, and B is the number VmDas increments every time filesize exceeds 10 Mbyte. This contains single-ping data in structured array “d”.

4) JR245_00A_000000_ATT.mat. As (3), but for the whole section of data in the user-incremented series A

5) JR245_00A_00000B_bad_heading.mat. Record of the data points removed due to bad heading

6) JR245_00A_00000B_bad_nav.mat. Record of the data points removed due to bad navigation.

7) jr245_000_000000_A_ave_ping. Two minute averaged data, including ship velocity.

8) jr245_000_000000_A_abs. Two minute averaged data, water velocities.

9) adcp_vel_contours_A.ps Individual plots of data in jr245_000_000000_A_abs, “A” here is the first in any list of files given to OS75_JCR _jr245.m. This was introduced at A=43 so is only present before that if data has been reprocessed.

10) adcp_vel_contours.ps A file with each of the individual plots appended, each as an extra page when converted to pdf.

Command Files used:
Command files created during JR218 (modified on JR239 to 16m bins) were used.

2.4 CTD Deployment and Data Acquisition

Hugh Venables

2.4.1 Introduction

A Conductivity-Temperature-Depth (CTD) unit was used to vertically profile the water column. Twenty four casts were carried out in total, including one test station, six as part of the Western Core Box survey (full depth or 1000m), one prior to the acoustics calibration with the rest at target fishing stations, to full depth or 1500m. CTD positions are included in Table 2. CTD profiles were numbered by event number.

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, an oxygen sensor, 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 Win32 version 5.37b (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 wire out, 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 between 30 and 60 seconds after the instrument is deployed, but during JR245 they could take up to 2 ½ minutes to switch on.

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 or to the maximum depth specified. 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 led to no SBE35 readings for the second bottle of the pair.

Bottle firing depths were determined by water sample and calibration requirements. Water samples from 20m was taken from every station cast and most core box casts for chlorophyll, POC and lugols. Salinity samples were taken from 20m and other depth with low vertical salinity gradient to calibrate the CTD conductivity and salinity.

2.4.4 Data acquisition and preliminary processing

The CTD data were recorded using SeaSave Win32 version 5.28e, which created four files:

jr245ctd[NNN].dat	binary data file
jr245ctd[NNN].con	ascii configuration file containing calibration information
jr245ctd[NNN].hdr	ascii header file containing sensor information
jr245ctd[NNN].bl	ascii file containing bottle fire information

where NNN is the CTD number. The *.dat* file was then converted from binary to ascii using the SBE Data Processing software version 5.37b *Data Conversion* module. The output was a file named *jr245ctd[NNN].cnv*. The *Data Conversion* module calculates parameters using the coefficients 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 $T_0 = T_1 + T_2U + T_3U_2 + T_4U_3 + T_5U_4$, where U is the temperature in ˚C.

Conductivity: $$cond = \frac{\left(g + hf^2 + if^3 + jf^4\right)}{10\left(1 + \delta t + \varepsilon p\right)}$$

where *cond* is the conductivity in Sm^{-1}, p is pressure, t is temperature, δ = CTcor and ε = CPcor.

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

Where the temperature, *temp*, is measured in ˚C, *g*, *h*, *i* and *j* are coefficients 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*.

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

where *V*, *B*, *M*, *offset*, *multiplier* and *C*, the calibration constant.

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.

Transmission: $$Light\,transmission = M.output\,voltage + B$$

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

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 *jr245ctd[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 *jr245ctd[NNN]_ctm.cnv*. The correction applied to the CTD data is detailed below:

Corrected conductivity = conductivity + ctm

where

$$ctm = -1 \times \left(\frac{1-5\alpha}{2s\beta + 4}\right) \times ctm_0 + \frac{2\alpha}{s\beta + 2} \times 0.1(1 + 0.006[T - 20]) \times \Delta T$$

and *s* is the sample interval, *T* is temperature, ctm_0 is the uncorrected cell thermal mass, α = 0.03 and β = 7.0.

Finally *WildEdit* was run after an early cast had large pressure spikes. The output is another ascii file, named as *jr245ctd[NNN]_ctmw.cnv*.

2.4.5 SBE35 high precision thermometer

Data from the SBE35 thermometer were usually uploaded after every cast using the *SeaTerm* program. Once the readings had been written to an ascii file (named *jr245sbeNNN.asc*), the file was opened and the contents checked to make sure the correct number of readings had been stored. The memory of the SBE35 was then cleared using the '*samplenum=0*' command. To check that the memory was clear, the command '*ds*' was entered, which displays the number of data points stored in the instrument's memory. This number should be 0.

Once all data had been downloaded and the preliminary processing described above carried out, the directory containing all data for that CTD cast was copied to the Unix system for further processing in mstar.

2.4.6 Salinity samples

At each CTD station 24 niskin bottles were closed at up 8 distinct depths. Up to eight (typically 4-6) salinity samples were taken. Sampling, storage and analytical procedures were as per those described in Section 2.3.4 (Underway).

Once analysed, the conductivity ratios were entered by hand into *jr245_master.xls,* converted to salinities and used for further CTD data processing.

2.4.8 CTD data processing

CTD data were processed using mstar scripts written by Brian King. They were run on a laptop PC (which required minor editing of calls to unix functions to built in equivalent Matlab functions). Some of the navigation pre-processing, written for linux, was not compatible with unix processing so was done using previous Unix and Matlab code and then written across to mstar format. Processing was much faster than on JR239, for unknown reasons though possibly linked to the smaller number of variables in each file.

M_setup_*** - roots and global variables (ship, cruise etc.)

Files in ../ctd relative to processing scripts unless stated

Mstar processing route:

ctd_all_part1 – includes:
msam_01 and **mdcs_01** (these can be created in advance but processing was fast enough for this not to be necessary)
mctd_01 ctd_jr245_002_ctm – > ctd_jr245_002_raw.nc
Reads in CTD *ctm.cnv data and gives it a dataname. No need to tell it how CTD is setup – works that out by comparing .cnv file with list of SBE output variables. Replaces special characters in name such as '/'. Writes list of SBE programs run on data into comments.
mctd_02a ctd_jr245_002_raw.nc (then archived) –> ctd_jr245_002_24hz.nc
Renames variables (from SBE names to usual names, via reference to a .csv file). Write-protects *_raw.nc and copies to *_24Hz.nc which is working version.
mctd_02b ctd_jr245_002_24hz.nc –> ctd_jr245_002_24hz.nc
Applies oxygen hysteresis correction
mctd_02c ctd_jr245_002_24hz.nc -> ctd_jr245_002_24hz_fr.nc

Calls hfallrate, which is a matlab equivalent of loopedit. It creates a NaN/1 flag variable where 1 is good (so variable.*Flag leaves good data). Bad is defined as the initial soak (which it identifies and asks for confirmation), times when the CTD package is above a previously reached depth or when the CTD package speed is <0.25 m/s downwards. It only flags data bad if >=2 consecutive points are considered bad, to allow for noise in the speed calculation at 24Hz. Datacycle for start of downcast is written to dcs_jr245_0nn.nc
mctd_02d ctd_jr245_002_24hz_fr.nc-> ctd_jr245_002_24hz_fr_app2.nc
Applies the fallrate flag to appropriate CTD variables
End of ctd_all_part1

ctdcheckplot245 Program to plot the 24Hz profiles to allow for visual checking before further processing and averaging.

mplxyed Interactive editing if needed, ctd_jr245_002_24hz_fr_app.nc –> ctd_jr245_002_24hz_fr_app.nc

ctd_all_part2

mctd_03_noave ctd_jr245_002_24hz_fr_app.nc –> ctd_jr245_002_1hz.nc + ctd_jr245_002_psal.nc + ctd_jr245_002_24hz_psal.nc
Average to 1hz – used for LADCP processing. Also calculates salinity and adds to 24hz which is used for further processing and averaging (rather than going through 1hz data)
mdcs_02 ctd_jr245_002_psal.nc –> dcs_jr245_002.nc (again)
Finds bottom of cast and adds it to datacycle file (requires pressure spikes to have been dealt with first)
mdcs_03 user input –> dcs_jr245_002.nc (again)
Mlists end of cast to allow user to select, copy and paste the scan number of the end of cast (last good conductivity).
mctd_04 dcs_jr245_002.nc+ ctd_jr245_002_psal.nc–>ctd_jr245_002_2db.nc
Use start, bottom and stop data cycles to split cast and average to 2dbar.
mfir_01 -> fir_jr245_002_bl.nc
Read in .bl file
mfir_02 fir_jr245_002_bl.nc + ctd_jr245_002_1hz.nc -> fir_jr245_002_time.nc
Merge times from CTD into fir file
mfir_03 fir_jr245_002_time.nc+ ctd_jr245_002_psal.nc -> fir_jr245_002_ctd.nc
Merge upcast data into fir file.
mfir_04 fir_jr245_002_ctd.nc-> sam_jr245_002.nc
Pastes fir data into sam file

No winch data was read in

end of ctd_all_part2

ctd_all_part3 – to be run once navigation data has been processed for the day of the cast. Written to loop through all CTDs from the day. Includes:

mdcs_04
Merge CTD times with navigation file to add positions to dcs_jr245_nnn_pos.nc file. Changed to merging with bestnav rather than seapos
mdcs_05
Apply positions to ctd, fir, sal, sam and dcs files
mctd_04depth
mfir_04a
Calculate depth once position known. mfir_04a actually adds depth to the sam file rather than fir files

end of ctd_all_part3

ctd_all_part4– to be run once salinity data are available. Written to loop through CTD casts where bottle files are available. Includes:

msal_01 sal_ jr245_002.txt->sal_ jr245_002.nc
Reads in bottle salinities from csv file (format one row per sample; station,bottle,salinity)
msal_02 sal_ jr245_002.nc-> sam_jr245_002.nc
Paste sal into sam
msbe_01/02, moxy_01/02, mnut_01/02 do same as above for sbe35, oxy and nutrients
msam_oxykg – converts bottle oxygen from umol/l to umol/kg (accidentally in batch file twice but to no consequence
msam_02 sam_jr245_002.nc –>sam_jr245_002_resid.nc
Calculate residuals between samples and ctd bottle averages

2.4.9 CTD calibration

In total, 291 SBE35 temperature data points were recorded, and 99 salinity samples analysed. These were compared with CTD data and, excluding a small number of outlying points, yielded a temperature offset for temperature1 of $\approx 2\times10^{-3}$°C and salinity1 offset of -2×10^{-3} Applying the temperature calibration will thus likely account for the salinity offset and the conductivity will not need to be calibrated. No offset was found for either temperature2 or salinity2.

Table 2 - CTD Calibration

Event	Jday	Time In (GMT)	Lat (S) (deg, min)	Lon (W) (deg, min)	Wout (m)	Chl1	Chl2	POC	Station
1	356	11:45:20	52 15.14	51 24.82	300				Test
20	359	07:03:20	53 42.02	38 12.58	305	4	38	35	TF1
33	360	23:27:00	53 50.76	39 08.60	266				W1.2S
36	361	07:00:51	53 29.58	39 15.05	1000	49	54	65	W1.2N
42	361	21:02:00	53 25.87	38 41.92	1000	35	63	6	W2.2N
46	362	06:59:31	53 47.11	38 35.04	194	9	32	12	W2.2S
53	362	20:10:00	53 42.86	37 57.88	122	23	98	52	W3.2S
55	364	07:00:54	53 21.63	38 04.98	1000	1	25	95	W3.2N
70	365	06:59:40	53 29.46	37 42.44	1500	3	11	39	TF2
75	1	07:01:00	53 59.63	36 22.24	196	26	48	30	TF3
76	1	12:47:40	54 09.52	36 41.59	40				AC
78	2	07:14:35	53 59.63	36 22.24	199	13	17	91	TF3
86	3	07:27:47	54 06.05	35 27.34	315	40	62	47	TF4
90	3	14:30:25	54 05.99	35 27.36	150				TF4[1]
94	4	07:02:03	54 15.33	35 21.31	250	75	94	16	TF5
99	5	15:50:39	54 37.27	34 48.31	720	19	37	56	TF6
104	6	09:05:27	54 31.85	35 16.24	123	20	70	14	TF7
112	7	07:08:08	54 33.49	35 35.25	246	45	57	92	TF8
118	8	07:01:08	53 37.40	36 20.65	835	43	60	64	TF9
126	9	07:09:18	54 16.16	35 52.05	209	59	96	15	TF10
132	10	07:22:00	53 53.78	36 34.38	197	85	87	18	TF11
137	11	07:50:31	54 06.03	36 14.98	260	31	46	22	TF12
140	12	13:54:15	53 32.40	38 06.57	1500	79	81	61	TF13
150	13	11:09:38	53 45.03	38 59.01	253	41	58	72	TF14
161[2]	15	02:20	54 03.03	36 10.19	Surface	33	73,77	68[3],89	TF15
Blanks[4]								50, 86,21	

[1] Attempted CTD through a krill swarm
[2] Underway water sample to match target fishing event 161
[3] only 605 ml filtered
[4] 625 ml aliquots of MQ water filtered onto same batch of ashed GF/F filters to obtain a baseline value

Table 2. 'Wout' is the wireout at the bottom depth of the CTD. 'Station' refers to Western Core Box (W day.leg), Target Fishing (TF) and acoustics calibration (AC) CTDs. Numbered notes are found at the end of the table.Filtration of 20 m depth CTD water samples for Chl *a* (two 260 ml aliquots) and POC analysis (one 625 ml aliquot). Note that a 260 ml subsample was also preserved in 2% Lugols solution from 20 m depth at each of these stations. The 47 mm Filters were frozen in green 2ml ependorfs.

3 Acoustics

Sophie Fielding, Peter Enderlein

3.1 Acoustic instrumentation

3.1.1 Introduction

The EK60 was run throughout JR245 to collect information on the horizontal and vertical distribution of krill and to derive estimates of krill biomass for the Western Core Box and each iron AFI station.

3.1.2 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

3.1.3 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 1000 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 - 500 m (38 kHz), 0 – 500 (120 kHz) and 0 – 500 (200 kHz) data only (data from greater depths are available from the raw files)
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 JR245, all echolog data were saved in the folder JR245\ek6. All files were prefixed with JR245. Calibration data were additionally saved to the calibration folder.

EK60 (ER60) settings
The EK60 was calibrated on the 1st January 2011, seven days into the cruise. However it was run with standard settings all the way through the cruise. Table 3 lists the settings the EK60 was run with during JR245. The EK60 settings were not updated following calibration – it is assumed that calibrated settings will be used in post-processing only.

Table 3 - EK60 settings

Variable	38 kHz	120 kHz	200 kHz
Ping interval (per sec)	2	2	2
Salinity (PSU)	33.66	33.66	33.66
Temperature (°C)	2.74	2.74	2.74
Sound velocity (m/s)	1459	1459	1459
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)	10.396	28.68	41.99
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)	26.00	21.38	23.95
Sa correction (dB)	-0.52	-0.39	-0.39
Angle sensitivity along	22	21	23
Angle sensitivity athwart	22	21	23
3 dB Beam along	7.03	7.48	6.55
3 dB Beam athwart	7.00	7.48	6.55
Along offset	-0.06	-0.12	0.14
Athwart offset	-0.06	-0.07	-0.11

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)

3.2 EK60 Calibration

An acoustic calibration was carried out in Stromness Harbour, South Georgia on 01/01/2011. The ship was anchored, its movement balanced by minimal DP usage. The EK60 and EA600 were triggered through the SSU and the 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 was undertaken immediately prior to calibration. Temperature and salinity were averaged from 6 (depth of the transducers) to 27 m (depth of the calibration sphere) and were 2.74°C and 33.66 PSU resulting in a speed of sound constant of 1459 m/s (Francois and Garrison, 1982). The speed of sound was updated into the ER60 software.

The calibration was interrupted by a brown out shortly after locating the 38 kHz sphere under the transducers at 14:45 (GMT). Power was resumed and the calibration was restarted at 15:30 (GMT).

The 38 kHz calibration commenced at 15:30, the 120 kHz at 16:07 and the 200 kHz at 17:21. All calibration data was saved to both the calibration folder and the JR245 data folder.

Each transducer was calibrated at the settings used throughout the cruise. Parameters following two different procedures for calibrating are given in Table 4 (on-axis calibration) and Table 5 (lobe calibration).

Table 4 - Echoview calibration

Parameter	38kHz	120 kHz	200 kHz
Alpha (dB/km)	10.396	28.68	41.99
Theoretical TS (dB)	-33.70	-40.3	-44.85
TS gain	25.55	21.94	23.88
Sa correction	-0.04	0.02	0.05

Table 5 - ER60 Calibration

Date (dd/mm/yyyy)	01/01/2011	01/01/2011	01/01/2011
Location	Stromness	Stromness	Stromness
Time (GMT)	15:30	16:07	17:21
Frequency (kHz)	38	120	200
GPT serial no	009072033fa5	00907203422d	9072033191
Comments	EA600 on	EA600 on	EA600 on
Water temperature (°C)	2.74	2.74	2.74
Salinity (PSU)	33.66	33.66	33.66
Sound velocity (m/s)	1459	1459	1459
Absorption coeff (dB/km)	10.396	28.68	41.99
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)	26.00	21.38	23.95
Original Sa correction (dB)	-0.52	-0.39	-0.26
Theoretical TS of sphere (dB)	-33.70	-40.30	-44.85
New gain (dB)	25.62	22.09	24.07
New Sa correction (dB)	-0.51	-0.40	-0.29

Data processing in echoview
Post-processing was undertaken in Echoview. One template EV file was set up using the compressed data files with the following operators.

Table 6 - Echoview operators for EV template file

Variable name	Operator	Operand 1	Operand 2
F resampled even	Resample by number of pings	Fileset 1 Sv raw pings T?	
F bad data	Region bitmap	F resampled even	
F surface bottom	Line bitmap	F resampled even	
F all bad	And	F bad data	F surface bottom

F bad masked	Mask	F resampled even	F all bad
F resample 1 ping	Resample by number of pings	F bad masked	
F resample original	Resample by number of pings	F resample 1 ping	
F dropout range	Data range bitmap	F resample original	
F no dropout	Mask	F bad masked	F dropout range
F noise	Data generator	F no dropout	
F-noise	Linear minus	F no dropout	F noise
F convolute	3x3 convolution	F-noise	
F spike detect	Minus	F-noise	F convolute
F spike mask	Data range bitmap	F spike detect	
F-noise-spike	Mask	F-noise	F spike mask
F-500m	Resample by distance interval	F-noise-spike	

3.3 Data coverage

Acoustic transects

Acoustic transects were run at each station at least once every 5 hours, but typically more to generate information on the vertical distribution of krill over a 24 hour period for input into. Each transect consisted of a 10 nmile run at 10 knots down or upwind (or swell if more influential) with the mid-point as the station. Transect times and names are given in Table 7.

Table 7 - Transect times, directions and speeds.

Transect	Date	Start time (GMT)	End time (GMT)	Comments
TF1_1	24/12/2010	21:00	22:01	
TF1_2	25/12/2010	02:51	03:51	
TF1_3	25/12/2010	04:03	05:05	
TF1_4	25/12/2010	09:51	10:50	
TF1_5	25/12/2010	15:40	16:47	
TF2_1	30/12/2010	21:00	22:15	Broken off to fish
TF2_2	31/12/2010	02:23	03:21	
TF2_3	31/12/2010	03:40	04:41	
TF2_4	31/12/2010	04:51	05:52	
TF2_5	31/12/2010	09:40	10:38	
TF2_6	31/12/2010	15:46	16:43	
TF3_1	01/01/2011	01:57	02:57	
TF3_2	01/01/2011	03:08	04:30	
TF3_3	01/01/2011	04:39	05:30	
TF3_4	01/01/2011	08:02	09:02	
TF3_5	01/01/2011	21:20	22:22	
TF3_6	02/01/2011	09:12	10:12	
TF3_7	02/01/2011	14:50	15:50	
TF4_1	03/01/2011	05:26	06:26	
TF4_2	03/01/2011	09:33	10:33	
TF4_3	03/01/2011	15:32	16:32	
TF4_4	03/01/2011	16:39	17:42	
TF4_5	03/01/2011	17:49	18:51	
TF4_6	03/01/2011	19:05	21:08	Broken off to fish
TF5_1	04/01/2011	23:19 (03/01)	00:19	

TF5_2	04/01/2011	00:30	01:30	
TF5_3	04/01/2011	01:42	02:42	
TF5_4	04/01/2011	02:52	03:52	
TF5_5	04/01/2011	03:58	05:00	
TF5_6	04/01/2011	10:43	11:42	
TF5_7	04/01/2011	16:27	17:28	
TF6_1	05/01/2011	20:42	21:42	
TF6_2	05/01/2011	21:46	22:51	
TF8_1	06/01/2011	18:46	19:48	
TF8_2	06/01/2011	19:54	20:57	
TF8_3	06/01/2011	21:02	22:02	
TF8_4	06/01/2011	22:07	23:07	
TF8_5	07/01/2011	02:00	03:00	
TF8_6	07/01/2011	03:04	04:06	
TF8_7	07/01/2011	04:11	05:12	
TF8_8	07/01/2011	05:17	06:18	
TF8_9	07/01/2011	09:01	10:02	
TF8_10	07/01/2011	14:00	15:00	
TF9_1	08/01/2011	03:27	04:27	
TF9_2	08/01/2011	04:33	05:34	
TF9_3	08/01/2011	09:22	10:22	
TF9_4	08/01/2011	15:57	16:58	
TF10_1	09/01/2011	03:52	04:52	
TF10_2	09/01/2011	04:58	06:02	
TF10_3	09/01/2011	08:21	09:21	
TF10_4	09/01/2011	09:30	10:30	
TF10_5	09/01/2011	11:00	12:02	
TF10_6	09/01/2011	12:08	13:08	
TF11_1	09/01/2011	17:39	18:39	
TF11_2	09/01/2011	18:46	19:46	
TF11_3	10/01/2011	05:36	06:37	
TF11_4	10/01/2011	09:20	10:20	
TF11_5	10/01/2011	14:28	15:30	
TF13_1	12/01/2011	19:49	20:48	
TF13_2	12/01/2011	20:58	22:17	
TF13_3	12/01/2011	22:32	23:32	
TF14_1	13/01/2011	16:27	17:29	
TF14_2	13/01/2011	17:35	18:41	
TF14_3	13/01/2011	18:45	19:47	
TF14_4	13/01/2011	19:52	20:53	
TF14_5	13/01/2011	21:44	22:45	
TF14_6	13/01/2011	22:52	23:54	

Target fishing
It became apparent early on that any fishing for krill needed to be on targets. Therefore all K-NET fishing was on krill swarm targets, using the normal strategy of heading downwind searching for targets. Once found, the ship sails on for ½ mile more and then turns ready to shoot the net. This strategy worked well at most sites, although the net itself only successfully fished when in the surface 50 m.

Table 8 - K-NET target hauls times and comments.

Event No	Date	In water (GMT)	On deck (GMT)	Depth (m)	Krill
15	24/12/2010	20:06	20:26	55	Few
16	24/12/2010	22:20	22:42	66	Few
17	24/12/2010	23:17	23:41	50	Few
18	25/12/2010	00:37	00:57	25	AFI
19	25/12/2010	01:17	01:44	27	AFI-C
24	25/12/2010	19:59	20:19	45	Few
25	26/12/2010	02:17	02:44	38	Few
34	27/12/2010	02:53	03:21	40	AFI
35	27/12/2010	03:49	04:16	40	AFI-C
44	28/12/2010	01:24	01:55	50	AFI
45	28/12/2010	02:45	03:10	50	AFI-C
54	28/12/2010	21:17	21:54	50	AFI/-C
67	30/12/2010	22:33	22:55	60	AFI
68	30/12/2010	23:22	23:41	45	AFI-C
69	31/12/2010	01:07	01:30	30	AFI
74	01/01/2011	00:19	00:45	50	AFI/-C
81	02/01/2011	20:14	20:48	50	No
82	02/01/2011	23:45	00:21	50	No
83	03/01/2011	00:25	00:36	25	No
84	03/01/2011	01:28	02:04	40	No
85	03/01/2011	04:20	05:03	100	No
91	03/01/2011	19:54	20:19	90	No
92	03/01/2011	21:44	22:01	20	AFI
93	03/01/2011	22:20	22:36	40	AFI-C
102	05/01/2011	23:49	00:17	50	No
103	06/01/2011	00:50	01:03	35	Abort
107	06/01/2011	16:25	16:40	45	AFI
108	06/01/2011	16:40	17:03	35	AFI-C
109	06/01/2011	17:32	18:00	40	AFI-C
110	07/01/2011	00:12	00:55	26	AFI
111	07/01/2011	01:02	01:16	30	AFI-C
115	07/01/2011	22:57	23:38	60	No
116	08/01/2011	00:47	01:47	25	AFI/-C
117	08/01/2011	02:27	02:52	30	AFI-C
123	09/01/2011	00:53	01:20	55	AFI
124	09/01/2011	01:47	02:10	50	AFI/-C
125	09/01/2011	02:40	03:04	40	AFI/-C
127	09/01/2011	23:07	23:18	20	No
128	10/01/2011	00:20	00:50	40	AFI
129	10/01/2011	02:29	02:55	40	AFI
130	10/01/2011	03:47	04:06	40	AFI/-C
131	10/01/2011	04:43	05:10	40	AFI/-C
135	10/01/2011	22:34	23:05	40	No
136	10/01/2011	23:48	00:09	30	No
144	13/01/2011	00:30	00:44	30	No
145	13/01/2011	01:12	01:29	35	AFI
146	13/01/2011	02:14	02:28	35	AFI
147	13/01/2011	03:52	04:16	60	AFI-C
148	13/01/2011	04:39	05:00	60	AFI-C

149	13/01/2011	05:23	05:43	70	AFI-C
154	14/01/2011	01:53	02:19	40	AFI
155	14/01/2011	02:46	03:20	65	No
156	14/01/2011	04:27	04:54	50	AFI-C
161	15/01/2011	00:10	00:33	50	No

3.4 Problems encountered

The EK60 was initially set to logging the top 700m of the water column and sporadically crashed. Around the 1st January it was noted that the EK60 particularly crashed when the network was in use (catching up with EK6 process files for example). Doug IT man examined the network ports and found that the network was working off a 10 mbs network, not sufficient to adequately run the EK60. The network hub (10 mbs hub) was switched to a netgear switch (100 mbs) and the network speed increased to 100 mbs. The EK60 data was set to logging to 1000m and no further problems occurred. Interference from other acoustic instruments was at a minimum with respect to the other scientific instruments, although the Doppler logger was run throughout the cruise causing noise in the 120 kHz data whenever the water depth was less than 250 m.

4 Gear cruise report JR 245/246/247

Peter Enderlein & Natalie Ensor

4.1 K-Net

After the incident with the stern gantry, which left the JCR with no gantry system to deploy any kind of net over the stern; the UOR block, a metering sheave, a small depth sounder and two purpose built 1 m^2 nets made out of RMT mesh were sent south as possible fishing equipment. Everything arrived in time to meet JCR and after investigating what equipment was available and rigging the net up it was time to decide on how to go fishing this season for krill.

After discussions with the ship, it was decided that the UOR block would be hoisted into place (between the two trawl posts), using the Effer crane and hung over the stern using wires (which were load tested to 4to). These were run through shackles on the trawl posts and then fixed around the fairleads. Finally on each side two safety wires were attached to the main eye of the wires; which were secured to 1ton deck eyelets.

Figure 1 - Putting the block into place using the Effer crane

Figure 2 - The whole system assembled

The setup was then load tested with using railway wheels, weighing 2tonnes. Having the UOR block rigged in line with the Biowire, allowed us to go fishing using the DWNM system on the biowire. The UOR block was big enough to provide more than the required minimum bending radius for the

Biowire. Once this test was completed we had two deployments to come up with a safe and workable deployment and recovery procedure. From these test deployments, it was discovered that a team of 2-3 people are needed in the gantry area (attached to the ship by harnesses and wearing life jackets) and 1-2 people down the side of the gantry area. The agreed procedure uses a lazy decky rope attached to the cod end, which is used for recovery using the Gilson winch.

Once the method had been decided on, we had 4 deployments to train people on how to deploy and recover the net using this method.

4.1.1 Deployment Procedure

To begin with, deployment was carried out by 2 people in the gantry area, but we discovered that it is much simpler and less likely to entangle the net if 3 people deploy the net (pictures below are from early deployments with 2 people only). One person guides the DWNM system along the deck as the biowire slack is retrieved and carefully guides the DWNM up to the block, ready for the net to be deployed. Whilst this is being done, another 2 people guide the net and depressor to the edge of the stern.

The cod end is deployed first, by a person down the side of the gantry using the lazy decky. Next the depressor gets deployed, followed by lowering the net frame with a piece of rope. The net is now deployed and ready to catch Krill.

Figure 3 - K- Net ready for deployment

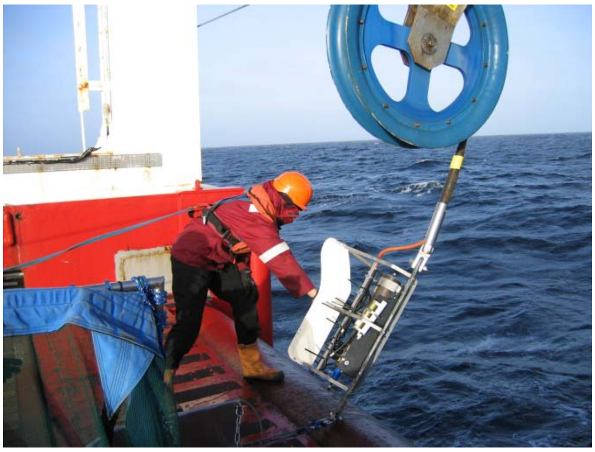


Figure 4 - Guiding the DWNM up to the block

Figure 5 - Deployment of the net, Depressor just deployed

Figure 6 - Successful deployed K-Net ready to go

4.1.2 Recovery Procedure

Once again, recovery was originally performed by 2 people, but it has been discovered that it is easier with 3 people (the pictures below only show 2 people recovering the net, from the earlier recoveries). To recover the net safely and quickly it was decided that a lazy decky with the Gilson winch would be used. When the net is bought up the surface, the biowire is pulled in so that the DWNM in just below the block. At this point one person on the port side of the block uses a hook to grab hold of the lazy decky. This is then pulled in and the Gilson winch wire was attached to the lower part of the lazy decky. The upper part is then passed over the one of the people on the starboard side.

The Gilson winch is then used to recover the cod end first. Once the cod end up to the frame is on deck the winch driver slackens the bio wire to allow the two people on the starboard side of the block to pull the DWNM system inboards, using the upper part of the lazy decky handed over earlier. Once the DWNM system is sufficient inboards one person grabs hold of the cross itself and pulls it into the centre of the gantry area and the catch is retrieved from the cod end.

Figure 7 - Using the hook to get hold of the lazy decky

Figure 8 - Attaching the Gilson winch wire to the lazy decky

Figure 9 - Pulling the DWNM cross in.

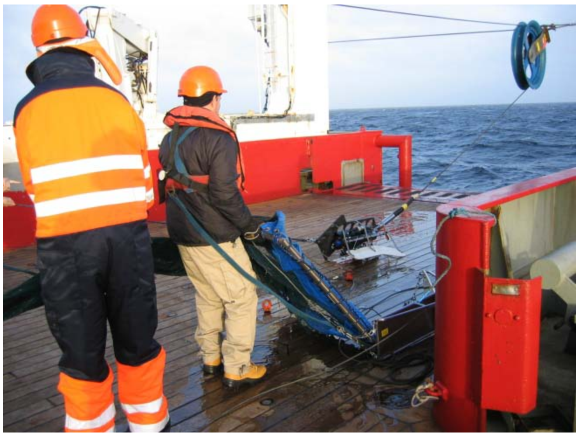


Figure 10 - Pulling the net in.

Overall we have had very few problems with the K-Net system, the main problems occurred if the depressor got entangled during deployment which most of the time was easily fixable. The other problems encountered were holes being made in the net through the self locking clasps on the cod end or due to wear from being dragged up the aft of the ship, these were easily fixable and we did not need to use the spare net. However we did had to change the cod end once, due to it splitting down a seam on one of the deployments; this could have been due to the amount of organisms we caught (it went through a very large swarm).

4.1.3 Krill Net success

Below is a table showing all the hauls performed with the K-net and if the deployment was successful in catching krill (not including method and training deployments).

Table 9 - Krill Net Succes Rate

Event Number	Krill Caught (Yes or No)
15	Yes
16	Yes
17	Yes
18	Yes
19	Yes
24	Yes
25	Yes
34	Yes
35	Yes
44	Yes
45	Yes
54	Yes
67	Yes
68	Yes
69	Yes
74	Yes
81	No
82	No
83	No
84	No
85	No

91	No
92	Yes
93	Yes
102	No
103	No
107	Yes
108	Yes
109	Yes
110	Yes
111	Yes
115	Yes
116	Yes
117	Yes
123	Yes
124	Yes
125	Yes
127	Yes
128	Yes
129	Yes
130	Yes
131	Yes
135	No
136	No
144	No
145	Yes
146	Yes
147	Yes
148	Yes
149	Yes
154	Yes
155	No
156	Yes
161	Yes

Overall we had 54 net deployments with a fishing deployment success (not including the 6 method or training deployments) of 78%

4.2 Towed Bongo Net

The towed bongo net with a 45kg cast iron depressor was set up and deployed 3 times on the last day of science; this was to collect different organisms. The net was deployed using a very similar procedure to the 'K' net, only the number of people and the attachment of the lazy decky changed. For the bongo net, the best deployment/recovery method involved a lazy decky attached to the main frame and the cod end. For deployment the cod end was deployed first, then the main frame was picked up by the wire and the heavy depressor was deployed by a person, using a steady line. When recovering the net, the lazy decky was pulled in first (using a boat hook) but here the upper part was attached to the Gilson winch and the lower part passed across. The Gilson winch then pulled in the frame with the weight in and the cod ends being pulled in by hand.

Figure 11 - The towed bongo net assembled

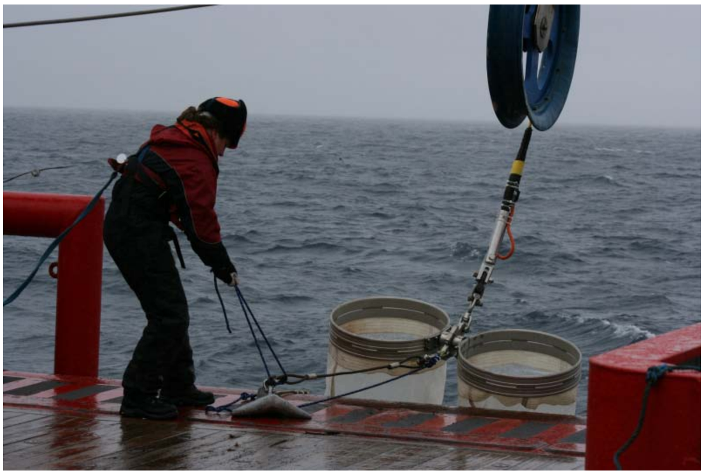


Figure 12 - Deployment of the bongo net – the depressor being deployed

4.3 Down Wire Net Monitor

During this cruise the DWNM had been used on the 'Biological wire' for the K-Net. This was the third season of the new developed DWNM system. The Bio wire had to be terminated at the beginning of the cruise as usual, but this year we used a heat jacket set to 40 degree Celsius for the electrical termination, warming the potting component to the right temperature to cure in time. This was a real improvement to previous years when the doors to the scientific workshop had to be closed and a little fan heater had to be blowing onto the termination to warm it up sufficiently. With the new heat jacket the cure time is coming down to 6 hours and by that time the potting component is fully cured. The DWNM deck unit was set up as usual and initially the serial card in the PC was causing problems again. This was overcome by using a USB to serial converter on one of the back USB ports for serial out to SCS logging and using the PC serial port 1 for the connection between the PC and the DWNM modem. This setup was working very well and we had no further coms problems.

The DWNM UW-unit was used on the normal Net-cross, to which the K-Net was shackled on. We used the RMT8 Unit1 for all deployments and it worked without any problems. Because of the nature of the deployments and recoveries of the K-Net – dragging it along the deck - only the depth sensor, and the TC sensors where put onto the cross to minimize wear and tear as well as potential damage to them. Initially there was a problem with the TC sensor cables – the new ones where not wired up correctly and have to be replaced, also they had no locking sleeves put on. Once it was swapped to the old ones from last year, everything worked fine. Despite the rough handling during the deployments and recoveries, the UW-unit and the sensors worked perfectly fine.

As the DWNM system was not used as much as on more “usual” cruises, the time was used to upgrade the LabView user Interface and the appearance of the GUI. The following new functions where implemented:

The logging locally to the PC function was enabled. By the press of the button the program is now logging locally to the PC. This can be used in conjunction with the logging to the SCS or independently. The message board will show which button is switched on (see also point 2). In the moment the path is set to: C:\DWNM\Data\ and the file name is set to DWNMdataYYYYMMDDHHMM.txt.

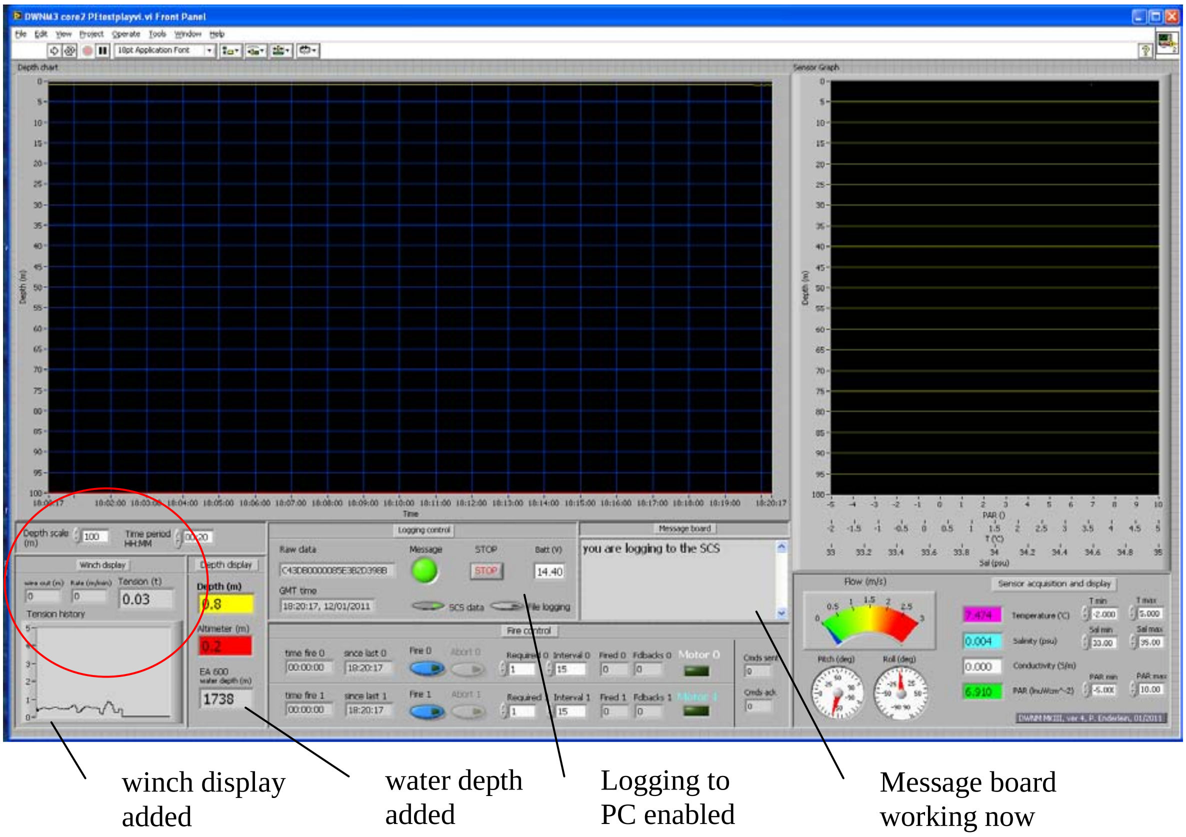
The calibration data are now stored under the same path as the local stored files in C:\DWNM\Data\ and the file name is set to calDD_MM_YY_HH_MM.txt
The message board is working now. A total of 12 messages are set up. These include information messages like the logging information: you are logging locally to the PC, and warning messages like: your pitch is beyond recommended level, check UW unit. The information messages are just that and no action should be taken. The warning messages indicate that something is wrong with the system and they include a suggestion of where the problem may be. Also when an error message comes up, the message board starts flashing red, to warn the user that something is wrong. The flashing can be stopped through acknowledging the message by a single click in the message board. The message will stay in the message board.

Through the TCP port of the PC the program is now capable of reading any SCS string of jrlb, port 8091. At the moment the program is reading and displaying the EA600 depth reading and the winch information: wire out, rate and tension, regardless which wire is used. Therefore it works with both wires: the Biowire and the 17mm wire. When the PC is not connected to any TCP port a error message will appear on the main screen pointing out the problem. By clicking “Continue” the program will be fully usable, but obviously no winch data and no EA600 water depth data can be displayed.

The GUI went through a major rearrangement of the different controls and displays. All are now in logical groups and labelled. As mentioned above the EA600 depth reading is now displayed in the depth display. For the winch information a new winch display was created showing wire out, rate, tension and a tension history chart.
The new name of the Front Panel is: DWNM3 core4.vi; all old versions are still in the same directory. The shortcut on the Desktop was updated and linked to the latest version. The new name is DWNM3. Also the icon was updated, showing a screenshot of the latest GUI.

All the implementations have been copied onto the Legwork data drive and the spare back up PC has been updated. This includes the .vi program, the data path and the shortcut link on the desktop. It should be therefore “hot swappable” with the main PC, but this was not tested.

Figure 13 - DWNM application improvements



4.4 DWCS – Lasers

We brought the 2 new Lasers for the DeepWaterCameraSysytem (DWCS) with us, which we could not test and assemble in HQ, due to time restrictions. Originally the tests where planned for the sea trials, but again, due to the Gantry issue, the sea trails had to be cancelled. So initially the new UW-housing was mounted empty onto the CTD frame for 3 test deployments. They included a cast down to 1000m. As these tests where successful, we then assembled the whole Laser system, consisting of the UW-housing, the cable and the two Lasers. The system was then mounted again onto the CTD frame for further test deployments. Three further cast where conducted successfully with a maximum depth of 1500m. A final test was conducted to test the endurance of the battery pack of the Lasers. For this test the Lasers where strapped onto their housing and placed into the sink of the science workshop, filled with cold fresh water. The batteries lasted for a minimum of 48 hours – far longer than expected. It has to be said, that this was a test in water temperatures of about 13-15 degree Celsius. When it comes to deployments in Antarctic waters with temperatures of about freezing, far shorter battery life time has to be expected. It can be expected to lose about 50% of the battery capacity. Recharging of the discharged battery pack took less 03:30 hours.

Figure 14 - The 2 Lasers with their battery pack mounted on the CTD frame

5 Western Core Box

Sophie Fielding, Hugh Venables, Peter Enderlein, Natalie Ensor, Gabriele Stowasser, David Connor & Mike Pinnock

5.1 Narrative

The Western Core Box (WCB) survey was run in the normal west to east direction. W1.1 was started at the southern end at 08:58 on Boxing Day (26/12/2010). The sea was reasonable and there was little dropout. XBTs were run (at 7 knots) through the first transect (at 10 knots) and completed. At the end of the second transect (W1.2) a GO-FLO and SAPS station was run as well as the traditional shallow water CTD, before a night of target fishing using the krill net (K-NET). The deep CTD was also run immediately prior to commencing the second transects. The second (W2.1 and W2.2) set of transects were run successfully followed by target fishing and night CTDs. The third (W3.1 and W3.2) set of transects were completed and the shallow CTD with one K-NET before the weather got up and ships activities were suspended due to swell and wind. As a result the ship was hove to on the 29/12/2010. The fourth transect, and the deep CTD from transect 3 were undertaken on the 30/12/2010 when the seas had calmed down. All instruments performed well, with only a crash in the SCS system immediately prior to W4.2 resulting in the loss of some EK60 data at the start of the transect. In addition at 18:10 the ship slowed to recover the iron fish for some maintenance (damage from kelp). WCB XBTs, CTDs and K-NET stations are listed below.

Table 10 - Western Core Box events and station listing

ID	Event no	Date	Start time (GMT)	End time (GMT)
XBTs				
W1.1	26	26/12/2010	08:58	
W1.1	27	26/12/2010	10:07	
W1.1	28	26/12/2010	11:18	
W1.1	29	26/12/2010	12:22	
W1.1	30	26/12/2010	13:30	
W2.1	37	27/12/2010	09:26	
W2.1	38	27/12/2010	10:34	
W2.1	39	27/12/2010	11:42	
W2.1	40	27/12/2010	12:48	
W2.1	41	27/12/2010	13:56	
W3.1	47	28/12/2010	09:05	
W3.1	48	28/12/2010	10:10	
W3.1	50	28/12/2010	11:24	
W3.1	51	28/12/2010	12:28	
W3.1	52	28/12/2010	13:34	
W4.1	56	30/12/2010	09:10	
W4.1	57	30/12/2010	10:15	
W4.1	58	30/12/2010	11:28	
W4.1	59	30/12/2010	12:34	
W4.1	60	30/12/2010	13:40	
W4.2	61	30/12/2010	14:50	
W4.2	62	30/12/2010	15:58	
W4.2	63	30/12/2010	17:06	
W4.2	64	30/12/2010	18:18	
W4.2	65	30/12/2010	19:25	

CTDs				
W1.2S	33	26/12/2010	23:29	23:57
W1.2N	36	27/12/2010	07:00	07:53
W2.2N	42	27/12/2010	21:00	21:57
W2.2S	46	28/12/2010	07:00	07:25
W3.2S	53	28/12/2010	20:11	20:35
W3.2N	55	30/12/2010	07:00	07:52
K-NET				
W1	34	27/12/2010	02:53	03:23
W1	35	27/12/2010	03:51	04:20
W2	44	28/12/2010	01:25	01:57
W2	45	28/12/2010	02:45	03:12
W3	54			
W3				
W4				

6 Krill length frequency, maturity stage and shape

Sophie Fielding, Gabriele Stowasser and Natalie Ensor

6.1 Introduction

Antarctic krill (*Euphausia superba*) were sampled to determine the variation in the structure of the population around South Georgia and to provide parameters required in the target strength model for krill biomass estimation.

6.2 Methods

Krill samples were taken from K-NET samples where there were sufficient numbers of krill to select 100 decent state specimens for length frequency, maturity and krill shape photographs. Krill were laid out on black plastic boards (in pre-drilled grooves) and photographed using a Nikon DX3 with two flash guns on a stand (Photograph). The same krill were then measured for length and staged. Krill total length was measured, 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 millimetre (Morris et al. 1988). Maturity stage was assessed using the scale of Makarov and Denys with the nomenclature described by Morris et al. (1988).

6.3 Data

Krill length frequency data were input into a spreadsheet on the L drive “JR245_krill_length_frequencies.xls. The Net event numbers from which krill were measured and whether they were photographed is identified in Table 11 with the mean length of those events.

Table 11 - Krill length frequency mean length per station

Event Number	Station	Photo	Mean Length (mm)
19	TF1	N	46.58
34	WCB	N	47.91
44	WCB	N	44.49
54	WCB	N	42.97
67	TF2/WCB	Y	37.68
69	TF2/WCB	Y	41.73
74	TF3	Y	38.43
92	TF5	Y	35.03
107	TF8	Y	38.28
110	TF8	Y	39.36
116	TF9	Y	42.17
123	TF10	Y	37.15
127	TF11	Y	41.14
145	TF13	Y	35.95
148	TF13	Y (1 board only)	54.19
154	TF14	Y	46.57

The krill length frequency pdf for the whole cruise, the western core box area, west South Georgia (Ev 19, 34-69, 145, 154), central north South Georgia (Ev 74, 116, 127) and eastern South Georgia (Ev 92, 107, 110, 123) are shown in Figure 15 as well as the pdf of all krill measured during the cruise (except Ev 148). A total of 62.30 m of krill were measured.

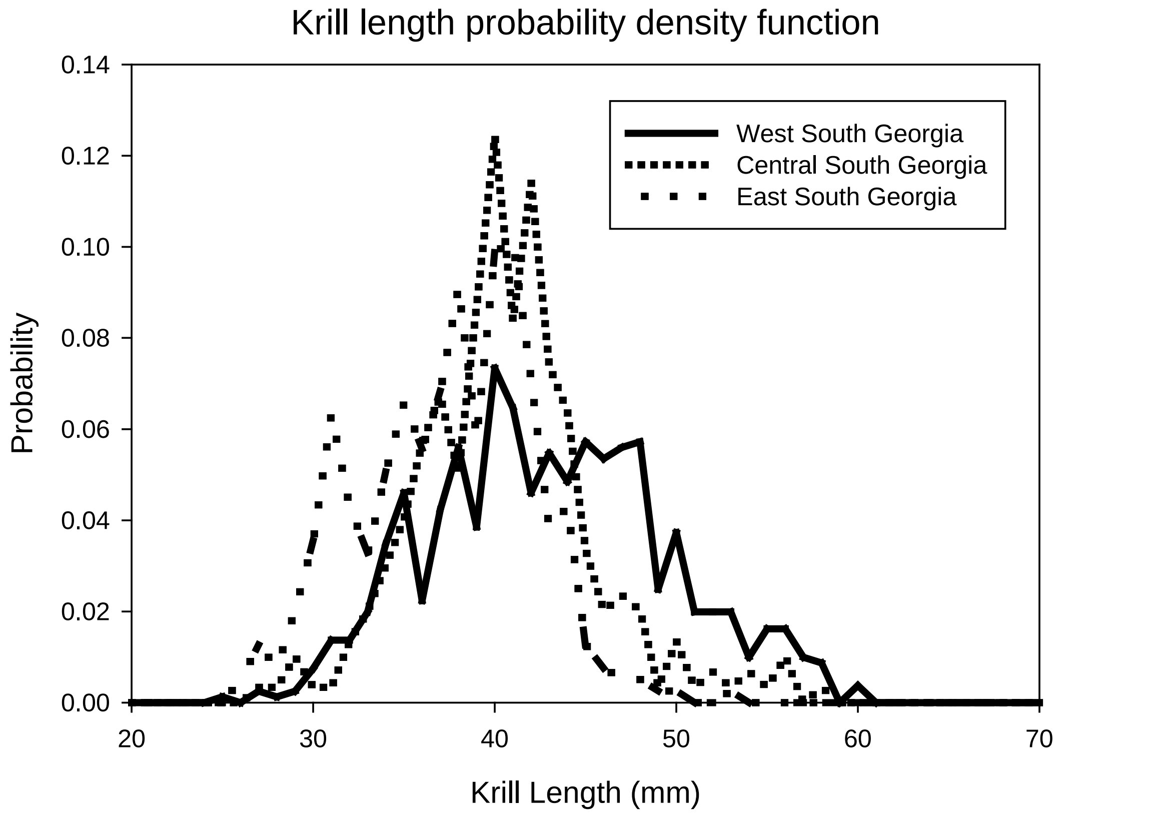


Figure 15 - Krill length probability density function from stations in the West, Central north and East South Georgia

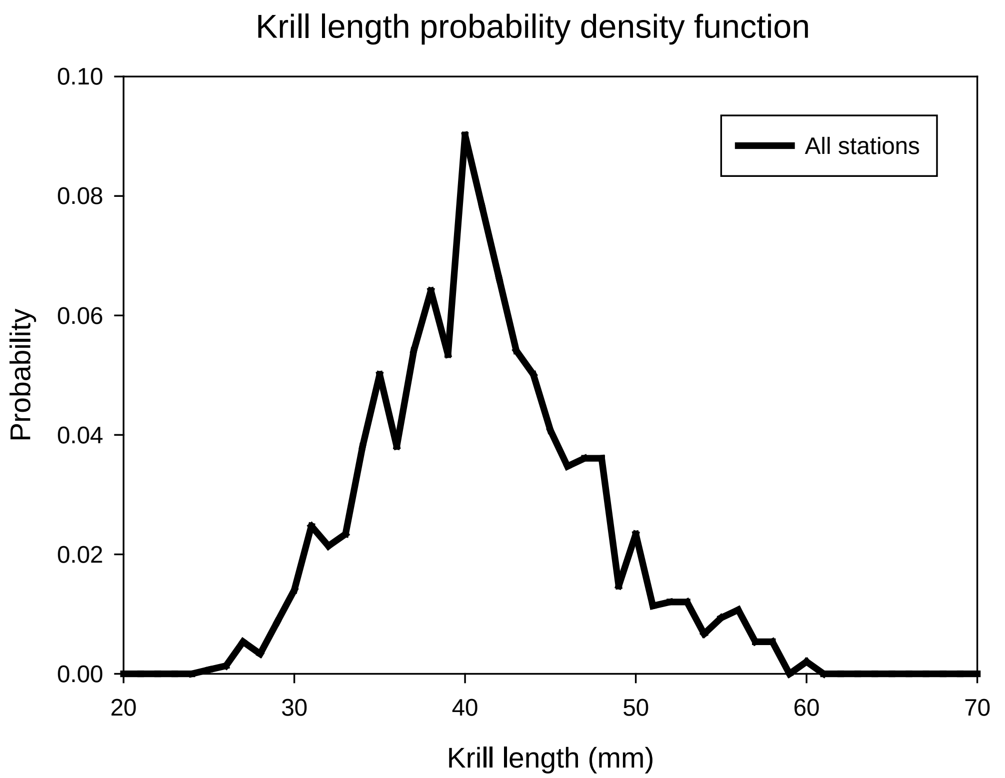


Figure 16 - Krill length probability density function from all stations.

7 Energetics – Lipids – Genetics of krill

Gabriele Stowasser, Sophie Fielding, Will Goodall-Copestake

Food quality has fundamental implications for the ecology of all species and yet few data exist in the literature concerning the energy content of fish and crustaceans from the Southern Ocean. The energy content of prey is a key factor controlling the structure of food webs as well as behavioural traits such as the proportion of time higher predators may spend foraging versus socialising or resting. The energy density of prey items can vary substantially between species as well as their being differences within species. These variations have been attributed to differences in relative status (size, age, reproductive state) and/or seasonal or geographical differences and influences. The aim during this cruise was to sample various sizes and life stages of Antarctic krill (*Euphausia superba*) and other prominent prey species of the Scotia Sea (e.g. *Themisto gaudichaudii, Salpa thompsoni*). Due to gear restrictions on this cruise however (i.e. net mesh size) we were only able to sample *E. superba* and *T. gaudichaudii* in numbers sufficient for comparative analysis. Ten specimens *of E. superba* were collected at each station and all specimens of *T. gaudichaudii* were sampled (see Table 12). Samples were bagged in batches of ten and frozen at -20°C prior to analysis in the laboratory at BAS.

In addition *E. superba* were collected for lipid and fatty acid analysis to determine the food availability and trophic niche of krill at each site. The use of fatty acids as biomarkers is based on the assumption that many fatty acids in the marine environment, particularly polyunsaturated fatty acids can only be biosynthesized by certain bacteria, phytoplankton and macroalgae species. They become essential dietary components to higher trophic levels and can therefore be useful as dietary tracers in food web analysis. Lipid analysis will therefore provide us with complimentary information regarding the quality of krill as food for higher predators. Where available, *E. superba* were sampled from the same events as those sampled for energetic analysis. Samples were bagged in batches of ten and frozen at -80°C prior to analysis in the laboratory at BAS.

A further aim during this cruise was to sample multiple krill species for evolutionary genetics research projects based at BAS Cambridge, where DNA would be extracted from the krill and multiple genetic loci PCR amplified and sequenced. The resulting sequence information will be used to start building a multi-gene molecular phylogeny of krill, the aim of which is to resolve the contradictions and weakly resolved nodes that occur in krill molecular phylogenies produced to date. When large sample sizes are available, DNA sequence information will be used for population-genetic historical demography analysis. These analyses generate historical trajectories of krill population size through time that can be compared with existing trajectories for *E. superba* and with paleo-environmental data (e.g. climate change inference) so that we can build up a picture of how krill communities (as opposed to just single species) may have changed in response to glacial-timescale climate change. Two sample-sets of 50 specimens of *E. superba* were collected from two contrasting areas in South Georgia waters to test for possible differences in population structure within the same year of recruitment. Furthermore *Themisto gaudichaudii* was sampled for genetic analysis at several stations (Table 12). In South Georgia waters *T. gaudichaudii* can be an important prey for higher predators, particularly in years of low krill abundance. However, little information exists on their population structure and dynamics in this region and currently no information exists on the molecular phylogeny of this species. Samples were bagged in batches of 10 and frozen at -80°C until further analysis.

Table 12 - Location and numbers of invertebrate species sampled in South Georgia waters during cruises JR245/246/247.				
Project	Species	Event*	Number sampled	Storage
Energetics	*E. superba*	16	10	-20°C
	E. superba	34	10	-20°C
	E. superba	44	10	-20°C
	E. superba	54	10	-20°C
	E. superba	67	10	-20°C
	E. superba	92	10	-20°C
	E. superba	108	10	-20°C
	E. superba	111	10	-20°C
	E. superba	116	10	-20°C
	E. superba	124	10	-20°C
	E. superba	146	10	-20°C
	E. superba	156	10	-20°C
	T. gaudichaudii	16	10	-20°C
	T. gaudichaudii	19	20	-20°C
	T. gaudichaudii	108	7	-20°C
	T. gaudichaudii	115	10	-20°C
	Thysanoessa sp.	24	3	-20°C
Genetics	*E. superba*	16	50	-80°C
	E. superba	108	50	-80°C
	T. gaudichaudii	123/124	10	-80°C
	T. gaudichaudii	156	50	-80°C
Lipids	*E. superba*	16	10	-80°C
	E. superba	34	10	-80°C
	E. superba	108	10	-80°C
	E. superba	111	10	-80°C
	E. superba	116	10	-80°C
	E. superba	146	10	-80°C
	E. superba	156	10	-80°C

* For geographical position of Events see Appendix B.1 Event log

8 The role of krill in Southern Ocean nutrient cycles (AFI9/07 project)

AFI team: Angus Atkinson, Sophie Fielding, Katrin Schmidt, Hugh Venables, Peter Enderlein, Eric Achterberg, Christian Schlosser, Matt Patey

8.1 Background.

Even though Antarctic krill (*Euphausia superba*) are a key species in the Southern Ocean food web and commercially fished, little is known about their role in biogeochemical cycles. None of the essential processes has been measured before in detail, and this AFI project will test the hypothesis that Antarctic krill helps to promote the drawdown of CO_2 from the atmosphere to the deep ocean by enhancing the biological C pump.

A key feature of this AFI is that we will measure how krill cycle iron (Fe) in relation to the other key elements, namely carbon, nitrogen and silica. Understanding the role of krill in the iron cycle is particularly important, because this nutrient limits primary production (and thus potential export of C to depth) in large parts of the ocean. If krill excrete large quantities of dissolved iron and produce C-rich, low iron fecal pellets that sink rapidly, they will tend to increase the efficiency of the biological C pump. Conversely, if their sinking pellets are enriched in iron, they will tend to reduce the efficiency of this pump, as they will hasten the onset of nutrient exhaustion.

8.2 Overall Objectives

The AFI9/07 fieldwork was arranged for practical purposes into two modules

1. To describe the horizontal and vertical distribution of dissolved and particulate Fe at South Georgia in relation to that of the other key elements, and to krill-mediated processes.

This is the in situ component of the study. It aims to determine element distribution in relation to distance from South Georgia, with an assessment of whether krill tend to enhance biological pump efficiency (lower Fe:C ratios in pellets than ambient particulates at depth) or decrease the pump (higher ratios)

Key measurements at contrasting sites (of varying water depth, iron, chl a concentration), plus underway transecting:

a) Horizontal dissolved (and total dissolvable and particulate) Fe concentrations
b) Profiles of dissolved/ total dissolvable/total Fe (Go-Flos) and particulate Fe (SAPS)
c) SAPS Profiles of particulate C,N, Si for ratios with trace metals
d) Krill biomass/vertical distribution from diel acoustic survey

2. To construct a budget for the processing of Fe/C/N/Silica by krill

This component aims to partition the fate of these key elements following ingestion into three pathways, namely assimilation into the body tissues, excretion in the dissolved form, and egestion in particulate form in the krill pellets.

Key measurements at contrasting sites (of water depth, iron, chl a):

a) C,N, Fe and metal content of freshly caught krill
b) Excretion rates of dissolved Fe and NH4 of freshly caught krill
c) Egestion rate of particulate Fe from freshly caught krill (and C:N:Si:Fe ratios in pellets)
d) C, N, Fe, Si content of krill food (suspended particulate material from SAPS)

Background environmental information for both modules were provided by oceanlogger and CTD, which included water sampling at 20m for chl a filtration, lugols sampling and POC analysis (see Table 2 in Physical Oceanography section 2). Below we describe sequentially the iron sampling, SAPS sampling and krill work that we attempted to run concurrently at as many stations as possible.

8.3 Distribution of dissolved and total dissolvable Fe in the water column at South Georgia

Christian Schlosser

8.3.1 Objectives

i) Profiles of dissolved and total dissolvable Fe (Go-Flo)
ii) Horizontal dissolved and total dissolvable Fe concentrations (Fish)

8.3.2 Methods

8.3.2.1 Water sampling

As Fe exists at extremely low levels in seawater, extreme caution is needed in taking samples at sea, because of the potential for contamination from the ubiquitous steel construction of modern research vessels. Thus for the purposes of the present work we employed a variety of techniques for obtaining clean water samples:

i) Discrete water samples from depth were obtained via Go-Flo samplers deployed on a Kevlar line. Dissolved samples were collected after filtration through 0.2 μm cartridge filters (Sartorius) with slight N_2 overpressure. All sample collection was carried out under a laminar flow hood in the NMF Lab Container situated on the working deck close to the Kevlar winch. Samples were usually taken between 20 and 1000 m water depth (See Table 6Ai) and immediately acidified after collection by adding 180 µL ultra-clean HNO_3 acid.
ii) Surface water samples were collected from the NMF towed fish deployed from a winch on the working deck some 3-4 m from the side of the ship and a depth of 2-3 m. From the fish samples were pumped to the clean lab container via a totally enclosed system with suction provided by peristaltic pump. Filtered samples were obtained by directly drawing a sample through a 0.2 μm cartridge filter (Sartorius). Sample Bottles were then filled under laminar flow clean air in a flow hood located over the sink in the Clean Air container and immediately acidified after collection by ultra-clean HNO_3 acid. The entire system was self enclosed.

8.3.2.1 On board measurements

Some collected seawater samples were analyzed on board for dissolved Fe concentrations using an online flow injection analysis (FIA) systems via luminol chemiluminescence (Klunder et al.in press).

8.3.3 Preliminary Results

The sampling locations around South Georgia are shown in Fig. 17. In total, samples from 12 deep Go-Flo stations and 34 samples of the underway fish sampling system were collected for dissolved and total dissolvable trace metal analysis during this cruise (Table 13).

Several samples from the towed fish were analysed on board. FIA measurements on these surface samples showed dissolved Fe concentrations between 0.059 and 0.547 nmol L^{-1}, depending from the distance to the shore. The results of dissolved Fe measurements of three sampled deep Go-Flo stations showed very different concentration gradients (Fig 18). A detailed explanation for this behaviour and the overall cycling of trace metals around South Georgia will be possible with samples collected for later measurement of Fe and other dissolved elements (Al, Cd, Zn, Pb, Cu, Co, etc.) in the laboratory in Southampton.

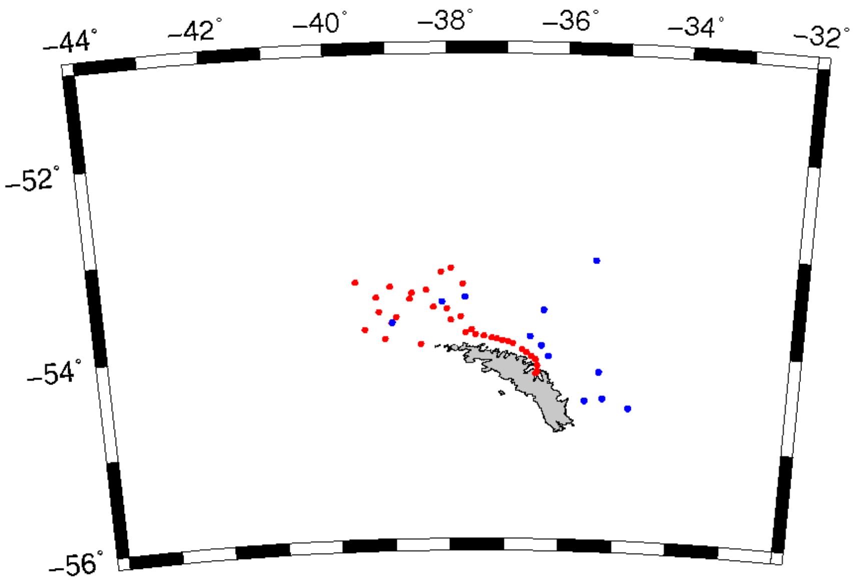


Figure 17 - Location of surface (red dots) and subsurface (blue dots) stations around South Georgia.

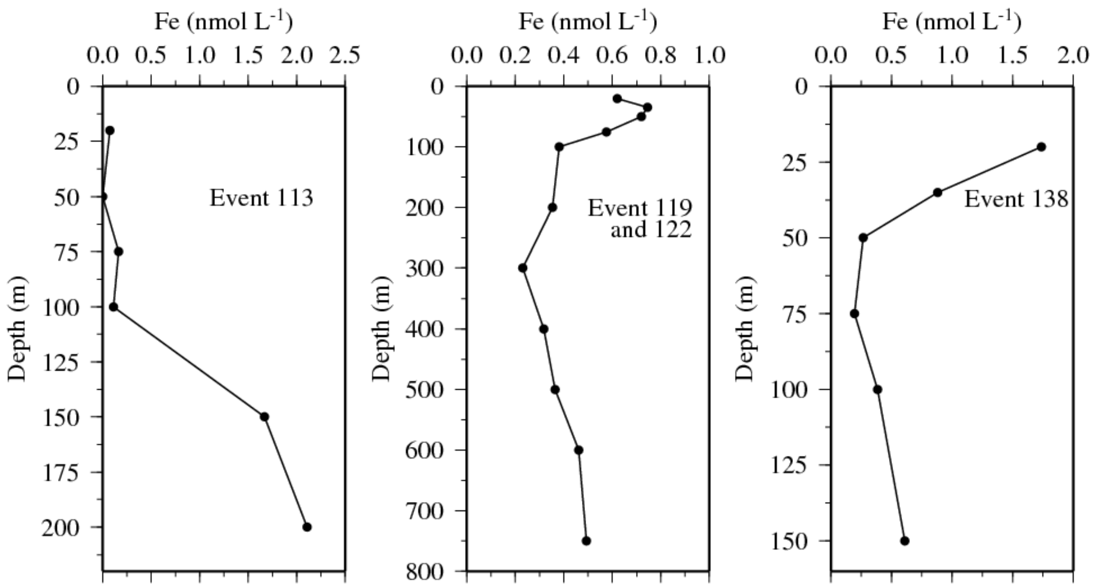


Figure 18 - Preliminary results of dissolved Fe concentration in the water column at three distinct locations north of South Georgia.

Table 13 - Collected samples for dissolved, total dissolvable Fe measurements at Southampton.

Event	Date	Latitude	Longitude	Sample Depth (m)
Fish 1	26.12.2010	-53.82	-39.46	Surface
Fish 2	26.12.2010	-53.33	-39.60	Surface
Fish 3	26.12.2010	-53.64	-39.21	Surface
Fish 4	26.12.2010	-53.92	-39.11	Surface
Fish 5	27.12.2010	-53.76	-38.99	Surface
Fish 6	27.12.2010	-53.49	-39.25	Surface
Fish 7	27.12.2010	-53.38	-39.01	Surface

Fish 8	27.12.2010	-53.70	-38.91	Surface
Fish 9	27.12.2010	-53.98	-38.48	Surface
Fish 10	27.12.2010	-53.51	-38.67	Surface
Fish 11	27.12.2010	-53.45	-38.63	Surface
Fish 12	28.12.2010	-53.60	-38.26	Surface
Fish 13	28.12.2010	-53.42	-38.38	Surface
Fish 14	28.12.2010	-53.24	-38.12	Surface
Fish 15	28.12.2010	-53.73	-37.96	Surface
Fish 16	28.12.2010	-53.61	-38.03	Surface
Fish 17	30.12.2010	-53.20	-37.95	Surface
Fish 18	30.12.2010	-53.69	-37.79	Surface
Fish 19	30.12.2010	-53.83	-37.60	Surface
Fish 20	30.12.2010	-53.36	-37.75	Surface
71	31.12.2010	-53.49	-37.71	40, 60, 80, 100, 150m
73	31.12.2010	-53.49	-37.71	20, 50, 200, 400, 600m
79	02.01.2011	-53.99	-36.37	20, 35, 50, 75, 100, 150m
87	03.01.2011	-53.10	-35.46	20, 35, 50, 75, 100, 150m
89	03.01.2011	-53.10	-35.46	200, 250m
95	04.01.2011	-54.26	-35.35	20, 50, 130, 150, 200m
97	04.01.2011	-54.26	-35.35	100m
98	05.01.2011	-54.62	-34.81	20, 35, 50, 75, 100, 150m
101	05.01.2011	-54.62	-34.81	200, 300, 400, 500, 600, 700m
105	06.01.2011	-54.53	-35.27	20, 35, 50, 75, 100m
113	07.01.2011	-54.56	-35.59	20, 50, 75, 100, 150, 200m
119	08.01.2011	-53.62	-36.34	20, 35, 50, 75, 100, 150m
122	08.01.2011	-53.62	-36.34	200, 300, 400, 500, 600, 750m
133	10.01.2011	-53.90	-36.57	20, 35, 50, 75, 100, 150m
138	11.01.2011	-54.10	-36.25	20, 35, 50, 75, 100, 150m
141	12.01.2011	-53.54	-38.11	100, 400, 600, 800m
143	12.01.2011	-53.54	-38.11	20, 35, 50, 75, 150, 200m
151	13.01.2011	-53.75	-38.98	20, 35, 50, 75, 100, 150m
Fish 20/2	15.01.2011	-54.28	-36.46	Surface
Fish 21	15.01.2011	-54.26	-36.44	Surface
Fish 22	15.01.2011	-54.20	-36.44	Surface
Fish 23	15.01.2011	-54.14	-36.47	Surface
Fish 24	15.01.2011	-54.10	-36.55	Surface
Fish 25	15.01.2011	-54.07	-36.63	Surface
Fish 26	15.01.2011	-54.04	-36.71	Surface
Fish 27	15.01.2011	-53.97	-36.87	Surface
Fish 28	15.01.2011	-53.95	-36.96	Surface
Fish 29	15.01.2011	-53.94	-37.06	Surface
Fish 30	15.01.2011	-53.93	-37.15	Surface
Fish 31	15.01.2011	-53.92	-37.24	Surface
Fish 32	15.01.2011	-53.90	-37.38	Surface
Fish 33	15.01.2011	-53.88	-37.53	Surface
Fish 34	15.01.2011	-53.86	-37.70	Surface

8.3.4 References

Klunder, M.B., Middag, R., de Baar, H.J.W., and Laan, P. Dissolved Fe in the Southern Ocean (Atlantic sector). Deep-Sea Res. II, in press

8.4 In-situ particle sampling during JR245 / 247 with SAPs

Matthew Patey

8.4.1 Introduction

Three stand-alone pump systems (SAPs) were deployed on 15 occasions during the cruise to sample suspended particulate material in the water column. Station locations were chosen based on where krill had been found the night before. SAPs deployments were carried out in conjunction with water sampling using Go-Flo bottles in order to obtain complementary information on trace metals in the dissolved and particulate phases. Three Challenger Oceanic SAPs were supplied from NMF, NOC, Southampton. Originally it had been intended to sample simultaneously onto two filters: a 54 µm pore size Nitex pre-filter and a 1 µm pore size polycarbonate final filter, but the pre-filter assemblies were not supplied with the SAPs, so the Nitex pre-filters could not be used.

8.4.2 Method

SAPs were pre-programmed to start pumping after a 0.8 hour delay once started and to pump for 1 hour. The pumping delay was reduced first to 0.6 hours, then to 0.5 hours once it became clear how long it took to get the pumps into position. From event 120 onwards (8/1/2011) the pumping time was increased to 1.5 hours since many of the stations appeared to be in low chlorophyll areas and not much material was visible on the filters.

To minimise the risk of contamination, the handling of filters was conducted in the clean chemistry container and, where possible, inside a class-100 flow bench. Before the first use, filter assemblies were soaked in 2% Decon-90 detergent solution overnight and rinsed thoroughly with ultra-pure water before use. Before subsequent deployments, the assemblies were rinsed thoroughly with ultra-pure water and stored in a plastic bag. 1 µm pore, 293 mm diameter polycarbonate filters (purchased from Sterlitech, USA) were cleaned by soaking in 1M HCl for 7 days. The filters were rinsed with ultra-pure water before installing them in the filter assemblies. Following some deployments, the filter was found to have torn during pumping, probably due to the sharp ridges of the filter supports. From event 100 (5/1/2011) onwards, the polycarbonate filters were placed on top of a 54 µm pore Nitex mesh, which supported and protected the polycarbonate filters. No problems with torn filters were encountered following this change. The Nitex mesh was cleaned by soaking in 2% Decon-90 solution overnight and rinsed thoroughly with ultra-pure water. Between deployments, the same support mesh was rinsed with ultra-pure water and re-used.

Immediately before deployment, the filter assemblies were connected to the systems and filled with ultra-pure water. Once on deck and ready to be deployed, the timers for all three pumps were started simultaneously and the systems were attached to a 6 mm plastic-coated Kevlar cable. Rubber blocks were used to protect the cable and a 100 kg weight was attached to the end of the cable to keep it vertical in the water column. The pumps were positioned on the cable to obtain final depths of 150 m, 50 m and 20 m (for one shallow station (event 106, 6/1/2011) 100 m, 50 m and 20 m were used). These depths were chosen to correspond approximately to below the winter mixed layer, the base of the summer mixed layer, and the surface. Similar depths have also been used by Eric Achterberg's group in Southampton during three recent cruises (in the Atlantic Ocean) and this may facilitate any comparisons of the datasets.

Following recovery of the SAPs, the filter assemblies were immediately removed and placed in a plastic bag. Any excess water above the filters was pumped off and the assemblies then taken to the clean chemistry container. Inside a flow-cabinet, each filter was inspected and photographed. One or two small pieces of the filter were cut out (ca 5 cm^2) and placed in a bottle containing Lugol's solution. This bottle was then topped up with filtered (0.2 µm) seawater from the towed fish. This sample will be used for visual identification of the material composition under a microscope at

Cambridge. The remaining filter was folded three times, placed in a re-sealable plastic bag and stored in a freezer at -80C. Chemical composition of the particulate material using portions of the frozen filters will be conducted in Southampton. An ammonium acetate leach and a total acid digestion will be used to extract labile metals and all metals, respectively. ICP-MS analysis will be used to determine the metal concentrations in the extracts.

8.4.3 Data Coverage

Table 14 - List of SAPs deployments during JR245 / 247.

Event No.	Time in (GMT)	Lat. (°N)	Long. (°E)	Water Depth (m)	SAP depth (m)	SAP No.	Pump Delay (hrs)	Pump time (hrs)	Volume Filtered (l)
8	23/12/2010 14:05	-52.676	-45.178	3316	150	03-04	0.8	1	613
					50	03-01	0.8	1	301
					20	03-06	0.8	1	307
22	25/12/2010 11:47	-53.700	-38.211	318	150	03-04	0.8	1	515
					50	03-01	0.8	1	749*
					20	03-06	0.8	1	753*
31	26/12/2010 20:27	-53.846	-39.143	287	150	03-04	0.6	1	592
					50	03-01	0.6	1	274
					20	03-06	0.6	1	321
72	31/12/2010 11:55	-53.491	-37.707	1917	150	03-04	0.6	1	932*
					50	03-01	0.6	1	725*
					20	03-06	0.6	1	983*
80	02/01/2011 11:10	-54.994	-36.372	208	150	03-04	0.6	1	662
					50	03-01	0.6	1	469
					20	03-06	0.6	1	231
88	03/01/2011 11:38	-54.101	-35.455	330	150	03-04	0.6	1	646*
					50	03-01	0.6	1	353
					20	03-06	0.6	1	343
96	04/01/2011 13:30	-54.255	-35.355	263	150	03-04	0.6	1	558
					50	03-01	0.6	1	389
					20	03-06	0.6	1	1097*
100	05/01/2011 16:44	-54.621	-34.805	746	150	03-04	0.6	1	570
					50	03-01	0.6	1	442
					20	03-06	0.6	1	372
106	06/01/2011 11:54	-54.531	-35.271	133	100	03-04	0.5	1	458
					50	03-01	0.5	1	452
					20	03-06	0.5	1	416
114	07/01/2011 11:35	-54.558	-35.588	264	150	03-04	0.5	1	577
					50	03-01	0.5	1	485
					20	03-06	0.5	1	414
120	08/01/2011 11:35	-53.623	-36.344	857	150	03-04	0.5	1.5	743
					50	03-01	0.5	1.5	501
					20	03-06	0.5	1.5	495
134	10/01/2011 11:35	-53.896	-36.573	210	150	03-04	0.5	1.5	598
					50	03-01	0.5	1.5	543
					20	03-06	0.5	1.5	510
139	11/01/2011 11:38	-54.101	-36.250	276	150	03-04	0.5	1.5	798
					50	03-01	0.5	1.5	615
					20	03-06	0.5	1.5	522+
142	12/01/2011 16:51	-53.540	-38.109	1742	150	03-04	0.5	1.5	820
					50	03-01	0.5	1.5	217
					20	03-06	0.5	1.5	199
152	13/01/2011 13:35	-53.751	-38.983	270	150	03-04	0.5	1.5	821
					50	03-01	0.5	1.5	354
					20	03-06	0.5	1.5	322

* Filter torn at some point during pumping. Material is still present on filters, but the volume of water filtered is unknown.

8.4.4 Preliminary Results

Chemical analysis in Southampton and microscope examination of the samples preserved in Lugol's Solution at Cambridge will be necessary to draw meaningful conclusions about the nature of the samples collected. However some example images from the filters collected are shown in Figure 1. krill faecal pellets were usually observed on the filters deployed at 150 m depth, and to a lesser extent at 50 m depth, while they were not often observed at 20 m depth. Figure 1 shows a fairly typical station, with very little visible on the filters at 150 m except for numerous krill faecal pellets. At 50 m depth, some faecal pellets are visible along with a greenish hue due presumably to higher chlorophyll concentrations. In the surface sample, a green hue is apparent and with very few, if any, krill faecal pellets.

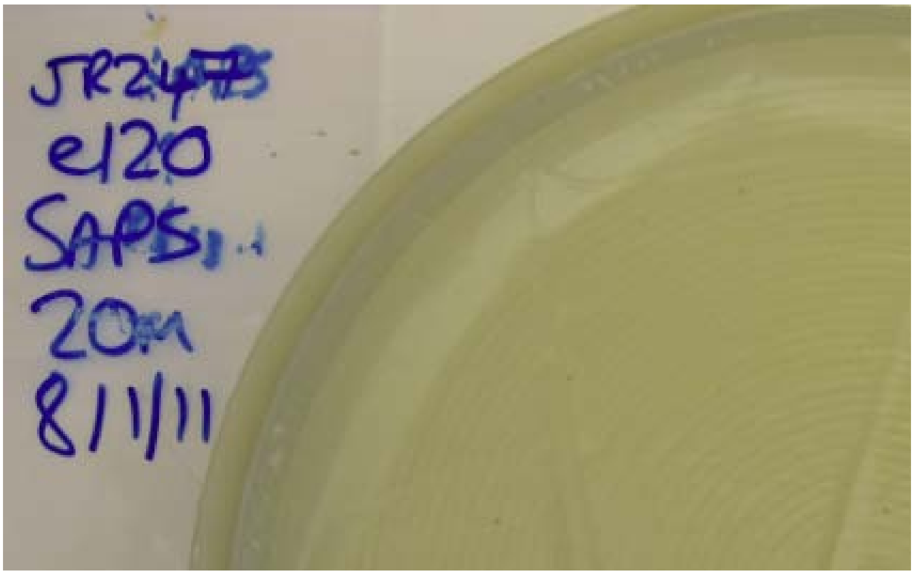


Figure 19 - SAPS Filter Image

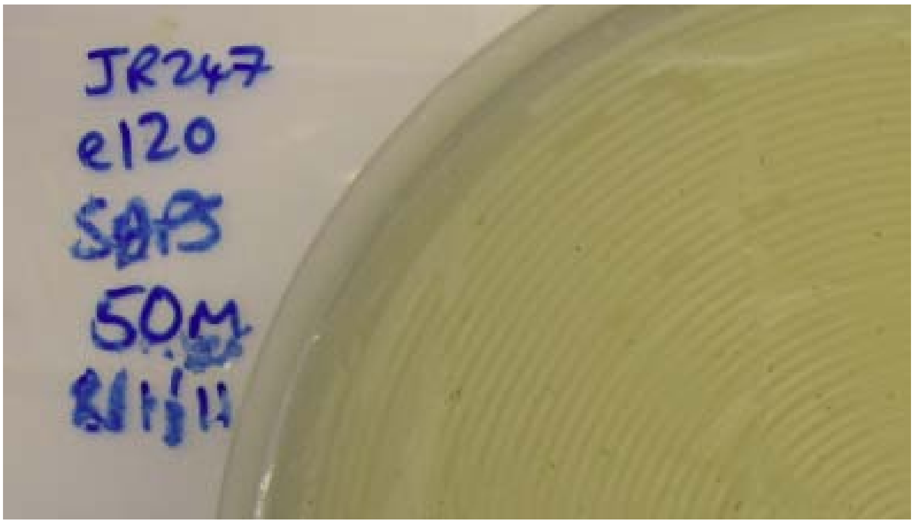


Figure 20 - SAPS Filter Image

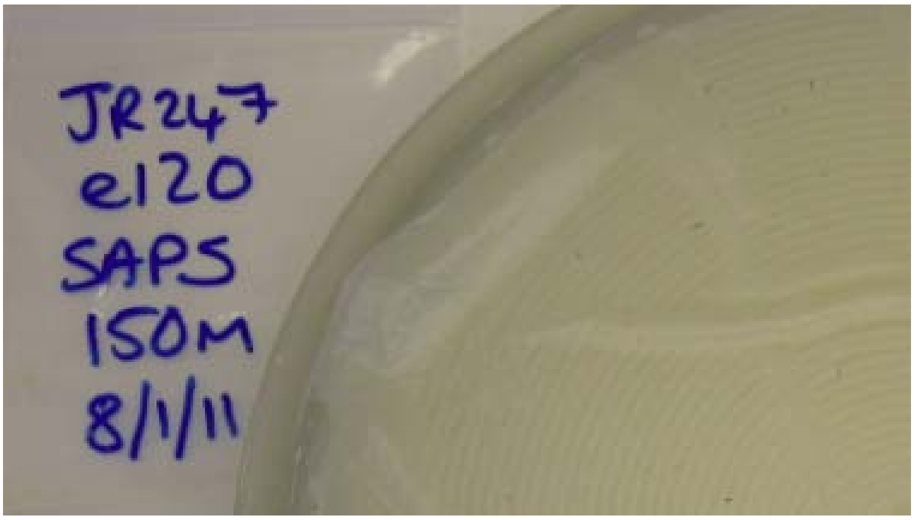


Figure 21 - Image 3 of SAPs filters from Event 120 (on 8/1/11).

8.5 A budget for the processing of Fe/C/N/Silica by krill

Angus Atkinson

8.5.1 Objectives

Measure C,N, Fe and trace metal content of freshly caught krill
Measure Excretion rates of dissolved Fe and NH4 of freshly caught krill
Measure Egestion rate of particulate Fe from freshly caught krill (and the C:N:Si:Fe ratios in pellets)

8.5.2 Methods

i) Measure C,N, Fe and metal content of freshly caught krill
We caught krill in 29 events covering most of the stations (Table 15). A subsample of these (typically at least 50 randomly-selected animals) was frozen at -80oC immediately on retrieval of the net. These will be analysed in the UK for elemental content.

ii) Measure excretion rates of dissolved Fe and NH4 of freshly caught krill
To set up these experiments, water from the iron fish was passed through a 0.2µm membrane filter and filled sequentially four acid washed polycarbonate carboys of 9L capacity. This was typically on the afternoon before the evening's krill experiment, to allow the water to cool back down to ambient experimental temperature of 2oC (+- 1oC). These carboys were placed in the experimental laminar flow cabinet mounted in the cold room (Fig6ci) and shielded from the cool room fans by a plastic tent over the entrance.

Experimental krill (10-20 per carboy) were first rinsed in spare experimental water with 3 sequential transfers between 5L buckets using an acid washed plastic spoon. They were then transferred to 2 experimental carboys, with the other 2 carboys serving as controls without added krill. After mixing, initial subsamples were then taken immediately from each carboy. These subsamples comprised 120 ml subsample for dissolved and total dissolvable iron, and a 50 ml subsample for ammonium, The iron samples were dispensed straight from the carboy taps and the 50 ml ammonium subsamples were first filtered (0.45 µm Swinex membrane filter) with a syringe before being frozen (-20oC).

Figure 22 - Interior of laminar flow cabinet showing 9L experimental carboys used for krill iron excretion experiments. Despite being sited in a draughty cold room, the plastic tent covering the working area (removed here) precluded contamination

Subsequent subsamples were taken after 1 h and at the end of the experiment, after 3h.
On termination of the experiment, experimental temperatures were noted, the volumes dispensed recorded, krill were frozen and where possible fecal pellets present in the experimental carboys were dispensed into 10 ml acid washed plastic tubes. These were then rinsed twice in MQ water (to displace almost all the incubation water) and then frozen at -80oC

The iron subsamples were stored in the cold room until their processing in the iron-clean container lab, typically 12 h later. This treatment comprised simply acidifying the samples for total dissolvable iron and then filtering (0.2 micron) and acidifying the samples for dissolvable iron. Methods for this work were the same as described in the section on iron analysis. To check for contamination and the presence/absence of excretion we took additional 120 ml samples for measurement of dissolved and total dissolvable iron using chemiluminescence aboard ship. These extra samples were taken just from the initial and final subsampling of one of the krill carboys and from the end point of one control (Table 15).

Table 15 - Summary of all collections of freshly-frozen krill and presence/absence of experiments to measure iron excretion and fecal pellet composition from the rearing of large numbers of krill.

Event no.	Stn	Date Local (GMT-3h)	Approx local time of catching krill	Min estimated no. of Freshly frozen krill	Excretion expt?	Bulk fecal pellet collection?
15	TF1	24.12.10	17:15	15	-	-
16	TF1	24.12.10	19:30	15-20	-	-
17	TF1	24.12.10	20:25	30	yes	yes

34	WCB	27.12.10	00:10	30-40	-	yes
44	WCB	27.12.10	22:38	30,after 1h	yes	yes
45	WCB	27.12.10	23:50	50	-	-
54	WCB	28.12.10	18:45	30	-	yes
67	TF2	30.12.10	19:38	40	yes	Yes
68	TF2	30.12.10	20:30	30	-	-
69	TF2	30.12.10	22:15	30	-	yes
74	TF3	31.12.10	2130	50	-	yes
82	TF4	2.1.11	2050	30	-	-
83	TF4	2.1.11	2130	30	-	-
85	TF4	3.1.11	0128	15	-	-
91	TF4	3.1.11	17:03	12	-	-
92	TF5	3.1.11	18:48	30	yes	yes
102	TF6	5.1.11	21: 06	40	-	-
107	TF8	6.1.11	13:30	40	yes	yes
110	TF8	6.1.11	21:48	40	-	yes
111	TF8	6.1.11	22:10	40	-	-
116	TF9	7.1.1	22:30	60	yes	yes
123	TF10	8.1.11	21:55	50	-	yes
124	TF10	8.1.11	22:45	50	-	-
128	TF11	9.1.11	21:39	50	yes	-
129	TF11	9.1.11	23:40	50	-	yes
130	TF11	10.1.11	01:00	15	-	-
145	TF13	12.1.11	22:22	50	yes	yes
154	TF14	13.1.11	23:02	50	yes	yes
161	none	14.1.11	21:39	100	-	-

iii) Measuring egestion rate of particulate Fe from freshly caught krill (and the C:N:Si:Fe ratios in pellets)

Where it was possible to collect fecal pellets quantitatively at the end of the excretion experiments this was done to provide an estimate of the partitioning of ingested iron between fecal pellets and the excretion of iron in the dissolved form. To supplement these measurements, we incubated large numbers of krill to collect larger fecal pellets samples, collecting these pellets quantitatively at regular intervals for an indication of production rates as well as elemental composition.

As the excretion rate experiments were being set up (as soon as possible after the net came aboard) actively swimming krill were transferred first to 20L filtered seawater for rinsing and thence into a series of buckets of iron-clean 0.2 micron filtered water obtained from the iron fish. Typically we incubated 150-200 krill in up to 8 acid washed buckets, maintaining relatively low krill densities (<5 per L) to minimise pellet re-suspension and fragmentation. Incubation was typically for 3h and in dim light, during which pellets were pipetted off at 0.5-1 h intervals.

At the end of the incubation typically 50 of the krill were frozen and their pellets were concentrated, checked for purity and transferred either to 4.5ml or 10ml acid washed plastic tubes. They were then rinsed twice in MQ water to leave a small pellet sample (typically 0.2-0.3 ml) suspended in a small MQ water volume at the bottom of the tube. These tubes were then deep-frozen immediately.

For events 116 and 145 we performed a simple degradation experiment by dividing the bulk pellets sample into two halves. One half was processed immediately as described above, while the other was allowed to stand in the incubation water for 36-40h before processing in the same way.

To check for iron contamination, blanks were obtained, whereby water overlying the concentrated pellet samples was pipette into a fresh tube, then rinsed with MQ in exactly the same way as if the actual pellets samples were being processed. Six blanks were processed in this way.

Due to concerns that pellet volumes may be insufficient to obtain ratios of multiple elements, where possible we ran parallel, non-Fe-clean incubations in 100 micron-filtered seawater to collect additional pellets for silica, carbon and nitrogen analyses. These pellets were repeatedly rinsed in 0.2 micron filtered seawater before the two rinses in MQ, with an additional check for purity under the binocular microscope, as described in JR177 and 200 JCR cruise reports.

8.5.3 Preliminary results

In addition to the 29 collections of freshly caught krill we obtained approximately 35 samples of fecal pellets from 13 stations for analysis of elemental content. Results of the preliminary analysis of iron excretion rate are presented in Table 16. These showed an increase in dissolved iron concentrations in 6 of the 7 incubations, with rates equating roughly to an average of 1 nmol Fe krill-1 d-1. Very roughly, this would represent a turnover of about 10% of a krill's total body iron content per day, and a significant recycling flux.

More precise estimates should be available from IC-PMS analysis in NOCS, but these preliminary results are the first estimates of excretion rate of dissolved iron by krill. The only study previous to this (Tovar-Sanchez et al. 2007 Geophys Ress Letts 34) measured a 30-fold range in production of total iron based on 3 stations). Their estimates were overall higher than ours and this is is probably partly because some of the total iron release is in particulate form within the pellets. Our shipboard estimates of total Fe release were contradictory, being sometimes higher and sometimes lower than the dissolved rates. IC-PMS analysis in NOCS will determine rates of particulate iron release by krill

8.5.4 Problems encountered and recommendations

Despite the lack of a stern gantry and various other setbacks, we were able to fully realise the field objectives of this AFI. This was due to a great spirit of teamwork and attention to detail by all involved. Examples include the meticulous planning of gear operation by Peter Enderlein in switching to the use to the K-Net from Geraint Tarling, the experience of Peter Enderlein and Sophie Fielding in target fishing, smooth cruise planning and running by Sophie Fielding and continuous support from netting from Gabi Stowasser and Natalie Ensor and others. Problems with Go-Flo contamination were solved by the persistence of Christian Schlosser, and Matt Patey was a great help in taking care of the SAPS and Go-flo sampling. The shipside staff were very accommodating to the necessary hour-to-hour flexibility we required to run this cruise effectively.

Aside from stern gantry, the only serious issues related to fulfilling cruise objectives were all related to the NMF-SS. Some or all of these could easily have contributed to failure and they include consignment of SAPS/go-flos to the wrong ship, non arrival of 53 micron filter bracket for SAPS, non-Fe clean go-flos, go-flos not in working order and the lack of NMF-SS technician. These are serious issues to learn lessons from and are covered elsewhere.

Table 16 - Summary of experiments for constructing an iron budget through krill during JR245

Event	No. krill used	Initial krill (nM)	Final krill (nM)	Final Control (nM)	Final minus init krill (nM)	Excretion rate nM Fe krill d-1
17	9	-	-	-	-	
44	11	0.057	0.258	0.16	0.201	0.877
67	17	0.181	-	0.128	-	
92	17	4.07	5.39	4.45	1.32	3.72
107	15	1.402	1.381	1.298	-0.021	(0)

116	12	1.856	2.212	2.86	0.356	1.424
128	14	0.590	0.854	0.629	0.264	0.905
145	20	0.674	0.856	0.663	0.182	0.436
154	20	0.553	0.653	0.495	0.100	0.240
mean						1.09

9 AFI-CGS61: Response of *Euphausia superba* to acute temperature change

Geraint Tarling (BAS), Magnus Johnson (U. Hull, Scarborough Campus), Neil Thompson (U. Hull, Scarborough Campus)

9.1 Rationale

The physiology of krill (*Euphausia superba*) is considered to be stenothermal, operating most efficiently within a narrow temperature range of between 0 and 2°C. South Georgia is a krill rich region, but recent reports have indicated there has been a mean increase of 0.9°C in its surface waters over the past 81 years (Whitehouse et al. 2008). Trend analyses have also pointed to significant negative relationship between summer South Georgia water temperatures and mean summer density of *E. superba,* predicting a decline in the suitability of this area as a future krill habitat (Murphy et al. 2007). Such work has been mainly based on population level analyses. The physiological resilience of krill to temperature change has not been investigated in similar detail. During the present cruise, we set out to measure aerobic respiration and other indicators of performance of freshly caught krill along a cline around South Georgia. We incubated krill at a range of temperatures and made accompanying performance measurements. A customised temperature controlled respiration apparatus was used alongside more established techniques of activity measurement used on previous BAS cruises (Tarling and Johnson 2006, Johnson and Tarling 2008, Tarling et al. 2009).

Our overall aim was to consider whether Antarctic krill become thermally stressed at the temperatures they may encounter at their northern distributional limit.

9.2 Methodological approach

Our approach divided into two parts. Firstly we examined the respiration and mortality rate of krill exposed to a range of temperatures over short (1-3 h) to medium (24 h+) time intervals. Secondly, we determined the swimming response of krill exposed to short-term temperature changes.

1. Respiration and mortality experiments

Krill were caught at a variety of locations in the vicinity of South Georgia (Table 17) using 1 m^2 MIK net fitted with a 2 mm mesh and non-filtering cod-end.

Table 17 - Krill catches used in respiration incubations

Event number	Lat (S)	Long (W)	Date	Time (GMT)	Max net depth
18	53.70695	38.18605	25/12/2010	00:37:00 00:57:49	21 m
44	53.60767	38.23436	28/12/2010	01:24:49 01:55:52	58 m
45	53.61291	38.24039	28/12/2010	02:45:53 03:10:41	44 m
74	53.99585	36.35807	01/01/2011	00:19:42 00:45:36	59 m
93	54.26053	35.35364	03/01/2011	22:20:30 22:36:27	40 m
108	54.55503	35.60416	06/01/2011	16:40:00 17:03:34	??
109	54.55829	35.58579	06/01/2011	17:32:17 18:00:32	47 m
111	54.55915	35.58569	07/01/2011	01:02:48 01:16:35	??
116	53.62301	36.34162	08/01/2011	00:47:29 01:47:53	55 m

117	53.62300	36.34105	08/01/2011	02:22:23 02:52:12	38 m
124	54.27487	54.26549	09/01/2011	01:47:38 02:10:04	??
131	53.87294	36.74385	10/01/2011	04:43:09 05:10:45	??
146	53.59231	37.61264	13/01/2011	02:14:31 02:28:58	36 m
149	53.59129	37.70458	13/01/2011	05:23:55 05:43:15	??
154	53.69436	38.71951	14/01/2011	01:53:29 02:19:20	49 m
156	53.70875	38.56402	14/01/2011	04:27:21 04:54:03	50 m

Around 100 individuals were left in approximately 50 L of ambient seawater for a minimum of 12 h before further experimentation.

A temperature incubation apparatus was prepared containing a series of up to 72 x 250 ml glass stoppered bottles filled with seawater (Figure 23). The type of seawater (coarse filtered –[5 mm] or fine filtered [0.2 µm sartorius membrane filters]) and the starting temperature of the bottles varied according to the type of experiment, as did the number of krill inserted into each bottle (Table 18). A glass stopper was placed on bottles in which respiration rates were measured. Stoppers were not placed on bottles where only the mortality response was being assessed.

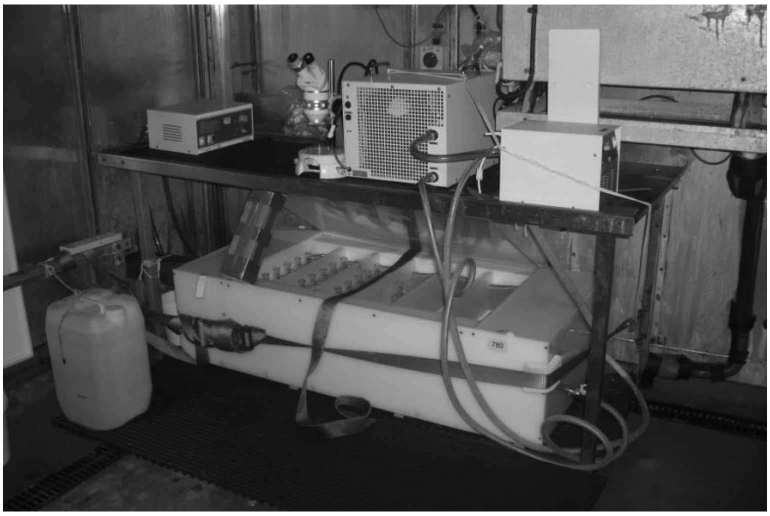


Figure 23 - Plate 1: Temperature-gradient incubator that held a maximum of 72 x 250 ml stopped bottles.

Figure 23: Temperature-gradient incubator that held a maximum of 72 x 250 ml stopped bottles. The apparatus operated through circulating a warm liquid (a general purpose coolant) through a steel tank located underneath half of the bottles (left hand side in this instance) and a cold liquid through a second steel tank underneath the other half (right hand side). For experiments after Jan 2^{nd}, the liquid heater was set to 14.5°C and the liquid cooler to -4.5°C. This established a bottle water temperature gradient of 12°C at the extreme left to 0.5°C at the extreme right.

The temperature incubation apparatus established a gradient in incubation bottle temperatures. In the earlier experiments, the gradient was around 5°C between the warmest to the coldest bottles, with the coldest averaging around 0.5°C and the warmest around 5.5°C. In later experiments (after 2^{nd} Jan), a 10°C gradient was established, with the warmest bottles being maintained at between 11° and 12°C, and the coldest between 0° and 1°C.

Respiration rates were estimated by determining the concentration of 0_2 in the bottles at the start and end of an experiment. In the majority of cases, live krill were inserted into a bottle and left for around

10 minutes. The temperature of the bottle was taken and a stopper then placed on the bottle ebfore the first 0_2 measurement was made. A second measurement was made after a period of time that varied according to the type of experiment.

O_2 concentration was measured via a Presens oxygen sensor spot glued to the inside bottle-neck using silicone rubber compound (Figure 24). The spots were read by a fibre optic probe held to the outside wall of the glass (Figure 25), at a sample rate of 1 reading per second. Usually, 1 minutes-worth of readings were taken each time 0_2 concentration in a sample bottle was assessed. The readings were made in three different units: oxygen saturation (%), µmol O_2 L^{-1} and hPA (mbar), so giving 20 s of readings per unit. In the case of experiments to determine mortality response, only 20 s of oxygen saturation (%) readings were made at the end of the experiment.

Figure 24 - 250 ml glass stoppered bottle showing the Presens O2 sensitive spot glued to the bottle-neck

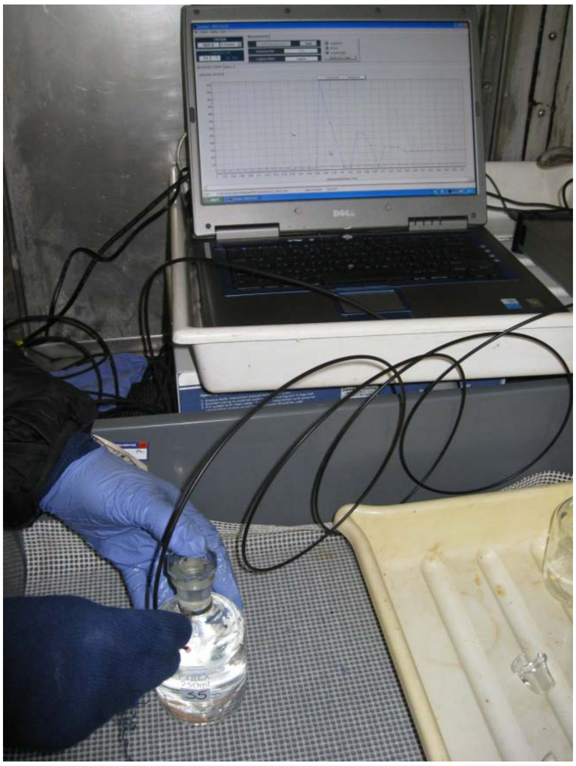


Figure 25 - Taking a measurement of 0_2 concentration through holding the fibre-optic cable next to the O2 sensitive spot. Data is logged to the Presens software via a modem (out of picture)

At the start of the sampling campaign a variety of incubations were tried to test out the system and determine the most appropriate combination of number of krill per bottle and incubation time (Table 18). After 2nd January, 2 main types of incubation were concentrated upon:

1. Respiration Incubation: (i) 6-10 bottles containing fine filtered seawater were placed at various preset locations within the temperature incubator at least 3 h before the start of an experiment until they became stable at the desired temperature. The aim was to achieve a ~2°C difference between bottle temperatures, covering a gradient between 12°C to 0.5°C. (ii) Bottle temperature was measured and noted before the start the experiment using the Presens temperature probe. (iii) Krill were extracted from the holding 50 L bins and placed in the bottles and left in the incubator for around 10 minutes. The number of krill per bottle varied according to krill size: 10 x 30 mm krill, 5 x 40 mm krill, 3 x 50 mm krill, 1 x adult krill. (iv) Stoppers were placed on the bottles, being careful not to trap any air bubbles in so doing. (v) Any excess liquid on the outside of the bottles was wiped away and a first 0_2 concentration measurement was made – (bottle temperature was inserted manually into the Presens software, based on the temperature measurements made above). (vi) A second measurement was made after between 60 and 90 minutes, being careful to note the exact duration between the first and second measurement. Again the same temperature as before was inserted manually into the Presens software (vii). After around 2 h, each bottle was removed from the incubator and the krill extracted. (viii) Total body length of all incubated was measured before specimens were frozen intact at -80°C within 5 minutes of extraction.

2. Mortality incubations: (i) between 54 and 72 pre-rinsed bottles were filled with coarse-filtered seawater at surface-water temperature (around 3°C) (ii) krill were extracted from the 50 L holding tank in which they had been held for at least 12 h. (iii) a single krill was inserted into each bottle and the bottle placed into a preset location within the temperature incubator. A stopper was not placed on the bottle. (iv) For the first experiment of this type, the bottles were checked every hour to determine whether individuals were active, weak (lying on their backs with intermittent pleopod movement) or dead. A temperature reading with the Presens temperature probe was also taken during each these checks (this was to determine the rate of change in temperature to the final stable temperature). (v) for all other subsequent experiments, a single check was made after ~24 h of incubation, to determine the state of the krill (as above), bottle temperature, and the level of O_2 % saturation. The latter measurement was only made on those bottles where krill were either weak or active. (vi) Once all checks had been made, krill were removed from the bottles, total length and maturity assessed. In the case of active or weak specimens, the body was subsequently divided into three: the head was placed immediately into RNA later, the thorax frozen at -80°C and the tail into a sorting tray for subsequent moult stage classification. In the case of dead specimens, only the tail was retained for moult stage classification.

Table 18 - Euphausia superba temperature incubations carried out in 250 ml stoppered bottles. O2 measured via Presens O2 sensitive spots fixed to inside of bottles using silicone based glue.

Date of incubation	Exp. No.	Event from which krill were caught	Number of animals incubated	Incubation media	Min/ Max temp. (°C)	0_2 Filenames	Length of incubation	Length Maturity Moult stage	Fate of animals	Comments
24/12/10	1	18	25	Filtered seawater	1.6°/ 5.6°	event 18.txt event 18 t30.txt event 18 t30b.txt event 18 t60.txt evebt 18 t90.txt	~3 h	Yes	Heads in RNA later, thorax frozen at -80oC	Only % saturation measurements made on these animals. Water brought up to temperature before krill inserted
30/12/10	2	44 and 45	36	Coarse filtered throughflow water	-1.5°/ 3.8°	30_12_10_1 to 30_12_10_12.txt	~3 h	Yes	Half of the krill – heads into RNA later, thorax into - 80oC	Left in filtered seawater for 3 h before incubation. Water brought up to temperature before krill inserted
31/12/10	3	44 and 45	72	Coarse filtered throughflow	0.8°/ 5.8°	31_12_10_1 to 31_12_10_13.txt	~12 h	Yes	Heads in RNA later, thorax into - 80oC	Left in filtered seawater for 3 h before incubation. Water brought up to temperature before krill inserted
1/1/11	4	74	72	Coarse filtered throughflow	0°/ 6.6°C	1_1_11_1 to 1_1_11_24.txt	~ 9 h	Yes	Heads in RNA later, thorax into - 80oC	Left in filtered seawater for 3 h before incubation. Water brought up to temperature before krill inserted. Respiration measurements made for a 3 h period within the

										period of incubation
2/1/11	5	74	72	Coarse filtered throughflow	0.1°/11.8°	3_1_11_1 to 3_1_11_6.txt (% saturation only at end of experiment)	~24 h	Yes	Heads in RNA later, thorax into -80oC. Live specimens only	Left in filtered seawater for 3 h before incubation. Water brought up to temperature over course of experiment. Krill in highest temperature returned to ambinet (2oC) after 12 h to see if they recovered
4/1/11	6	93	72	Coarse filtered throughflow	1.4°/ 11.0°	4_1_11_1 to 4_1_11_24.txt	~8 h	Yes	Heads in RNA later, thorax into -80oC	Left in filtered seawater for 3 h before incubation. Water brought up to temperature before krill inserted. Respiration measurements made for a 3 h period within the period of incubation.
5/1/11	7	93	6 x 10	Filtered seawater	0.5°/ 11.7°	5_1_11_1 to 5_1_11_12.txt	~2 h	Length only	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
5/1/11	8	93	7 x 10	Filtered seawater	0.6°/ 11.6°	5_1_11_13b to 5_1_11_25.txt	~2 h	Length only	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
6/1/11	9	93	54	Coarse filtered seawater	1.1°/ 11.9°	6_1_11_1 to 6_1_11_6.txt (% saturation only at end of experiment)	~26 h	Yes	Heads in RNA later, thorax into -80oC. Live specimens only	Left in non-through flow water before incubation (for at least 12 h). Water brought up to temperature over course of experiment.

6/1/11	10	109	12	N/A	N/A	N/A	N/A	All stage C, SA male or SA female	Heads in RNA later	Preserved within 5 minsof staging (7 male, 5 female)
6/1/11	11	111	10	N/A	N/A/	N/A	N/A	All stage C, SA male or SA and A female	Heads in RNA later	Preserved within 5 mins of staging (7 male, 3 female)
7/1/11	12	108	6 x 10	Filtered seawater	0.5°/ 12.1°C	7_1_11_1 to 7_1_11_12.txt	~2 h	Length only	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
7/1/11	13	109	8 x 10	Filtered seawater	0.5°/ 11.8°C	7_1_11_13 to 7_1_11_28b.txt	~2 h	Length only	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
7/1/11	14	108	54	Coarse filtered seawater	0.9°/ 11.7°	N/A	~25 h	Yes	Heads in RNA later, thorax into -80oC. Live specimens only.	Left in non-through flow water before incubation (for at least 12 h). Water brought up to temperature over course of experiment.
8/1/11	15	116 and 117	8 x 1	Filtered seawater	0.5°/ 12.0°	8_1_11_1 to 8_1_11_16.txt	~2 h	Length and sex	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
8/1/11	16	116 and 117	7 x 10	Filtered seawater	0.4°/ 11.1°	8_1_11_17 to 8_1_11_30.txt	~ 2 h	Length only	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
9/1/11	17	124	6 x 5	Filtered seawater	0.3°/ 12.1°	9_1_11_1 to 9_1_11_12.txt	~1 h	Length only	Frozen -80oC intact	Left in non-through flow water before

										incubation (for at least 12 h).
9/1/11	18	124	54	Coarse filtered seawater	1.2°/ 12.1	10_1_11_25 to 10_1_11_30.txt	~32 h	Yes	Heads in RNA later, thorax into -80oC. Live specimens only.	Left in non-through flow water before incubation (for at least 12 h). Water brought up to temperature over course of experiment.
9/1/11	19	124	6 x 5	Filtered seawater	0.6°/ 11.2°	9_1_11_13 to 9_1_11_24b.txt	~ 5 h (NB resp. measured over 1 h)	Length only	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
9/1/11	20	124	6 x 5	Filtered seawater	0.6°/ 10.6°	9_1_11_25 to 9_1_11_36.txt	~2 h	Length only	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
9-10/1/11	21	124	6 x 5	Filtered seawater	0.8°/ 11.8°	9_1_11_37 to 9_1_11_48.txt	~2 h	Length only	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
10/1/11	22	131	6 x 3	Filtered seawater	0.4°/ 12.0°	10_1_11_1 to 10_1_11_18.txt	~2 h	Length only	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
10/1/11	23	131	6 x 3	Filtered seawater	0.8°/ 11.0°	10_1_11_7 to 10_1_11_24.txt	~90 mins	Length only	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
12/1/11	24	146	14	N/A	N/A/	N/A	N/A	All stage C, SA male or SA female	Heads in RNA later	Preserved within 5 mins of staging (8 male, 6 female)
13/1/11	25	149	6	Filtered	1.4°/11.	13_1_11_1 to	~ 90 mins	Length	Frozen -80oC	Left in non-through

				seawater	9°	13_1_11_6 and 13_1_11_13 to 13_1_11_18.txt		(all Fem D)	intact	flow water before incubation (for at least 12 h).
13/1/11	26	149	6	Filtered seawater	2.4°/ 10.7°	13_1_11_7 to 13_1_11_12 and 13_1_11_25 to 13_1_11_30.txt	~ 2 h	Length (all Fem D)	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
13/1/11	27	149	6	Filtered seawater	1.5°/ 11.3°	13_1_11_19 to 13_1_11_24 and 13_1_11_37 to 13_1_11_42.txt	~2 h	Length (all Fem D)	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
13/1/11	28	149	6	Filtered seawater	1.9°/ 12.0°	13_1_11_31 to 13_1_11_36 and 13_1_11_43 to 13_1_11_47.txt	~2 h	Length (sex to be checked)	Frozen -80oC intact (1 dead not frozen)	Left in non-through flow water before incubation (for at least 12 h).
13/1/11	29	149	6	Filtered seawater	0.6°/ 11.4°	13_1_11_49 to 13_1_11_54 and 13_1_11_55 to 13_1_11_60.txt	~ 2h	Length (all male adults)	Frozen -80oC intact (2 dead not frozen)	Left in non-through flow water before incubation (for at least 12 h).
13/1/11	30	149	8	Filtered seawater	0.9°/ 11.3°	13_1_11_61 to 13_1_11_76.txt	~2 h	Length (all Fem D)	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
14/1/11	31	156	6	Filtered seawater	0.6°/ 12.2°	14_1_11_1 to 14_1_11_6 and 14_1_11_13 to 14_1_11_18.txt	~90 mins	Length (all Fem D)	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
14/1/11	32	156	6	Filtered seawater	0.9°/ 11.2°	14_1_11_7 to 14_1_11_12 and 14_1_11_19 to 14_1_11_24.txt	~90 mins	Length (all Fem D)	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).
14/1/11	33	156	6	Filtered seawater	1.3°/ 11.3°	14_1_11_25 to 14_1_11_30 and 14_1_11_37 to	~90 mins	Length (all Fem D)	Frozen -80oC intact	Left in non-through flow water before incubation (for at least

						14_1_11_42.txt				12 h).
14/1/11	34	156	6	Filtered seawater	0.9°/ 10.8°	14_1_11_31 to 14_1_11_36 and 14_1_11_49 to 14_1_11_53.txt	~ 2 h	Length (all adult male)	Frozen -80oC intact (1 dead not frozen)	Left in non-through flow water before incubation (for at least 12 h).
14/1/11	35	154	6 x 3	Filtered seawater	1.2°/ 11.7°	14_1_11_43 to 14_1_11_48 and 14_1_11_54 to 14_1_11_59.txt	~90 mins	Length only	Frozen -80oC intact (1 dead not frozen)	Left in non-through flow water before incubation (for at least 12 h).
15/1/11	36	154	6 x 3	Filtered seawater	1.7°/ 11.7°	15_1_11_1 to 15_1_11_12.txt	~ 2 h	Length only	Frozen -80oC intact (1 dead not frozen)	Left in non-through flow water before incubation (for at least 12 h).
15/1/11	37	154	8 x 3	Filtered seawater	0.5°/ 12.0°	15_1_11_13 to 15_1_11_28.txt	~90 mins	Length only	Frozen -80oC intact	Left in non-through flow water before incubation (for at least 12 h).

In addition to the temperature incubations, further collections of krill were made for RNA expression analysis (Exps 10, 11 and 24, Table 19). Individuals were extracted fresh from a net catch and their maturity and moult stage examined immediately under a cold-light binocular microscope. Specimens that were either sub-adult male or sub-adult female and were in moult stage C were measured for total length and their heads subsequently preserved in RNA later. Table 19 lists all specimens that were preserved in RNA later, including the above and also those from the temperature incubations. Some of these specimens were carried directly back to UK at the end of the cruise for RNA analysis. The remainder were transported back via RRS James Clark Ross within the -80°C freezer.

Table 19 - Preserved or frozen krill (T0 or T+4) for Tarling, Tremblay, Seear and Johnson

Date	Experiment number	Number of krill	Incubated temperature or T0	Comments	Freight
24/12/10	1	25	1.6°/5.6°	3 h incubation, filtered seawater, at temperature at start of experiment	On JCR
30/12/10	2	18	-1.5°/3.8°	3 h incubation, coarse filtered, at temperature at start of experiment	On JCR
31/12/10	3	72	0.8°/5.8°	12 h incubation, coarse filtered, at temperature at start of experiment	On JCR
1/1/11	4	72	0°/6.6°C	9 h incubation, coarse filtered, at temperature at start of experiment	On JCR
2/1/11	5	72	0.1°/11.8°	24 h incubation, coarse filtered, brought up to temperature during experiment	Hand carry
4/1/11	6	72	1.4°/11.0°	8 h incubation, coarse filtered, brought up to temperature during experiment	On JCR
6/1/11	9	54	1.1°/11.9°	26 h incubation, coarse filtered, brought up to temperature during experiment	On JCR
6/1/11	10	12	T0	Event 109, 7 male, 5 female subadult. All moult stage C	Hand carry
6/1/11	11	10	T0	Event 111, 7 male, 3 female subadult. All moult stage C	Hand carry
7/1/11	14	54	0.9°/11.7°	25 h incubation, coarse filtered, brought up to temperature during experiment	Hand carry
9/1/11	18	54	1.2°/12.1°	32 h incubation, coarse filtered, brought up to temperature during experiment	On JCR
12/1/11	24	14	T0	Event 146, 8 male, 6 female subadult. All moult stage C	On JCR

Table 19: Krill heads preserved in RNA later from temperature incubations or directly from the net (T0). Hand carry specimens were transported directly back to UK at the end of the cruise. The remainder were transported via RRS James Clark Ross within the -80°C freezer. It is to be noted that RNA later is an effective preservative at room temperature and storage in freezers was only an extra precaution

Further specimens directly extracted from the nets (T0) or held in 50 L containers for 4 d (T + 4) were either frozen at -80oC or preserved in formalin for other purposes. Table 20 details these collections including the ultimate consignee.

Table 20 - Krill heads preserved in RNA later from temperature incubations or directly from the net (T0).

Date	Event	Lat (S)	Long (W)	Max depth	Final consignee	Preserved	Comments
27/12/10	35	53.754	39.007	33 m	Tremblay	-80oC	T0 in red topped tubes
27/12/10	35	53.754	39.007	33 m	Tarling	-80oC	T0
30/12/10	69	53.479	37.721	30 m	Tremblay	-80oC	T0 in red topped tubes
6/1/11	74	53.996	36.3586	59 m	Seear	-80oC	Preserved intact after 4+ d of incubation in white holding bin
6/1/11	74	53.996	36.3586	59 m	Tremblay	-80oC	T0 in red topped tubes
5/1/11	102	54.567	34.900	96 m	Johnson	Formalin	For teaching
6/1/11	109	54.558	35.586	47 m	Johnson	Formalin	For teaching
6/1/11	109	54.558	35.586	47 m	Tremblay	-80oC	T0 in red topped tubes
8/1/11	117	53.623	36.341	38 m	Tarling	-80oC	T0
12/1/11	146	53.592	37.613	36 m	Tremblay	-80oC	T0 in red topped tubes
14/1/11	156	53.709	38.564	50 m	Tremblay	-80oC	T0 in red topped tubes

Table 21 provides details on the consignment of all frozen specimens to BAS

Table 21 - Euphausia superba frozen at -80 °C consigned to BAS

Box label (filename)	BOL number	Contents
AA (gant 1)	JS/C/11/gant/4803	Intact specimens. Short term incubations. Experiment numbers 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37
AB (gant 2)	JS/C/11/gant/4804	Intact specimens. Short term incubations. Experiment numbers 7, 8, 12, 13, 15, 16
AC (gant 3)	JS/C/11/gant/4805	Intact specimens. Short term incubations. Experiment numbers 17, 19, 20, 21, 22, 23
BB (gant 4)	JS/C/11/gant/4806	Thorax. Long term incubations. Experiment numbers 4, 5, 6, 9, 14, 18
BC (gant 5)	JS/C/11/gant/4807	Thorax. Long term incubations. Experiment numbers 1 (labelled event 18), 2, 3
DD (gant 6)	JS/C/11/gant/4808	T0 specimens in red top tubes for Tremblay (1 of 2)
EE (gant 7)	JS/C/11/gant/4809	T0 specimens in red top tubes for Tremblay (2 of 2)
FF (gant 8)	JS/C/11/gant/4810	Krill heads in RNA later. Experiments 1, 2, 3, 4, 6, 9, 18, 24

GG (gant 9)	JS/C/11/gant/4811	T0 intact specimens. Events 117, 35 and 74(+ 4 d)
Hand carry to UK		Krill heads in RNA later. Experiments 5, 10, 11, 14

10 Swimming behaviour of nektonic crustaceans (*Euphausia superba* and *Themisto gaudichaudi*).

Magnus Johnson, Geraint Tarling and Neil Thompson

10.1 Introduction

During JCR116 a method for recording the swimming behaviour of pelagic crustaceans on board ship was developed based on a technique previously used for Northern krill (*Meganyctiphanes norvegica*; Thomasson et al, 2003). This resulted in a better understanding of factors influencing swimming patterns of *Euphausia superba* (Tarling & Johnson 2006, Johnson & Tarling 2008, Tarling et al 2009, Gaten & Johnson, 2011). In short it demonstrated differences in swimming capacity and behaviour between krill of different sexes, moult stages, maturity and stomach fullness. Previous work confirmed the idea that pelagic crustacean have a diurnal vertical migration pattern that is much more complex than a simple phototacic response resulting in deep distributions during the day and shallow distributions at night. Extrapolation of the results from individual krill recordings suggested that they may contribute to a greater extent than had previously been supposed to the sequestration of carbon to depth through multiple migrations between the mixed layer and depth. It is hypothesised that there will be a strong link between swimming capacity and respiration that will be affected by ambient conditions.

10.2 Aims

During JCR245 the aims were to investigate the effects of temperature and ambient light conditions on the swimming behaviour of a range of krill (sex, size, moult stage) and to build upon the knowledge of swimming patterns developed during previous work. Ultimately it is hoped that the work will contribute to the development of an algorithm capable of describing the stage/state-specific behaviours of *E. Superb*.

In addition records were made of swimming behaviour of *T. gaudichaudi* as they became available.

10.2 Methodology

Krill were attached to a virtually friction free rotational transducer connected to a data acquisition system (PowerLab) that allowed records of swimming behaviour to be taken at 100 Hz. Krill were attached so that their movement was restricted along their antero-posterior axis. A control transducer was used to compensate for the movement of the ship and predict what the position of individual krill would have been at a given point in time had they not been swimming. The resulting traces (Figure 26) reveal the rotational displacement of the krill, patterns of activity and pleopod beat rates.

The newtons force produced by the krill (*Fp*) can be calculated from:

$$F_p = [w_{krill} + w_{arm}] \times g \times \mathrm{Sin}\Theta$$

Where W_{krill} is the weight of the krill in water, W_{arm} is the weight of the pendulum, g is acceleration due to gravity and Θ the angle through which the pendulum is displaced.

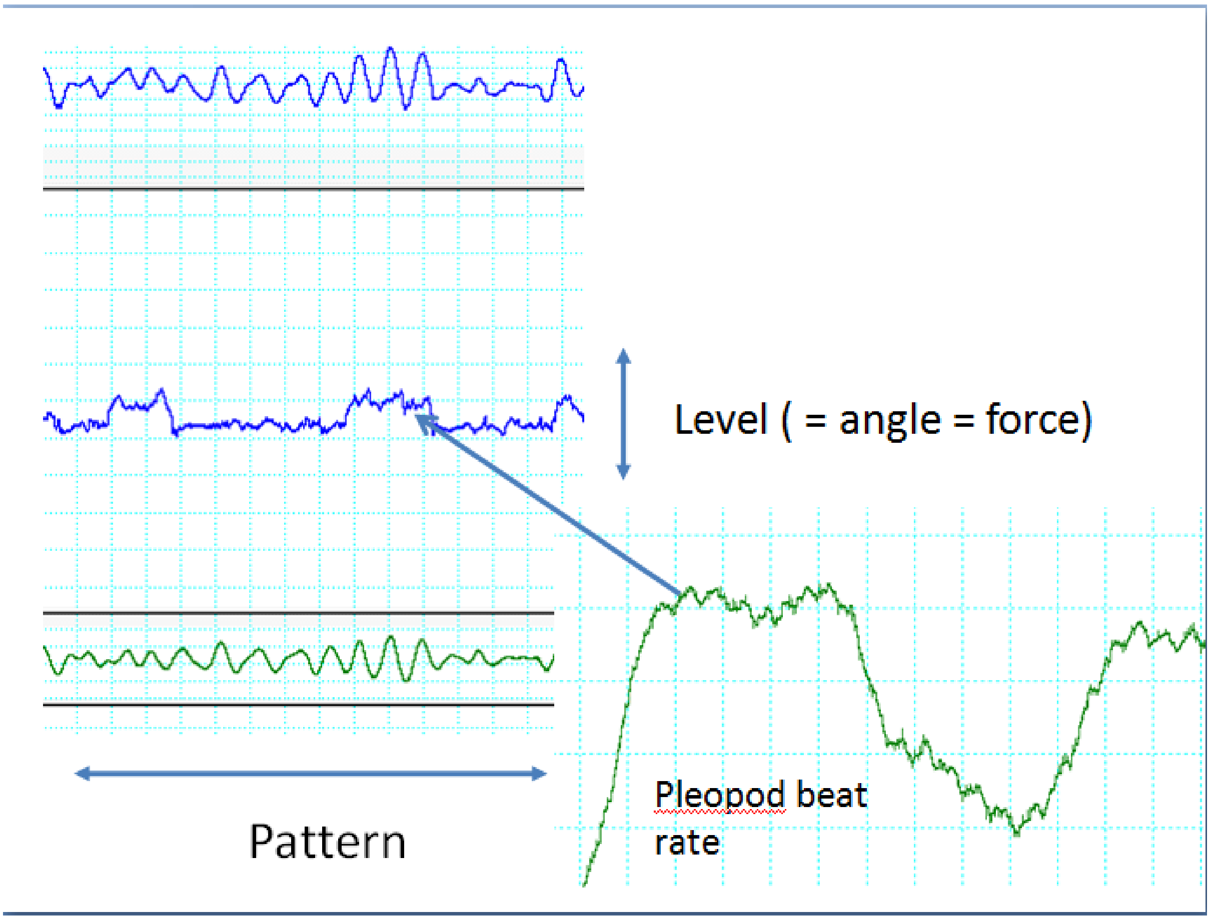


Figure 26 - Example of data recorded from krill attached to a pendulum showing the raw trace

Figure 26: Example of data recorded from krill attached to a pendulum showing the raw trace (a), the control trace (c) and the resultant record from a – c (b). The pleopod beat rate is visible as a high frequency signal (d) superimposed on the gross movements of the pendulum.

Krill were subject to two lighting conditions (dark and dim light corresponding approximately to light levels experienced at 20-30 m during the day) and temperatures ranging from -2 to 14°C and their swimming activity recorded for 5 min in each condition. Each krill was exposed to 4 conditions combining two light levels and two temperatures (ambient and warm or cold). At the end of each 20 min trial tail flip escape responses were elicited through gentle stimulation around the anterior region until the animal ceased to respond further. The responses of 343 krill were collected.

After collection of behavioural responses the size, sex, moult stage and maturity of each specimen was recorded.

In addition opportunistic sampling of the swimming behaviour 60 *Thermisto gaudichaudi* were obtained. These are the first records of individual swimming behaviour collected for this species and highlights the potential of the pendulum method for studying pelagic crustacean generally.

10.4 Data analysis

Analysis of responses will be carried out back in the UK and we will seek to link state specific variations in behaviour to data collected separately on the respiration of krill under various temperature regimes. Analysis of data collected will be hugely enhanced by the use of specific software developed by and with assistance from BAS staff during the cruise.

10.5 References

Gaten, E, Weise, K & Johnson, ML (2011). Laboratory-based observations of behaviour in *Meganyctiphanes norvegica*. Advances in Marine Biology, in press

Johnson, ML & Tarling, GA (2008). Influence of individual state on swimming capacity and behaviour of antarctic krill (*Euphausia superba*). Marine Ecology Progress Series. 366:99-110

Tarling, GA & Johnson, ML (2006). Satiation gives krill that sinking feeling. *Current Biology*, 16(3): R83-84

Tarling, GA, Cuzin-Roudy, J, Wootton, K & Johnson, ML (2009). Egg-release behaviour in Antarctic krill. Polar Biology, 32:1187-1194

Thomasson, MA, Johnson, ML, J-O Strömberg and E Gaten (2003) Swimming capacity and pleopod beat rate as a function of sex, size and moult stage in Nordic krill, *Meganyctiphanes norvegica*. Marine Ecology Progress Series. 250: 205-213

11 The development of a time-frequency analysis suite for Short-Term Fourier Transform (STFT) analysis of continuous and measurable behaviour.

Julian Klepacki, Magnus Johnson & Mike Pinnock

11.1 Introduction

Previous analyses of swimming behaviour of krill recorded on pendulums have relied on basic fast fourier transform (FFT) to pick out the pleopod beat rate signal from noisy data (Thomasson et al, 2003; Figure 27). The signal results from the fact that the pleopods of swimming crustaceans have a metachronal rhythm that produces a slight "bump" for each complete cycle. When attached to a pendulum, this results in a sinusoidal variation in angular displacement super-imposed upon larger movements of the pendulum that are caused by ship movement and forward-backward movement of the animal.

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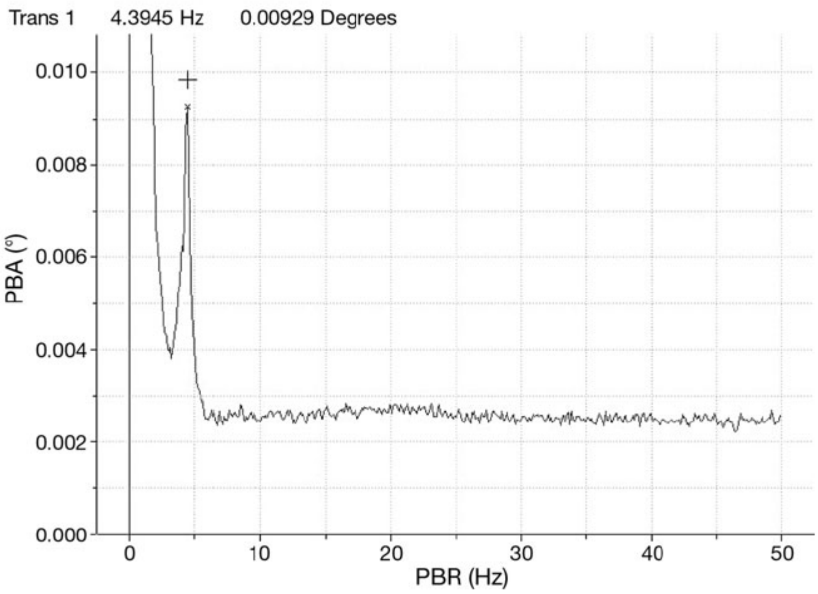

Figure 27 - Figure 1: An example of a FFT trace from Euphausia superba taken during JCR116

Figure 27: An example of a FFT trace from *Euphausia superba* taken during JCR116. The peak relating to the pleopod beats of the animal at 4.39Hz is clearly visible (Thomasson et al, 2003)

While the previous approach demonstrated overall differences in pleopod beat rate (PBR) between sexes and among moult stages and size classes of krill (Johnson & Tarling, 2008) the removal of the temporal component through FFT obscured variations and patterns in swimming behaviours over the sample times. A straight FFT may conceal important details, as with a mean and standard deviation when the central tendency paradigm is not true. For example two similar frequencies occurring alternately would be represented as a single broad peak or repeat bursts of a high frequency signal would be represented in a similar fashion to a constant signal.

A package was developed that allows filtration of the raw signal data to remove ship noise and the application of short-term fourier transform (STFT) to swimming behaviour records of krill. It is envisaged that the package will allow re-analysis of data collected previously (on JCR116) and have applications for other researchers interested in similar behavioural or ecological data

11.2 Aims

This was a serendipitous project resulting from the specific expertise of J. Klepacki in fourier transform and programming, M. Pinnock in the application of these techniques to earth sciences and M. Johnson in their application to ethology. Initial discussions resulted in the aim of developing a user-friendly virtual-instrument analysis suite that would facilitate application of fast fourier analysis and short term fourier transform to data collected from krill attached to pendulums. In order to analyse what are very small signals relative to background noise from ship based recordings a parallel aim was the development of controllable and robust filtration methodologies. Initial analysis of data using the fourier transform function in excel and a freely available filter (Kurt Annen, http://) demonstrated significant temporal variation in the PBR signal during 5 minute PowerLab recordings of krill swimming activity.

11.3 Programme Development

The instrument was developed using National Instruments LabView virtual instrument programming environment. The time-frequency analysis suite implements an Elliptical Infinite Impulse Response (IIR) filter. Unfiltered or filtered data can be windowed to reduce spectral-leakage before being processed via the Discrete Fourier Transform (DFT). On satisfactory DFT results further processing by a STFT algorithm can be used to obtain time-frequency information. The STFT is carried out utilising a sliding window analysing 'short-terms' of the data set at incremental periods of time. The sliding window has 50% overlap and the windowed data set is zero-padded to increase the discrete frequency resolution. The STFT window parameters (size and shift) are programmatically calculated to give a good compromise between time-frequency information, which are inversely proportional.

The analysis suite allows the user to upload data files of spreadsheet text based tab delimited format. Data are arranged in columns and the user can specify which column they wish to analyse and the sampling frequency rate entered (A). Up-loaded data are initially displayed (B) as time v amplitude in the unfiltered form (red line) and filtered form (blue line). Just inspecting the bandpass filtered data (before Fourier transform) can give valuable insight to krill behaviour as the overall envelope of the signal shows bursts of swimming. It is also important to be aware of step functions or DC shifts that may appear as low frequency signals after fourier transform. Switching the filter off removes the filtered trace from the graph. If the filter is switched on the user can choose between low-pass, high-pass, band-pass and band-stop and set cut off/on frequencies as they wish, but limited by Nyquist criterion, which is automatically set. The frequency spectrum of the data are displayed in raw form (C) and binned (D) to the desired resolution in the latter, which is user definable.

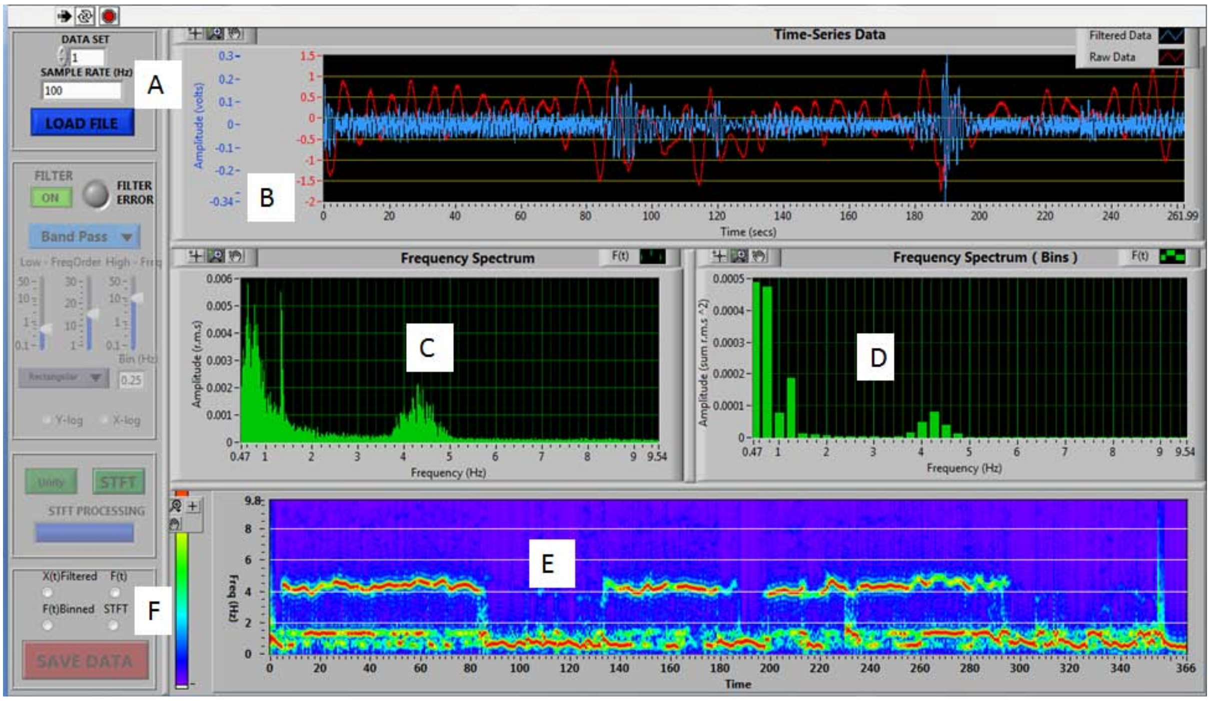

Figure 28 - Graphical user interface for time-frequency analysis suite

Figure 28: *Graphical user interface for time-frequency analysis suite. A peak in the fourier transformed data (plots C & D) corresponds to the pleopod beat rate of the krill. The utility of STFT is demonstrated in plot E where it becomes apparent that the animal was not swimming constantly.*

A selection of windows (Rectangular, Hamming, Blackman etc) are available and the axes of the frequency distribution graphs can be set to linear or logarithmic scales so as to better discriminate minor components. Once the user has defined the signal to be processed through the filtration settings, it can then be passed through a STFT algorithm. The STFT process has the option to re-scale frequency components to per-unit maximum. This option improves the identification of time-frequency characteristics of the resultant STFT spectrum, by accentuating low magnitude components. The STFT is visible in the lower window (E). All graphs are adjustable so that the user can define which portion of the data they wish to see. The user can select for data to be saved to text file (F) with the filtered signal, straight fourier transform, binned fourier transform and the STFT data being saved to separate files in a dedicated folder.

11.4 Further development

It is thought that the package developed may be of interest beyond the current project. It is hoped that we can produce a methodology paper and that the software can be lodged somewhere publically accessible.

11.5 References

Johnson, ML & Tarling, GA (2008). Influence of individual state on swimming capacity and behaviour of antarctic krill (*Euphausia superba*). Marine Ecology Progress Series. 366:99-110

12 Technical Support

Julian Klepacki, Douglas Willis and David Connor

12.1 AME

Julian Klepacki

Cruise:JR245 Start date: 18/12/2010 Finish date: 23/01/2011

Name of AME engineer: Julian Klepacki
Name of principle scientist (PSO): Sophie Fielding

Instrument	Used ?	Comments
XBT (aft UIC) (PC, I/F box, handgun)	Y	
Scintillation counter (prep lab)		
AutoSal (labs on upper deck) S/N 68959	Y	
AutoSal (labs on upper deck) S/N 65763		
AutoSal (labs on upper deck) S/N 68533		
Portasal S/N 68164		
Magnetometer STCM1 (aft UIC)	Y	
AME workshop PC	Y	

12.1.1 GPS, MRU, Gyro

GPS Furuno GP32 (bridge – port side)	Y	
DGPS Ashtec ADU5 (bridge – port side)	Y	
DGPS, MRU Seatex Seapath (UIC – swath suite)	Y	Unit replaced with spare Oct 24th #5298

DGPS Ashtec Glonass GG24 (bridge – starboard side)	Y	Required Reset on Bridge (IT dealt with it)
Gyro synchro to RS232 Navitron NT925HDI (UIC – aft)	Y	
TSS HRP (UIC repeater)	Y	

12.1.2 ACOUSTIC

Instrument	**Used ?**	**Comments**
ADCP (aft UIC)	Y	
PES (aft UIC)	Y	Re-Installed, see notes.
EM120 (for'd UIC)	Y	Monitor needs replacing with dual input for Bridge Display?
TOPAS (for'd UIC)		
EPC plotter (used with TOPAS)		
EK60 (mid UIC)	Y	Network switch replaced by IT, causing system to crash (data rate)
HP deskjet 1 (used with EK)		
HP deskjet 2 (used with EK)		
SSU (for'd UIC)	Y	
SVP S/N3298 (cage when unused)		
SVP S/N3314 (cage when unused)		
10kHz IOS pinger		
Benthos 12kHz pinger S/N 1316 + bracket		
Benthos 12kHz pinger S/N 1317 + bracket		
MORS 10kHz transponder		
Sonardyne USBL (aft UIC)		
Sonardyne 7970 SSM Beacon Tape room (blue case)		
Sonardyne 7971 SSM Beacon Cupboard 709 (by PES)		

Sonardyne 7970 SSM Beacon Taperoom (Blue Case)		

12.1.3 OCEANLOGGER

Instrument	Used ?	Comments
Main logging PC hardware and software	Y	
Barometer (back of logger rack) #V145002 (7/03)	Y	
Barometer #V145003 (7/03)	Y	
Barometer #Y2610005		
Barometer #W4620001		
Air humidity & temp (for'd mast) #15619015	Y	If this is primary instrument then not OK
Air humidity & temp #60000120	Y	see additional notes
Air humidity & temp #28552023 (HT1, 7/03)		
Air humidity & temp #18109036 (HT2, 7/03)		Please note that I have not been up the mast and cannot confirm that these serial # are correct
Thermosalinograph SBE45 (prep lab) #4524698-0016	Y	
Thermosalinograph SBE45 # 4532920-0072		
Thermosalinograph SBE45 #4524698-0018 (7/04)		
Fluorometer (prep lab)		
TIR sensor (pyranometer) (for'd mast) #990684	Y	
TIR sensor #32374 (TIR1, 7/03)		
TIR sensor #990685		
TIR sensor #011403 (TIR2, 7/03)		
PAR sensor (for'd mast) #990069	Y	

PAR sensor #990070		
PAR sensor #30335 (PAR1, 7/03)		
PAR sensor # 010224 (PAR2, 7/03)		

Flow meter (prep room) #45/59462	Y	
Uncontaminated seawater temp (transducer space)	Y	

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

Instrument	Used ?	Comments
Deck unit 1 SBE11plus S/N 11P15759-0458		
Deck unit 2 SBE11plus S/N 11P20391-0502	Y	
Underwater unit SBE9plus #09P15759-0480 Press #67241		
Underwater unit SBE9plus #09P20391-0541 Press #75429		
Underwater unit SBE9plus #09P30856-0707 Press #89973	Y	
Underwater unit SBE9plus #09P35716-0771 Press #93686		
Carousel & pylon SBE32 #3215759-0173		
Carousel & pylon SBE32 #0248		
Carousel & pylon 24 Bottle	Y	
CTD swivel linkage	Y	
CTD swivel S/N196115		
CTD swivel S/N196111	Y	

Temp sensor SBE3plus #03P5042		
Temp sensor SBE3plus #03P5043		
Temp sensor SBE3plus #03P2307		
Temp sensor SBE3plus #03P4472		
Temp sensor SBE3plus #03P2705		
Temp sensor SBE3plus #03P2709		
Temp sensor SBE3plus #03P4235	Y	sec
Temp sensor SBE3plus #03P4302	Y	pri
Cond sensor SBE4C #043491		
Cond sensor SBE4C #043488		
Cond sensor SBE4C #042222		
Cond sensor SBE4C #042248	y	Pri (replacement for 2875)
Cond sensor SBE4C #042255		
Cond sensor SBE4C #041913		
Cond sensor SBE4C #042813	y	sec
Cond sensor SBE4C #042875		
Pump SBE5T # 54488		
Pump SBE5T # 51813		
Pump SBE5T # 52371	Y	pri
Pump SBE5T # 52395	Y	sec
Pump SBE5T # 52400		
Pump SBE5T # 53415		
Instrument	**Used ?**	**Comments**
Fluorometer Aquatracka MkIII #088216	y	

Fluorometer Aquatracka MkIII #088249		
Standards Thermometer SBE35 #3515759-0005		
Standards Thermometer SBE35 # 3527735-0024		
Standards Thermometer SBE35 # 51	y	
Altimeter PA200 #163162		
Altimeter PA200 #27002	y	see notes
Transmissometer C-Star #CST-396DR		
Transmissometer C-Star #CST-527DR	y	
Transmissometer C-Star CST 846DR		
Oxygen sensor SBE43 #0242		
Oxygen sensor SBE43 #0245		
Oxygen sensor SBE43 #0620		
Oxygen sensor SBE43 #0676	y	
PAR sensor #7235		
PAR sensor #7252	y	
PAR sensor #7274		
PAR sensor #7275		

Notes on any other part of CTD e.g. faulty cables, wire drum slip ring, bottles, swivel, frame, tubing etc.		Slip Rings Cleaned. See additional notes.

12.1.5 AME UNSUPPORTED INSTRUMENTS BUT LOGGED

Instrument	**Used ?**	**Comments**
EA600 (bridge and UIC remote)	Y	

Anemometer	Y	
Gyro	Y	
DopplerLog	Y	
EMLog		
CLAM winch monitoring system	Y	see additional notes

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.

<u>Please clean the intake fans on the following machines:</u>

Instrument	**Cleaned?**
Oceanlogger	Y
EM120, TOPAS, NEPTUNE UPSs	Y
Seatex Seapath	Y
Topas tweendeck	Y
EM120 Tween deck	Y

12.1.6 Additional notes and recommendations for change / future work

Handover Notes from JR245

- CTD

Rubber sleeving on ‘fin’ deteriorated, replaced with what i could find, but it’s abit thick. had to slacken the clamps off a touch, otherwise too tight. seems to works o.k.

Altimeter occasionally depicts a signal between approximate depths of 200-300 meters. signal is structured; periodic and reduces in magnitude linearly with depth until it disappears. Detects bottom correctly and satisfactorily. I have seen this before on other cruises (other units). I believe it is picking up a harmonic from somewhere; below 200m within beam, below 300m out of range? CTD operator(s) do not find it an issue. Even with shallow CTD (200<CTD<300) it does not affect bottom detection. Otherwise CTD operated without problems.

- CLAM

numerous things seem to have been causing problems with the clam system. from notes they seem to have started since a display panel was changed over the spring/summer? failing serial chips, failing cards, erroneous signals etc. too much going on to make any sense of it all, so my investigations start afresh with present main problem. That is 10T inboard back-tension signal causing frequent alarm due to erroneous back-tension measurement. outboard tension and cable rate/feed appears o.k. 30T side appears to work fine.

My findings are, there appears to be a problem with the ground on the interface card side. During investigations it was discovered that connecting a scope-probe to the back-tension signal output of the signal-conditioner, resolved the problem. Correct communication indication was restored with effectively synchronous bright Rx and Tx LEDs. Stable physical back-tension value was displayed on clam display.

This ground issue also affects cards randomly is what i experienced too. i.e. one (spare or otherwise) card in the 10T will not function at all, another card will appear to function, but be erroneous (asynchronous/dim LEDs). With the test chassis-ground link attached all the cards worked o.k. I think this is where the appearance of faulty/problematic cards has come from?

The 10T inboard back-tension circuit appears the source of problem.

- The branch from the conditioner output for 10T back-tension feeding the console was disconnected, isolating the card in case that (console) was pulling the system down somehow? Made no difference.
- The signal conditioner was replaced with a new spare unit. They are internally transformer isolated and differential output. Made no difference.
- The loadcell wiring (excitation + signal) to conditioner were by-passed using a long lead. Made no difference.
- The back-tension (plus other measurement) signal ground is referenced to the IF card A-comm, common analogue, which is also connected to the cards digital ground. Feeding the A-comm pin from ground source within the cabinet failed to make any difference.

my understanding now is that the signal output on the conditioner side has a different ground source to that of the tranducer(s) supply/source/excitation etc within the cabinet. Whose origin is the supply ground.

Feeding any of the card's A-comm pin to chassis-ground fixed the problem. Temporarily a lead has been fitted to the A-comm terminal of 10T IF card 2 to the cabinet chassis-ground. This restores correct operation of the clam back-tension logging.

Without the chassis-ground wire:
With 10T inboard back-tension connected 10T communication is affected. Rx and Tx LEDs indicate odd behaviour and illumination isn't right (dim); the bad ground effecting the functionality of the whole card? Unplug the inboard back-tension and correct communication is restored, but obviously without back-tension information. outboard tension and cable feed/payout works fine (card above).

I was then going to follow and investigate the analogue grounds on the signal/interface-card side of the clam system. opportunities were limited and just ran out of time. I have left the spare IF cards out on the bench in case you do need them afterall.

- OCEAN LOGGER

Primary temperature / humidity is not working now. previously secondary wasn't working, but sensor changed (RB) during refit.
Secondary temperature has developed a random, but frequent 0.2 degree fluctuation. fluctuation is step-change, probably a bad connection of some sort? no realistic access (mast) to investigate this?

- SEAPATH

Was noticed that heading was 7-9 degrees out and no Gyro information could be displayed. Investigated and port settings were incorrect for gyro. updated port settings and stuck label onto front with gyro settings for future reference. also created a 'parameter' file and report file for latest settings filename: 29122010.par and 29122010.rtf. these files reside on the ame laptop in the scc folder and on the workshop pc within the 'manuals' folder under the seapath directory under instrumentation etc. modified SBAS 'Enable' satellite list to remove a superfluous SV number in the hope it removes a warning message about 'unnecessary parameters' , that Mike RO said not to worry about. Believe warning didn't return.

- PES

PES computer has sustained damage in transit. Plastic front face is broken/cracked. It has been re-installed and it appears to functions correctly within the capacity it could be tested, i.e. display appears normal and functionality is all there. Was picking up the EK and displaying 'lines' etc

- CORER

Cabling (control+supply) for the corer required for next cruise is in the cage. The cables will need to be re-attached to the corer with new glands fitted to the corer motor (larger diameter cable used). I was going to fit new glands ready, but found out the corer itself had been left at Stanley once we'd left. Cabling is as follows.

4-Core (Brwn/Blk/Gry/Grn+Yl) cable is the motor 3-phase supply. I have snipped the wires at the motor terminals, so wiring is obvious, but BROWN=W2, BLACK=U2 and GREY=V2.

3-Core (Brn/Bl/Grn+Yl) cable is motor brake. The BROWN and BLUE wires connect to the CONTACTS (black wires) on the little module (rectifier i think?) in the motor terminal box. Doesn't matter which goes to which, simply contacts.

I have placed the cable glands in the cable control box in the science cage. I got as assortment as best could from Cambridge. Hopefully they will be o.k, i'm sure the ship ETO has a descent supply of these in case?

12.2 ICT Report

Douglas Willis

12.2.1 Acquisition machines

<u>12.2.1.1 SCS</u>

Logging ran well but there issued with the seatex-psxn data stream. The SCS system is seeing all data but only logging a fraction of the records. The system was restarted several time to try and remedy this but no remedy was found. This will be addressed when the JCR returns to Stanley as it will require disruption to logging to trace and fix the fault.

Acquisition started at 10 352 11:18:00.
Acquisition stopped at 11 19 01:00:00

There were several gaps in the data acquisition.

All data streams experienced the following interruptions to logging.

time gap : 10 352 18:38:18 to 10 353 13:03:10
time gap : 10 364 14:05:05 to 10 364 14:59:53
time gap : 11 001 11:56:10 to 11 001 11:59:55
time gap : 11 001 12:04:47 to 11 001 12:06:08
time gap : 11 001 14:49:59 to 11 001 15:18:33
time gap : 11 002 14:14:43 to 11 002 14:30:21
time gap : 11 003 16:23:39 to 11 003 16:24:24
time gap : 11 003 16:26:03 to 11 003 16:27:52
time gap : 11 003 16:28:07 to 11 003 16:28:42

Further gaps were identified in the Gyro data stream. The repeater in the UIC was powered off following fault finding on the tsshrp data stream.
time gap : 10 355 19:21:14 to 10 356 20:10:21

The Ashtec ADU5 stopped reporting its heading various times during the cruise and has the following header value gaps.

18/12/2010 12:02:49 - 12:02:56
21/12/2010 15:50:45 - 15:51:03
25/12/2010 07:07:38 - 07:07:49
30/12/2010 05:35:42 - 07:27:38
04/01/2011 16:01:11 - 19:10:40
09/01/2011 10:06:52 - 11:17:33
14/01/2011 04:52:12 - 10:19:27
16/01/2011 00:27:36 - 00:27:38

<u>12.2.1.2 CTD PC</u>

Performed well with no faults.
Recommend that it be upgraded to the latest hardware and software as it is running Windows 2000 which is far from being supportable.

<u>12.2.1.3 XBT PC</u>

Performed well with no faults.

12.2.1.4 ADCP
Performed well with no faults.

12.2.2 Servers

12.2.2.1 JRNA
No real problems, occasional reports of very slow network file share access. No cause found.

12.2.2.2 JRLB
MSA 2000 storage array had a failed disk which led to a controller failure. The system was restarted and the storage rebuilt. On completion of the file system rebuilds the faulty disk was replaced and the system restarted.

The system stopped twice with memory problems and had to be restarted. The problem was traced to a memory leak in the raw2compress program. This has been fixed. Details of the problem can be found in the Data Managers section of the report.

LDAP certificate was not being recognised as valid by various systems. Replaced the certificate and re-exported the LDAP configuration to the Solaris systems. All working well following the certificate update.

12.2.2.3 AMS3
No problems. Worked well

12.2.3 Supplemental data logging.
A requirement was raised for a faster logging frequency for the heave, roll and pitch data from the Seatex system. A simple perl program was written to capture the data available from the Seatex system which was delivering 4 updates per second. This program logged to PSXN 24&23 plus the GGA string to a file in /data/cruise/jcr/current/krill

```
#!/usr/bin/perl

use strict;
use Device::SerialPort;
use Time::HiRes qw( gettimeofday );
use POSIX qw(strftime);
use IO::Handle;

sub resetscr () {
        # Reset the screen to default values
        print "\e[0m";
        # Set the default background to blue and foreground to cyan
        print "\e[44;36m\e[8]";
}
sub clearscr () {
        print "\e[2J";
         print "\e[1;1f";
}

sub printxy {
        my $xpos = shift(@_);
        my $ypos = shift(@_);
        my $string = shift (@_);
        print "\e[".$xpos.";".$ypos."f".$string;
}

my $in_seatex_port = "/dev/ttyS0";
my $Seatex_Configuration_File_Name = "seatex.cfg";

my $key = '';
```

```
my $seatex_string;
my $gga_string;
my $gll_string;
my $hdt_string;
my $psxn20_string;
my $psxn22_string;
my $psxn23_string;
my $psxn24_string;
my $vtg_string;
my $zda_string;

# Setup configuration for Seatex incoming port
my $seatex_port = Device::SerialPort->new ($in_seatex_port) || die "could not open
port from $in_seatex_port\n";
$seatex_port->baudrate(19200);
$seatex_port->parity("none");
$seatex_port->databits(8);
$seatex_port->stopbits(1);
$seatex_port->write_settings;
$seatex_port->save($Seatex_Configuration_File_Name) || warn "Can't save
$Seatex_Configuration_File_Name: $^!\n";
$seatex_port->close || die "failed to close";
undef $seatex_port;

my $seatex_port = start Device::SerialPort($Seatex_Configuration_File_Name)
    || die "Can't open port: $^!\n";


sub waitfor_seatex {

        # read a complete line from the serial port before returning.
        my $timeout=$seatex_port->get_tick_count ;
        my $gotit = "";
        for (;;) {
            return unless (defined ($gotit = $seatex_port->lookfor));
            if ( $gotit ne "" ) {
                my ($found, $end) = $seatex_port->lastlook;
                return $gotit.$found;
            }
            return if ($seatex_port->reset_error);
            return if ($seatex_port->get_tick_count > $timeout);
        }
}

# Draw the screen.

# Reset to default values
resetscr;
# Clear screen
clearscr;
# Layout display
printxy (1,1,"Position Data");
printxy (2,1,"-----------------------------------------------------------------------
-------");
printxy (1,59,"Press ^C to exit");
printxy (3,20,"System Time");
printxy (4,20,"GGA Time");
printxy (6,1,"Incoming Data");
printxy (20,1,"Outgoing Data");

# Set the line terminator details
$seatex_port->are_match("\n");

$key = ' ';

open (RAW_OUT,'>>','/data/current/krill/seatex.raw') || die "Could not open the
seatex.raw file for writing.";
RAW_OUT->autoflush(1);

while (lc($key) ne 'q') {

        my ($seconds, $microseconds) = gettimeofday();
        my $current_slice = int($microseconds / 100000);
```

```
        my $now_string = sprintf("%s.%02d", (strftime "%T", gmtime) ,(int
($microseconds /10000)));
        printxy (3,45,$now_string);

        # A key press will exit program. Poll for the key but don't wait.
        #$key = $simp->GetKey(0);

        $seatex_string = waitfor_seatex();
        if ( $seatex_string =~ /^.{3}GGA.+$/) {

             # Found GGA string
             $gga_string = $seatex_string;
            printxy (8,5,$gga_string);

            my ($data,$time_string) = split(',',$gga_string);

             my $time = substr($time_string,0,2) . ":"
                      . substr($time_string,2,2) . ":"
                      . substr($time_string,4,length($time_string));
            printxy (4,45,$time);

             my $output_string = sprintf("%s,%s.%02d,%s", (strftime "%d/%m/%Y", gmtime
), (strftime "%T", gmtime) ,(int ($microseconds /10000)),$gga_string);
             printxy (22,5,$output_string);

            print RAW_OUT "$output_string\r\n";

        } elsif ( $seatex_string =~ /^.{3}GLL.+$/ ) {

             # Found GLL
             $gll_string = $seatex_string;
            printxy (9,5,$gll_string);

         } elsif ( $seatex_string =~ /^.{3}HDT.+$/ ) {

             # Found HDT string
             $hdt_string = $seatex_string;
             printxy (10,5,$hdt_string);

         } elsif ( $seatex_string =~ /^.{3}XN,20.+$/ ) {

             # Found PSXN 20
             $psxn20_string = $seatex_string;
            printxy (11,5,$psxn20_string);

         } elsif ( $seatex_string =~ /^.{3}XN,22.+$/ ) {

             # Found PSXN 22
             $psxn22_string = $seatex_string;
             printxy (12,5,$psxn22_string);

         } elsif ( $seatex_string =~ /^.{3}XN,23.+$/ ) {

             # Found PSXN 23

             $psxn23_string = $seatex_string;
            printxy (13,5,$psxn23_string);
            my $output_string = sprintf("%s,%s.%02d,%s", (strftime "%d/%m/%Y", gmtime
), (strftime "%T", gmtime) ,(int ($microseconds /10000)),$psxn23_string);
            printxy (23,5,$output_string);

            print RAW_OUT "$output_string\r\n";

        } elsif ( $seatex_string =~ /^.{3}XN,24.+$/ ) {
               $psxn24_string = $seatex_string;
                printxy (14,5,$psxn24_string);
               my $output_string = sprintf("%s,%s.%02d,%s", (strftime "%d/%m/%Y",
gmtime ), (strftime "%T", gmtime) ,(int ($microseconds /10000)),$psxn24_string);
               printxy (24,5,$output_string);

               print RAW_OUT "$output_string\r\n";

         } elsif ( $seatex_string =~ /^.{3}VTG.+$/ ) {
             # Found VTG string
            $vtg_string = $seatex_string;
```

```
            printxy (15,5,$vtg_string);

        } elsif ( $seatex_string =~ /^.{3}ZDA.+$/ ) {

            # Found ZDA
            $zda_string = $seatex_string;
            printxy (16,5,$zda_string);

        }
}
undef $seatex_port;
```

12.3 Data Management

David Connor

12.3.1 DPS (SCS Data Processing System)

I've made some additions and changes to the DPS system that I think would be beneficial. At the moment I've added a few modules to the main branch in /pacakges/dps but the majority of changes still only exist in /users/dacon/projects/dps/ as I would like Jeremy to have a change to review some of the ideas and such. You can see details of which changes are applied and which aren't in the last section of the DPS summary.

12.3.1.1 utils

dps.pl

-v option added that will enabled showing of thee DPS::Log entries. By default all calls to DPS::Log do not action but with the -v option large amounts of details about what the DPS system is doing are outputted. It's generally useful when trying to understand how the system works.

12.3.1.2 perl/DPS

Log.pm

The Log.pm module is a very simple logging interface that doesn't do much. It will output messages, formatted dates, dumped arrays and attach a timestamp. By default, the module will not display any information. You must actively set a flag. The module is used in a classless way so a call of:

```
DPS::Log::set_level(1);
```

will turn on debugging. There are a functions and if you look in the module they are self explanatory. Here is a quick summary:

set_level

> Sets the level of message to display. The msg call allows you to set a number as a cutoff of how detailed to go. At the moment any positive number will turn on all messaging as Ive not implemented it as it would be better to apply an existing perl Logging module in this file.

msg

> Diplays a passed in message. The first parameter is the module which is normally passed in as __PACKAGE__ but can be any text. The second is the message. The third parameter is for level of verbosity but hasn't been properly implemented

dumper

> DPS::Log::dumper can be used as a pass thru for Data::Dumper so each module doesn't have to include it.

error

> Same as msg but terminates program

tmsp

> Displays a formatted timestamp

date

Displays fully formatted date

Engine.pm

1) Recatoring sub initialize

To facilitie some changes in the web based use of the DPS module I've added a module in Control called Chain.pm which is a mimic of the structure that is returned by the XMLSimple routine. I've thus split the initial DPS module to do the XML parsing in **sub initialize** and then pass the returned perl data structure into a routine called **intialize_from_chain**. Using DPS/Control/Chain.pm you can manually assemble a chain file in perl and pass this structure to the Engine initialization.

2) DPS::Log calls - This module has had a few DPS::Log calls added throughout.

Control/Chain.pm
The Chain.pm module is an object that allows you to construct DPS chains without XML. This is useful when assembling DPS instructions from web based interfaces.

add_input

This will add an input module to the chain.
Inputs: $module - DPS Input module, $name - Chain section name, used for linking, $params - Any additional params passed in via a hash)

add_filter

Same as add_input but adds module to filter section

set_output

Same as add_input but sets the single output module

chain_module_onto_from

Makes a link between one module to another. The first parameter is $from and the second is $to. This means that the first module will get its input from the $to module.

get_chain

Returns perl data structure that matches the output of XMLSimple

Example usage:

```
my $chain = DPS::Control::Chain->new();

# Input
my $input_params = {};
$input_params->{'var'} = [];
foreach my $var(@{$streams->{$stream}->{vars}}) {
        push @{$input_params->{'var'}}, {'out' => $var, 'in' =>
$var};
}
```

```
$input_params->{'stream'} = $stream;
$chain->add_input('SCSIn', 'inputstream', $input_params);

# Filter
my $filter_params = {};
$filter_params->{'interval'} = $interval;
$chain->add_filter('Interval', 'main', $filter_params);

# Output
$chain->set_output('JSON', 'final', {'stream' => $stream});

# Set chaining
$chain->chain_module_onto_from('main', 'inputstream');
$chain->chain_module_onto_from('final', 'main');
```

Input/EventLog.pm

Provides an input mechanism to get data out of the ships eventlog.

The module takes three parameters:

- id - The SQL id of the log
- type - The type of log. There are two valid choices: science or event. science is for the bridge log and event is for a user-created log.
- window - Is an optional parameter that is specified in seconds. It allows an event to be valid for -window to +window. That means all stream data inside that window will count as happening during that event. This makes using modules like Merge.pm happier.

Example:
This example brings together the GPS data with the eventlog to put bridge events onto a KML file.

```
<chain name="stat-test">
        <input name="bridgelog" module="EventLog">
                <params>
                        <id>82</id>
                        <type>science</type>
                        <window>40</window>
                </params>
        </input>

        <input name="gps" module="SCSIn">
                <params>
                        <stream>seatex-gga</stream>
                        <var in="seatex-gga-lat" out="lat" />
                        <var in="seatex-gga-lon" out="lon" />
                </params>
        </input>
```

```
        <filter name="merge" module="MergeLeft">
                <input>gps</input>
                <input>bridgelog</input>
        </filter>

        <filter name="main" module="Interval">
                <params>
                        <interval>60</interval>
                </params>
                <input>merge</input>
        </filter>

        <output name="stat" module="KML">
                <params>
                        <lat>lat</lat>
                        <lon>lon</lon>
                        <nameprefix>Event #</nameprefix>
                        <name>el82:event_no</name>
                </params>

                <input>main</input>
        </output>
</chain>
```

Filter/MergeLeft.pm
This module is similar to the Merge.pm module except that it acts like a SQL Left Join query. Whatever the first input module is will be treated as the left column. All data will be matched from this column and any additional input modules will have to match against the timestamps from the left module. Merge works as a UNION.

Output/EVLSimple.pm
EVLSimple is a modification of the EVL.pm module to remove the dependency on the Net data. It will simply take all inputs and format them in a EVL format. If you specify too many inputs it will still add them to the file and it will then likely be incompatible.
This module was used to tie Winch depth data to GPS nav data for approximate CTD positions during an acoustic transect.

Output/KML.pm
There are about a billion methods and processes for generating KML from cruise data but none are documented well. Harmonising these approaches is a project that can be tackled in Cambridge. But in the meantime I've made the starting point of a DPS module that I used just for simple plotting of the cruise track and eventlog.

There are a few parameters required for the KML module to be happy:

- 'lat' and 'lon' - You need to tell the KML module which variables coming in from previous modules in the chain represent the latitude and longitude.
- nameprefix - Is used in the markers that represent markers.
- name -

For each line returned by the DPS chain the KML module checks if the line has a timestamp, and lat /lon field. If it only has these then it will include it in the cruise track line. If there is MORE data then it will create a marker. That means at the moment this only works with the MergeLeft module or any other module that allows empty data to be returned in some lines.

This KML module is only a quick and dirty starting point to get cruise track and eventlog data out. It can be expanded but it'll be worth exploring with other groups.

Output/JSON.pm

This module is a rewrite of the CSV.pm module to output the data as JSON.

12.3.1.3 DPS XML and transects

A few specific DPS XML file were used on this cruise and they can be viewed in /users/dacon/dps/

12.3.2 SCS (Perl Applications and Modules)

12.3.2.1 raw2compress.pl

Two problems were encountered with raw2compress during this trip:

1) raw2compress would only build data from the newest Raw file. If the SCS was stopped and raw2compress attempted to update existing compress files it would overwrite them with data using only the latest raw file. Problem tracked to SCS::Raw perl module and corrected.

Line 304:

```
# Last file or nothing
if(!$found_file || $found_file < 0) {
        $found_file = $raw->{num_files} - 1;
}
```

2) The raw2compress process was showing signs of large memory usage. We rebuilt the compress files after about 2 1/2 weeks of the cruise and it crashed due to a memory error. This has been tracked down to a line in the SCS::Raw module which has now been changed. The change can be seen in the subversion history. The per-process memory usage of raw2compress now sitting at 11mb without increasing during operation. We changed over to the update raw2compress after the oceanlogger stream unexpectedly failed.

Line 467:

```
# Memory Leak Fix - dacon - January 5th, 2010
# The combo of eval and passing in the raw string with the
# hash reference $raw->{record}->{raw} seems to cause a slow but
steady memory
# leak. Making a string copy and using that reference in the eval
seems to bring it
# under control. Why? Good question.

my $raw_string = $raw->{record}->{raw};
```

```
my $cmd = '$val = $raw->_convert_' . $v->{type} . '($v, \@infs,
$raw_string)';
```

12.3.2.2 listit

There is one issue we've run into with the listit command that requires either some changes or a clarification. In some cases non-numeric data is getting to listit and then within listit it can't properly handle the ouput.

Here's the example case that might explain it better. In listit when you ask for some number of fields, if one of the runs of while ($rec->{timestamp} <= $etime) returns something like: '-53', '-38','343','2344',, the last two blanks cause the check on line 99ish to spit out a error about comparing a non-numeric field with >=

From listit this can be handled with something like:

```
      if(!looks_like_number($rec->{vals}->[$_])) {
           $outstr .= sprintf(" %0.6e $scs->{REJECT}","-999");
       } else {
           $outstr .= " " if $rec->{vals}->[$_] >= 0;
           $outstr .= sprintf(" %0.6e $scs->{GOOD}", $rec->{vals}-
>[$_]);
       }
```

This obviously just checks if the value is non-numeric or empty and spits out a -999 with the data condition flag on reject. This temporarily fixed a script that was getting stuck on the perl error message.

The bigger question is how raw2compress takes the raw and makes a compressed file. A good example is the ashtech stream. The last field, the -aq field that determines if the altitude fields are correct is either a 0 or a 1 in the raw stream. In the compressed stream it only shows blank value or the number 1. Does the raw2compress file treat all 0 or equivalent values as no value? In this case a zero is appropriate and some additional flag like NaN or something would be more appropriate for actual missing data.

When we lost one of the streams for a while it did produce error data and these showed up as blank comma separated values. The timestamp for that was 2010 352.501956. That area shows both error conditions. The first when the whole line is nonsense, and the second when only one value is missing but the rest is good.

I've made a temporary listit so that Hugh V's script can run but I want to check if its something that needs changing from raw2compress as it's hard to distinguish between valid 0's and no data. This listit version is currently in:

/users/dacon/projects/scs/bin/listit

12.3.2.3 Web Application

I added a new module to the SCS web interface called Download.pm. This is a slightly more advanced version of the JSON interface that Jeremy set up. I started in a separate module because I didn't want to cause any adverse affects to systems already using the existing JSON interface.

Apache/SCS/Main.pm
The only modification to this file was to allow calls to /scs/download to be passed to the Download.pm module.

Apache/SCS/Download.pm
The download module provides an interface for accessing data from the SCS system.

One portion of the module, the part satisfies interval queries, is using the perl DPS interface directly using some of the new modifications mentioned in the DPS section.

JSON Interface Usage for Download.pm
The download interface requires the user to interact via HTTP POST. This allows multiple variables to be passed in more easily.

The address for posting to is: **http://www/scs/download/**

The script is expecting a post with one or more of the following input variables:

- stime - (optional, default=now) - Specifies a start time in seconds based on unix timestamps.
- period - (optional, default=1) - Number of seconds to get from history. This uses the **stime** or now and counts **period** seconds into the past.
- output - (optional, default=JSON) - Allows you to specify output type Only JSON is supported right now.
- interval - (optional, default=1) - Allows you to seperate records by **interval** seconds. If you specify 5, you will get one record for every five seconds up to your specified **period**.
- streamstatus - (optional, default=no) - If you specify 'yes' the JSON return will have additional information showing you the last available record for each stream.
- vars - (optional, multiple allowed) - Specify one or more specific variables to return. You pass this in by including multiple var entries in your post request. Each one should be of the form: var = stream:variable. Example: var=seatex-gga:seatex-gga-lat

NOTE: interval does not work yet as the replacement DPS/Engine.pm has not yet been installed. Once installed interval will work.

There is an example page that allows you to post queries to the SCS interface to see how it works. http://www.jcr.nerc-bas.ac.uk/data/scs/examples/post1.php - This page is a simple web interface that allows you to modify each parameter and get the post results.

Using firefox or chrome you can inspect the resulting page to see how the post query was formed.

JSON Return Structure

The JSON return is structured in a way to allow multiple types of data to be returned at the same type.

The top level items in the JSON return indicate the various types of data. Currently there are three top level items:

- timestamp - Always included, this is the timestamp of the server serving the request.
- streams - This is an array of streams that may include multiple streams, and more than one data item per stream. See the examples for structure.

- streamstatus - This is a hash of all streams and a timestamp of when they were last updated.

Example 1: Specifying a return of 5 records for two variables


```
{
"timestamp":1295024460,
"streams":[
        {
                "stream":"seatex-gga",
                "units":{
                        "seatex-gga-lon":"degrees",
                        "seatex-gga-dage":"s",
                        "seatex-gga-lat":"degrees",
                        "seatex-gga-dbase":" ",
                        "seatex-gga-altitude":"m",
                        "seatex-gga-time":"HHMMSS.SS",
                        "seatex-gga-hdop":" ",
                        "seatex-gga-gq":" ",
                        "seatex-gga-svc":" "
                },
                "data":[
                        {
                                "timestamp":1293213600,
                                "vars":{"seatex-gga-lon":"-
38.44851","seatex-gga-lat":"-53.69102"}
                        },
                        {
                                "timestamp":1293213601,
                                "vars":{"seatex-gga-lon":"-
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                        },
                        {
                                "timestamp":1293213603,
                                "vars":{"seatex-gga-lon":"-
38.44852","seatex-gga-lat":"-53.69102"}
                        },
                        {
                                "timestamp":1293213604,
                                "vars":{"seatex-gga-lon":"-
38.44853","seatex-gga-lat":"-53.69102"}
                        },
                        {
                                "timestamp":1293213605,
                                "vars":{"seatex-gga-lon":"-
38.44854","seatex-gga-lat":"-53.69102"}
                        }
                ]
        }
```

```
]}
```


Example 2: Returning a few records and stream status


```
{
        "timestamp":1295024670,
        "streams":[
        {
                "stream":"seatex-gga",
                "units":{.... units ...},
                "data":[
                        {"timestamp":1293213600,"vars":{"seatex-gga-
lon":"-38.44851","seatex-gga-lat":"-53.69102"}},
                        {"timestamp":1293213601,"vars":{"seatex-gga-
lon":"-38.44851","seatex-gga-lat":"-53.69102"}}
                ]
        }],
        "streamstatus": [
                {"time":1295024667,"name":"anemometer"},
                {"time":1295024668,"name":"ashtech"},
                {"time":1295024669,"name":"dopplerlog"},
                {"time":1295024669,"name":"ea600"},
                {"time":1294202462,"name":"em120"},
                {"time":1295024667,"name":"emlog-vhw"},
                {"time":1295024668,"name":"emlog-vlw"},
                ... ALL STREAMS ...,
                {"time":1294981182,"name":"winch"}
        ]
}
```


12.3.4 Eventlog System

The Eventlog system worked fine during the cruise.

The Noon position report (http://eventlog.jcr.nerc-bas.ac.uk/noonpos/guest/showpos/science) has been modified to add a degree symbol in the lat/lon display at the request of the radio officer Mike. The changed file is in the eventlog app area under perl/Noonpos.pm. SVN will show the changes

12.3.5 Krill Photo Analysis

As part of the Krill length frequency analysis project, Sophie Fielding has taken a series of krill photos on a black background with a few rulers to provide scale. The rulers can be used when viewing the photo to get the length and proportions of the krill.

To measure the krill, each image must have a center line drawn along the length of the krill and then subdivide the whole krill into vertical segments.

If a krill image is converted to black and white a computer program can automatically calculate the centre line of the krill and draw in the proper lines. This program has been written during the cruise and exists at:

- users/dacon/projects/krill/
- /[CURRENT_CRUISE_WORK_AREA]/krill_shape/application

The main problem with this approach is that the krill have to be converted from full colour images to black and white. The current background has problems that make it difficult to quickly convert all krill shapes to black and white.

The black background has been formed out of a hard plastic that has left deep groves in the track that holds the krill. These grooves show up as bright white and interfere with easily pulling the krill out of the background. Doing tests on a consistent blue or green or black background has shown that a simple image thresholding can pull the krill out more easily.

For future image taking an improved background will be needed.

12.6 GIS & Mapping

15.6.1 KML Generators

During the cruise I was using the DPS to generate cruise tracks in Google Earth. I know there are many other approaches but the system KMLgen wasn't working on the ship and I didn't want to go to the effort of restoring a system that may or may not be used anymore. In Cambridge a look into all the approaches will be needed and ensure that we avoid duplication of effort.

The details of the very simple KML generator for the event log is located in /users/dacon/dps/

12.3.7 Web & Intranet

12.3.7.1 JCR Intranet

Even though http://www/ is a very easy URL to remember, many people still have trouble remembering or even knowing about the JCR website. Even though I tell them about it they don't really care or try to remember. With public internet sites being blocked on the JCR is it possible to setup something akin to how public wifi hotspots redirect people? I don't know how the blocking is taking place but in theory if someone went to a website that won't resolve can't we use DNS or something to redirect them automatically to www.jcr.nerc-bas.ac.uk? This way most people would instantly find it as all their homepages would redirect directly.

12.3.7.2 XBT Web Application

The processing system that takes XBT data and processes it for use in swath was not functioning. The cron job and processing scripts have been corrected and are working again.

The web interface was broken as well. This has been updated to use the JSON interface to the SCS and is working again.

http://www.jcr.nerc-bas.ac.uk/xbt/

12.3.8 Comments & Recommendations

After returning to Stanley a query came in from Doug and Julian in regards to what should be done with data acquisition. AME has the instructions to shut down all instrumentation while ICT has the instructions that data logging is required by the PDC at all times. It was decided to leave on those instruments whose data would be valid while in port (oceanlogger air/humidity/wind/etc). Clear instructions must be setup between three technical groups: ICT, AME and PDC.

Appendices

Appendix A: Log Sheets

A.1 K-net Log Sheet

Time	Latitude	Longitude	Event No	Cable out	Net Depth	Ship speed	Comment
15/01/2011 00:33	- 54.03873	-36.16114	161	-6	0.6	2.6	Net on deck dead krill
15/01/2011 00:20	- 54.04513	-36.16659	161	76	47	2.3	Winch stopped
15/01/2011 00:10	- 54.05091	-36.17018	161	-3	0.6	2.2	Net in water fishing mark (back to K-NET)
14/01/2011 19:19	- 53.81914	-35.99129	159	-6	0.6	1.4	Net on deck
14/01/2011 18:54	- 53.83036	-35.99813	159	-1	0.6	1.9	Bongo net deployed cable out 100 m
14/01/2011 18:46	- 53.83452	-36.00089	158	-6	0.6	2.1	Net on deck
14/01/2011 18:30	- 53.84279	-36.00669	158	-5	0.6	1.8	Bongo net in water cable out 22m
14/01/2011 17:43	- 53.75648	-35.95005	157	-4	0.6	2	Bongo net on deck
14/01/2011 17:14	- 53.77117	-35.95878	157	-6	0.6	2.1	Bongo net in water. Towed 67 m of cable out
14/01/2011 04:54	- 53.70815	-38.57154	156	4	0.8	2.4	Net on deck krill caught
14/01/2011 04:45	- 53.70875	-38.56402	156	71	49.7	1.7	Winch stopped

14/01/2011 04:27	-53.71019	-38.5478	156	-7	0.6	2	Net in water
14/01/2011 03:20	-53.69415	-38.73039	155	-4	0.6	2	Net on deck no krill
14/01/2011 02:46	-53.69429	-38.69924	155	-9	0.8	2.1	Net in water
14/01/2011 02:19	-53.69413	-38.73459	154	-9	0.6	2.3	Net on deck. Krill AFI
14/01/2011 02:06	-53.69436	-38.71951	154	99	48.9	2.3	Winch stopped
14/01/2011 01:53	-53.69448	-38.70601	154	-9	0.6	2	Net in water
13/01/2011 05:43	-53.598	-37.71849	149	-2	0.6	1.9	Net on deck big krill AFI-CGS
13/01/2011 05:23	-53.59129	-37.70458	149	4	0.6	2.1	Net in water
13/01/2011 05:00	-53.59198	-37.70595	148	-6	0.6	1.9	Net on deck few big krill
13/01/2011 04:39	-53.59937	-37.72193	148	-7	0.6	1.4	Net in water
13/01/2011 04:16	-53.59828	-37.71901	147	-8	0.6	2.2	Net recovered big krill AFI-CGS
13/01/2011 03:52	-53.59015	-37.70054	147	-7	0.8	1.9	Net deployed on 6 dB mark
13/01/2011 02:28	-53.59224	-37.62728	146	-8	0.6	1.9	Net on deck AFI krill
13/01/2011 02:21	-53.59222	-37.6192	146	72	36.3	2.4	Winch stopped
13/01/2011 02:14	-53.59231	-37.61264	146	-5	0.6	2.4	Net in water same mark as 145

13/01/2011 01:29	- 53.59175	-37.63684	145	-7	0.6	2.6	Net on deck AFI krill
13/01/2011 01:12	- 53.59182	-37.62098	145	-5	0	1.8	Net in water 300m krill mark
13/01/2011 00:44	- 53.59117	-37.64405	144	-6	0	3	Net on deck didn't fish right no krill
13/01/2011 00:30	- 53.59231	-37.62817	144	-6	0	2	Net in water
11/01/2011 00:09	-54.0821	-36.35167	136	-8	0.8	2.6	Net on deck cod-end ripped no krill
10/01/2011 23:48	- 54.08585	-36.33025	136	-8	0.6	1.8	Net in water
10/01/2011 23:05	- 54.08585	-36.33025	135	-8	0.6	1.8	Net on deck few krill
10/01/2011 22:34	- 54.09264	-36.29461	135	-8	0.6	3	Net in water
10/01/2011 05:10	- 53.87294	-36.74385	131	-2	13.5	2.2	Net on deck few krill
10/01/2011 04:43	-53.8843	-36.72595	131	-4	0.6	1.9	Net in water
10/01/2011 04:06	- 53.84648	-36.79179	130	-9	0.6	2.3	Net on deck few krill
10/01/2011 03:47	- 53.87824	-36.73598	130	-8	0.6	1.7	Net in water
10/01/2011 02:55	- 53.84648	-36.79179	129	-9	0.6	2.3	Net on deck few krill
10/01/2011 02:35	- 53.85455	-36.78004	129	63	39.3	1.5	Winch stopped
10/01/2011 02:29	- 53.85718	-36.77645	129	-7	0.6	1.5	Net in water

10/01/2011 00:50	-53.89393	-36.5899	128	-5	0.3	2	Net on deck some krill
10/01/2011 00:35	-53.89614	-36.57514	128	82	43	1.9	Winch stopped
10/01/2011 00:20	-53.89863	-36.55966	128	-13	0.6	2.1	Net in water
09/01/2011 23:18	-53.87612	-36.72091	127	-14	0.3	1.9	Net on deck not a good catch
09/01/2011 23:13	-53.87664	-36.71552	127	27	16.9	2.2	Winch stopped
09/01/2011 23:07	-53.87734	-36.70929	127	-14	0.6	2.4	Net in water
09/01/2011 03:04	-54.26549	-35.86073	125	-13	0.3	1.4	Net on deck caught krill
09/01/2011 02:40	-54.27529	-35.8757	125	-13	0.6	2.3	Net in water
09/01/2011 02:10	-54.26549	-35.86073	124	-13	0.3	1.4	Net on deck caught krill
09/01/2011 01:47	-54.27487	-35.87521	124	-12	0.6	1.9	Net in water
09/01/2011 01:20	-54.26237	-35.85687	123	-6	0	1.5	Net on deck caught krill
09/01/2011 01:04	-54.2689	-35.86656	123	99	0	2.4	Winch stopped
09/01/2011 00:53	-54.27437	-35.87522	123	-12	0	2	Net in water fishing layer at 50 m
08/01/2011 02:52	-53.62411	-36.35453	117	-12	0.6	2.2	Net on deck krill caught
08/01/2011 02:39	-53.623	-36.34105	117	64	37.9	2.7	Winch stopped

08/01/2011 02:22	- 53.62084	-36.32139	117	-12	0.6	2.9	Net in water
08/01/2011 01:47	- 53.62417	-36.35373	116	-12	0.6	2.3	Net on deck buckets of full guts krill
08/01/2011 01:36	- 53.62301	-36.34162	116	94	54.8	2.4	Winch stopped just pulling in when 1 km krill swarm arrived underneath
08/01/2011 00:47	- 53.61765	-36.29186	116	-4	0.6	2.3	Net in water
07/01/2011 23:38	- 53.63619	-36.41677	115	-11	0.6	2.4	Net recovered 2 krill caught
07/01/2011 23:29	- 53.63671	-36.40593	115	105	59.4	2.5	Winch stopped
07/01/2011 22:57	- 53.63851	-36.37098	115	-5	0.8	2	Net in water
07/01/2011 01:16	- 54.55658	-35.5912	111	-11	0	2.8	Net on deck krill caught
07/01/2011 01:10	- 54.55915	-35.58569	111	57	0	2.5	Winch stopped
07/01/2011 01:02	- 54.56292	-35.57856	111	-8	0	2.5	Net in water fishing mark
07/01/2011 00:55	- 54.56617	-35.57107	110	-11	0	3	Net on deck krill caught
07/01/2011 00:49	- 54.56871	-35.56464	110	47	0	2.4	Winch stopped
07/01/2011 00:12	- 54.58363	-35.5341	110	1	0	2.5	Net in water - finally at 00:43 due to deployment complications
06/01/2011 18:00	- 54.55644	-35.59517	109	-11	0.8	1.7	Net on deck krill caught
06/01/2011 17:50	- 54.55829	-35.58579	109	66	47.3	2	Winch stopped

06/01/2011 17:32	-54.56162	-35.56995	109	-10	0.8	1.5	Net in water
06/01/2011 17:03	-54.55503	-35.60416	108	-10	0.8	2.3	Net on deck krill caught
06/01/2011 16:40	-54.55503	-35.60416	108	-10	0.8	2.3	Net on deck krill caught
06/01/2011 16:40	-54.5589	-35.58351	108	-8	47	2.4	Net deployed repeat fishing of mark
06/01/2011 16:29	-54.5609	-35.57375	107	69	47	1.7	Winch stopped
06/01/2011 16:25	-54.56123	-35.57042	107	-6	47	2.3	Net deployed fishing on marks 50 m
06/01/2011 01:03	-54.5704	-34.89115	103	-13	47	2.7	Net on deck
06/01/2011 00:56	-54.57304	-34.88551	103	53	33.6	2.5	Winch stopped net aborted due to weather
06/01/2011 00:50	-54.57468	-34.87952	103	-12	0.6	1.3	Net deployed
06/01/2011 00:17	-54.56142	-34.91146	102	-13	0.6	2.6	Net onboard - no krill
06/01/2011 00:03	-54.56743	-34.89971	102	96	52.7	2.2	Winch stopped
05/01/2011 23:49	-54.57209	-34.88789	102	-4	1.1	1.3	Net deployed
03/01/2011 22:36	-54.2527	-35.35531	93	-10	0.8	2.4	Net recovered
03/01/2011 22:24	-54.26053	-35.35364	93	72	39.5	2.7	Winch stopped
03/01/2011 22:20	-54.26303	-35.35323	93	-8	0.8	2.6	Net deployed on target at 25 m

03/01/2011 22:01	-54.25429	-35.35521	92	-3	0.6	2.2	Net on deck
03/01/2011 21:51	-54.25969	-35.35394	92	41	18.6	1.9	Winch stopped
03/01/2011 21:44	-54.26382	-35.35317	92	12	2.7	2.3	Net deployed fishing mark at 25 m
03/01/2011 20:19	-54.11797	-35.4545	91	-9	1.4	1.5	Net recovered
03/01/2011 20:07	-54.12248	-35.44951	91	141	87.1	1.6	Winch stopped
03/01/2011 19:54	-54.25969	-35.35394	91	41	18.6	1.9	Net deployed fishing mark at 80 m
03/01/2011 05:03	-54.01019	-35.58063	85	-4	0.6	1.9	Net recovered
03/01/2011 04:44	-54.00396	-35.58964	85	121	72.3	1.9	Winch stopped - fishing deep marks at ~ 100m
03/01/2011 04:20	-53.99658	-35.59989	85	-9	0.6	1.1	Net deployed
03/01/2011 02:04	-54.04798	-35.52461	84	-3	0.6	2.6	Net recovered
03/01/2011 01:28	-54.03124	-35.5492	84	-6	0.8	2	Net deployed mark at 40 m
03/01/2011 00:36	-54.04823	-35.52366	83	-8	0.6	1.7	Net on deck small krill caught
03/01/2011 00:30	-54.04604	-35.52773	83	59	23.7	2.7	Winch stopped
03/01/2011 00:25	-54.0435	-35.53225	83	-5	0.6	2	Net deployed mark under ship
03/01/2011 00:21	-54.04246	-35.53423	82	-8	0.6	1.7	Net on deck missed mark

02/01/2011 23:59	-54.03333	-35.54526	82	94	48.7	1.8	Winch stopped
02/01/2011 23:45	-54.02815	-35.55184	82	-7	0.6	2.5	Net deployed
02/01/2011 20:48	-53.73826	-35.47447	81	-4	0.6	1.6	Net on deck missed mark
02/01/2011 20:26	-53.73795	-35.497	81	174	53.5	2.5	Winch stopped
02/01/2011 20:14	-53.73791	-35.51069	81	-6	0.8	1.9	Net deployed
01/01/2011 00:45	-53.99449	-36.36647	74	-7	0	2.1	Net recovered
01/01/2011 00:37	-53.99585	-36.35807	74	110	58.9	2.4	Winch stopped
01/01/2011 00:19	-53.99936	-36.33932	74	-7	0.6	1.5	K-NET deployed fishing mark near surface
31/12/2010 01:30	-53.47463	-37.73108	69	-6	0.8	2.4	Net on deck
31/12/2010 01:18	-53.47915	-37.72078	69	58	30.1	2.4	Winch stopped
31/12/2010 01:07	-53.48318	-37.7121	69	-6	0.6	2.2	Net in water two very large krill swarms
30/12/2010 23:41	-53.49109	-37.71293	68		1.4	1.3	Net on deck
30/12/2010 23:22	-53.49173	-37.69558	68	-5	0.8	2.5	Net in water fishing on mark at 50 m (missed original mark but located small second one)
30/12/2010 22:55	-53.49122	-37.71688	67	-6	0.6	1.7	Net on deck
30/12/2010 22:43	-53.49111	-37.7042	67	100	56.5	2.3	Winch stopped

30/12/2010 22:33	-53.49138	-37.69515	67	-6	0.6	2.3	K-NET in water mark at 75 m
28/12/2010 21:54	-53.72916	-37.97662	54		0.6	2.1	Net on deck
28/12/2010 21:41	-53.73315	-37.96598	54		62.4	2.1	Winch stopped
28/12/2010 21:17	-53.74205	-37.94556	54		0.8	1	Net in water fishing mark at 50 m which was originally near sea bed
28/12/2010 03:10	-53.60823	-38.25072	45	-11		2	Net on deck
28/12/2010 02:57	-53.61291	-38.24039	45	60	43.8	1.6	Winch stopped
28/12/2010 02:45	-53.6167	-38.23206	45	26	14.8	2	Net in water mark at 50 m
28/12/2010 01:55	-53.60343	-38.24502	44	-11	0.6	1.6	Net on deck
28/12/2010 01:42	-53.60767	-38.23436	44	75	57.8	2.2	Winch stopped
28/12/2010 01:24	-53.61293	-38.22117	44	-2	0.6	1.4	Net in water krill mark at 50 m
27/12/2010 04:16	-53.75504	-39.00432	35	6	0.8	2	Net on deck krill caught
27/12/2010 04:11	-53.75528	-38.99935	35	59	32.8	1.5	Winch stopped
27/12/2010 03:49	-53.75571	-38.97904	35	-7	0.8	1.5	Net in water fishing on same krill mark as ev 34
27/12/2010 03:21	-53.75526	-39.00861	34	-8	0.6	1.1	Net on deck krill caught
27/12/2010 03:15	-53.75514	-39.00335	34	75	42.2	1.9	Winch stopped

27/12/2010 02:53	-53.7554	-38.98329	34	-3	0.8	2.4	Net in water 600 m krill mark 0 to 50 m
26/12/2010 02:44	-53.58085	-39.14537	25	-4	0.3	1.1	Net on deck
26/12/2010 02:28	-53.5888	-39.13815	25	52	40.3	1.7	Winch stopped. No krill mark
26/12/2010 02:17	-53.59404	-39.13264	25	-7	0.6	1.9	Net in water. Krill mark at surface
25/12/2010 20:19	-53.74319	-38.9438	24	-7	0.6	1	Net on deck
25/12/2010 20:08	-53.74769	-38.93844	24	73	41.1	2.2	Winch stopped
25/12/2010 19:59	-53.75171	-38.93317	24	-6	0.6	2.3	Net in water. Fishing on fuzzy mark at 25 m
25/12/2010 01:44	-53.6894	-38.24495	19	-3		5.2	Net on deck. Enough krill for Geraint
25/12/2010 01:23	-53.69495	-38.22724	19	31	19.4	2.2	Winch stopped
25/12/2010 01:17	-53.69648	-38.22205	19	-6	0.8	1.6	Net in water mark at top 25 m
25/12/2010 00:57	-53.70234	-38.20298	18	-6	0.6	2.3	Net on deck 30 live krill for Geraint
25/12/2010 00:40	-53.70695	-38.18605	18	36	21.2	2	Winch stopped
25/12/2010 00:37	-53.70745	-38.18335	18	-6	0.8	2.7	Net in water. Target at 25 m
24/12/2010 23:41	-53.70234	-38.20298	17	-6	0.6	2.3	Net on deck. Plenty of krill for Angus AFI
24/12/2010 23:22	-53.70533	-38.19213	17	87	57.3	1.8	Winch stopped

24/12/2010 23:17	-53.70656	-38.18786	17	-6	0.8	2.6	Net in water. Target at 50m. Krill used by Magnus?
24/12/2010 22:42	-53.7054	-38.20746	16	-7	0.8	2.9	Net on deck. Krill used for T0
24/12/2010 22:31	-53.70677	-38.19522	16	154	66.7	2.9	Winch stopped
24/12/2010 22:20	-53.70816	-38.184	16	11	4.3	2.6	Net in water. Target at 60 m?
24/12/2010 20:26	-53.67562	-38.47839	15	-5	0.8	2.8	Net on deck
24/12/2010 20:17	-53.6764	-38.46877	15	102	52.2	2.2	Winch stopped
24/12/2010 20:06	-53.67721	-38.45796	15	-7	0.6	2.7	Net in water. Target @ 50 m
24/12/2010 18:21	-53.68877	-38.46707	14	-8	0.6	1.9	Net on deck
24/12/2010 18:14	-53.68917	-38.46167	14	44	21	2.9	Winch stopped
24/12/2010 18:07	-53.69005	-38.4545	14	-8	0.8	1.7	Net in water. A little faff to sort the strops. Training haul
24/12/2010 17:59	-53.69104	-38.44813	13	-8	0.6	0.8	Net on deck
24/12/2010 17:51	-53.69184	-38.44283	13	70	42.7	1.5	Winch stopped
24/12/2010 17:46	-53.69271	-38.43694	13	-8	1.1	2.5	Net in water training people
24/12/2010 17:37	-53.69383	-38.42976	12	-8	0.6	0.9	Net on deck
24/12/2010 17:29	-53.69365	-38.42395	12	58	38.7	1.6	Winch stopped

24/12/2010 17:25	-53.69382	-38.42021	12	-9	0.8	2.6	Net in water. Training people
24/12/2010 17:18	-53.6939	-38.41433	11	-5	0.6	1.5	Net on deck
24/12/2010 17:09	-53.69391	-38.40736	11	67	42.5	1.6	Winch stopped
24/12/2010 17:01	-53.69402	-38.39936	11	-9	0.8	3	Net in water. Second trial to train people
24/12/2010 16:38	-53.69246	-38.36021	10	-4	0.8	1.5	net recovered
24/12/2010 16:26	-53.69224	-38.35085	10	163	88.7	1.7	Hauling in
24/12/2010 16:24	-53.69208	-38.34866	10	163	96.2	2.2	Winch stopped - net held well at ~100m
24/12/2010 16:11	-53.69166	-38.33756	10	22	10.8	2.1	Pay out 30 m/min
24/12/2010 16:05	-53.69137	-38.33094	10	3	-11	3.1	Trial of net with netmon sensors on. Only depth as T and S not working

A.2 SAPS Log Sheet

Time	Latitude	Longitude	Water Depth	SAP depth	SAP no.	Pump Delay (hrs)	Pump time (hrs)	Flow count start (l)	Flow count end (l)	Filter description	Comment
13/01/2011 13:35	-53.75058	-38.98322	269.43	20	03-Jun	0.5	1.5	177175	177497	293 mm 1 um Nuclepore supported on Nitex mesh	Event 152

13/01/2011 13:35	- 53.75058	-38.98322	269.54	50	03-Jan	0.5	1.5	120840	121194	293 mm 1 um Nuclepore supported on Nitex mesh	Event 152
13/01/2011 13:35	- 53.75058	-38.98322	269.54	150	03-Apr	0.5	1.5	236352	237173	293 mm 1 um Nuclepore supported on Nitex mesh	Event 152
12/01/2011 16:51	-53.54	-38.10938	1741.8	20	03-Jun	0.5	1.5	176977	177176	293 mm 1 um Nuclepore supported on Nitex mesh	Event 142
12/01/2011 16:51	-53.54	-38.10938	1741.8	50	03-Jan	0.5	1.5	120624	120841	293 mm 1 um Nuclepore supported on Nitex mesh	Event 142
12/01/2011 16:51	-53.54	-38.10938	1741.8	150	03-Apr	0.5	1.5	235533	236353	293 mm 1 um Nuclepore supported on Nitex mesh	Event 142
11/01/2011 11:38	- 54.10051	-36.24962	277.82	20	03-Jun	0.5	1.5	176457	176979	293 mm 1 um Nuclepore supported on Nitex mesh	Event 139
11/01/2011 11:38	- 54.10051	-36.24962	275.74	50	03-Jan	0.5	1.5	120010	120625	293 mm 1 um Nuclepore supported on Nitex mesh	Event 139
11/01/2011 11:38	- 54.10051	-36.24962	275.74	150	03-Apr	0.5	1.5	234736	235534	293 mm 1 um Nuclepore supported on Nitex mesh	Event 139
10/01/2011 11:35	- 53.89629	-36.57302	209.46	20	03-Jun	0.5	1.5	175948	176458	293 mm 1 um Nuclepore supported on Nitex mesh	Event 134
10/01/2011 11:35	- 53.89629	-36.57302	209.81	50	03-Jan	0.5	1.5	119468	120011	293 mm 1 um Nuclepore supported on Nitex mesh	Event 134

10/01/2011 11:35	- 53.89629	-36.57301	209.81	150	03-Apr	0.5	1.5	234139	234737	293 mm 1 um Nuclepore supported on Nitex mesh	Event 134
08/01/2011 11:35	- 53.62318	-36.34426	859.78	20	03-Jun	0.5	1.5	175454	175949	293 mm 1 um Nuclepore supported on Nitex mesh	Event 120
08/01/2011 11:35	- 53.62318	-36.34426	859.78	50	03-Jan	0.5	1.5	118968	119469	293 mm 1 um Nuclepore supported on Nitex mesh	Event 120
08/01/2011 11:35	- 53.62318	-36.34426	856.95	150	03-Apr	0.5	1.5	233397	234140	293 mm 1 um Nuclepore supported on Nitex mesh	Event 120
07/01/2011 11:35	- 54.55816	-35.58757	264.1	20	03-Jun	0.5	1	175042	175456	293 mm 1 um Nuclepore supported on Nitex mesh	Event 114
07/01/2011 11:35	- 54.55816	-35.58757	263.83	50	03-Jan	0.5	1	118484	118969	293 mm 1 um Nuclepore supported on Nitex mesh	Event 114
07/01/2011 11:35	- 54.55816	-35.58757	263.83	150	03-Apr	0.5	1	232821	233398	293 mm 1 um Nuclepore supported on Nitex mesh	Event 114
06/01/2011 11:54	- 54.53088	-35.27059	132.85	20	03-Jun	0.5	1	174627	175043	293 mm 1 um Nuclepore supported on Nitex mesh	Event 106
06/01/2011 11:54	- 54.53088	-35.27059	132.85	50	03-Jan	0.5	1	118033	118485	293 mm 1 um Nuclepore supported on Nitex mesh	Event 106
06/01/2011 11:54	- 54.53088	-35.27059	132.76	100	03-Apr	0.5	1	232364	232822	293 mm 1 um Nuclepore supported on Nitex mesh	Event 106

05/01/2011 16:44	-54.62125	-34.80517	746.28	20	03-Jun	0.6	1	174257	174629	293 mm 1 um Nuclepore supported on Nitex mesh	Event 100
05/01/2011 16:44	-54.62124	-34.80517	746.28	50	03-Jan	0.6	1	117592	118034	293 mm 1 um Nuclepore supported on Nitex mesh	Event 100
05/01/2011 16:44	-54.62124	-34.80517	746.28	150	03-Apr	0.6	1	231795	232365	293 mm 1 um Nuclepore supported on Nitex mesh	Event 100
04/01/2011 13:30	-54.25522	-35.35458	262.61	20	03-Jun	0.6	1	173161	174258	293 mm 1 um Nuclepore	Event 96. Filter torn.
04/01/2011 13:30	-54.25522	-35.35458	262.61	50	03-Jan	0.6	1	117203	117592	293 mm 1 um Nuclepore	Event 96.
04/01/2011 13:30	-54.25522	-35.35458	263.01	150	03-Apr	0.6	1	231238	231796	293 mm 1 um Nuclepore	Event 96.
03/01/2011 11:38	-54.1006	-35.45501	330	20	03-Jun	0.6	1	172819	173162	293 mm 1 um Nuclepore	Event 88. Krill Pellets
03/01/2011 11:38	-54.1006	-35.45501	329.77	50	03-Jan	0.6	1	116852	117205	293 mm 1 um Nuclepore	Event 88. Krill pellets
03/01/2011 11:38	-54.1006	-35.45501	329.77	150	03-Apr	0.6	1	230594	231240	293 mm 1 um Nuclepore	Event 88. Filter torn. Krill Pellets
02/01/2011 11:10	-54.994	-36.372	209.09	20	03-Jun	0.6	1	172588	172819	293 mm 1 um Nuclepore	Event 80
02/01/2011 11:10	-54.994	-36.372	208.46	50	03-Jan	0.6	1	116384	116853	293 mm 1 um Nuclepore	Event 80
02/01/2011 11:10	-54.994	-36.372	208.46	150	03-Apr	0.6	1	229933	230595	293 mm 1 um Nuclepore	Event 80

31/12/2010 11:55	-53.49103	-37.70743	1916.64	20	03-Jun	0.6	1	171606	172589	293 mm 1 um Nuclepore	Event 72. Filter torn during pumping. Sample otherwise OK
31/12/2010 11:55	-53.49103	-37.70743	1916.94	50	03-Jan	0.6	1	115660	116385	293 mm 1 um Nuclepore	Event 72. Filter torn during pumping. Sample otherwise OK.
31/12/2010 11:55	-53.49103	-37.70743	1916.94	150	03-Apr	0.6	1	229001	229933	293 mm 1 um Nuclepore	Event 72. Krill Pellets. Filter torn during pumping. Sample otherwise OK.
26/12/2010 20:27	-53.84604	-39.14319	286.89	20	03-Jun	0.6	1	171285	171606	293 mm 1 um Nuclepore	Event 31
26/12/2010 20:27	-53.84604	-39.14318	286.77	50	03-Jan	0.6	1	115387	115661	293 mm 1 um Nuclepore	Event 31
26/12/2010 20:27	-53.84604	-39.14318	286.77	150	03-Apr	0.6	1	228410	229002	293 mm 1 um Nuclepore	Event 31
25/12/2010 11:47	-53.70038	-38.21049	318.07	20	03-Jun	0.8	1	170532	171285	293 mm 1 um Nuclepore	Event 22. Filter torn during pumping. However significant material collected.

25/12/2010 11:47	- 53.70038	-38.21049	318.07	50	03-Jan	0.8	1	114638	115387	293 mm 1 um Nuclepore	Event 22. Filter torn during pumping. However significant material still collected.
25/12/2010 11:47	- 53.70038	-38.2105	318	150	03-Apr	0.8	1	227896	228411	293 mm 1 um Nuclepore	Event 22. Krill pellets collected
23/12/2010 14:05	- 52.67638	-45.17809	3315.85	20	03-Jun	0.8	1	170226	170533	293 mm 1 micron nucleopore	
23/12/2010 14:05	- 52.67638	-45.17809	3315.85	50	03-Jan	0.8	1	114337	114638	293 mm 1 micron nucleopore	
23/12/2010 14:05	- 52.67638	-45.17809	3315.85	150	03-Apr	0.8	1	227278	227891	293 mm 1 micron nucleopore	

A.3 EK60 Log Sheet

Time	Latitude	Longitude	Water depth	Heading	Speed	Event	Comment
18/01/2011 13:20	- 51.93549	-53.47849		247.34	6.6		EK60 turned off logging
13/01/2011 23:54	- 53.82466	-38.90669	214.01	153.69	9.5	TF14_6	End of acoustic transect
13/01/2011 22:52	- 53.67215	-39.04329	1744.9	151.48	10.5	TF14_6	Start of acoustic transect TF14_6
13/01/2011	-	-39.05756	1732.56	329.52	10.2	TF14_5	End of acoustic transect

22:45	53.67737						
13/01/2011 21:44	- 53.82152	-38.91519	226	328.75	9.5	TF14_5	Start of acoustic transect TF14_5
13/01/2011 20:53	-53.7248	-38.84932	350.82	71.66	9.2	TF14_4	End of acoustic transect
13/01/2011 19:52	- 53.77411	-39.11672	386.79	70.89	10.2	TF14_4	Start of acoustic transect TF14_4
13/01/2011 19:47	- 53.77734	-39.11887	384.52	251.9	10.6	TF14_3	End of acoustic transect
13/01/2011 18:45	- 53.72231	-38.85028	353.1	248.76	5.6	TF14_3	Start of acoustic transect TF14_3
13/01/2011 18:41	- 53.72067	-38.85541	348.56	66.94	10.2	TF14_2	End of acoustic transect
13/01/2011 17:35	- 53.78036	-39.1126	363.39	67.25	8.3	TF14_2	Start of acoustic transect TF14_2
13/01/2011 17:29	- 53.78271	-39.11101	348.08	245.54	8.6	TF14_1	End of acoustic transect
13/01/2011 16:27	- 53.71777	-38.85808	359.34	245.34	9.1	TF14_1	Start of acoustic transect TF14_1
12/01/2011 23:32	- 53.55498	-37.8297	1035.77	87.17	9	TF13_3	End of acoustic transect
12/01/2011 22:32	- 53.55639	-38.10911	1605.59	87.49	10.2	TF13_3	Start of acoustic transect TF13_3
12/01/2011 22:17	- 53.54172	-38.10998	1723.09	270.8	8.2	TF13_2	End of acoustic transect
12/01/2011 20:58	- 53.54212	-37.81089	1079.42	272.76	7.3	TF13_2	Start of acoustic transect TF13_2
12/01/2011 20:48	- 53.53751	-37.82848	1292.91	88.16	11.6	TF13_1	End of acoustic transect
12/01/2011	-	-38.11573	1776.38	90.25	9.7	TF13_1	Start of acoustic transect TF13_1

19:49	53.53585						
10/01/2011 15:30	- 53.87361	-36.4355	204.47	76.71	9.7	TF11_5	End of acoustic transect
10/01/2011 14:28	-53.9237	-36.71968	0	345.37	7.3	TF11_5	Start of acoustic transect
10/01/2011 10:20	- 53.91936	-36.43369	203.65	95.64	10	TF11_4	End of acoustic transect
10/01/2011 09:20	- 53.87312	-36.70687	195.96	109.07	11.1	TF11_3	End of acoustic transect
10/01/2011 06:37	- 53.92077	-36.43555	0	121.6	9.9	TF11_3	End of acoustic transect
10/01/2011 05:36	- 53.87197	-36.70753	198.11	107.62	10.5	TF11_3	Start of acoustic transect
09/01/2011 19:46	- 53.89831	-36.79037	227.82	262.29	10.2	TF11_2	End of acoustic transect
09/01/2011 18:46	-53.8783	-36.51392	256.38	256.01	7.6	TF11_2	Start of acoustic transect
09/01/2011 18:39	- 53.87346	-36.51202	263.23	82.77	10.3	TF11_1	End of acoustic transect
09/01/2011 17:39	- 53.89012	-36.78957	238.08	104.39	4.9	TF11_1	Start of acoustic transect
09/01/2011 13:08	- 54.18604	-35.8699	234.18	357.29	9.3	TF10_6	End of acoustic transect
09/01/2011 12:08	- 54.34985	-35.86118	177.85	357.5	10.4	TF10_6	Start of acoustic transect
09/01/2011 12:02	- 54.35424	-35.86448	166.07	175.75	9.6	TF10_5	End of acoustic transect
09/01/2011 11:00	- 54.18273	-35.86932	0	219.1	7.3	TF10_5	Start of acoustic transect
09/01/2011	-54.2272	-35.74323	223.04	59.23	9.9	TF10_4	End of acoustic transect

10:30							
09/01/2011 09:30	- 54.31085	-35.98431	169.97	61.86	9.3	TF10_4	Start of acoustic transect
09/01/2011 09:21	-54.3196	-35.98302	158.69	229.03	9.9	TF10_3	End of acoustic transect
09/01/2011 08:21	- 54.22134	-35.75178	229.39	230.01	9.8	TF10_3	Start of acoustic transect
09/01/2011 06:02	- 54.20795	-35.76958	233.18	41.66	10.1	TF10_2	End of acoustic transect
09/01/2011 04:58	- 54.32774	-35.9656	176.16	42.24	8.7	TF10_2	Start of acoustic transect
09/01/2011 04:52	- 54.32973	-35.96183	189.15	220.23	10	TF10_1	End of acoustic transect
09/01/2011 03:52	- 54.21013	-35.77575	230.3	218.76	9.9	TF10_1	Start of acoustic transect
08/01/2011 16:58	- 53.60645	-36.20587	1929.07	78.2	10	TF9_4	End of acoustic transect
08/01/2011 15:57	- 53.63704	-36.4839	398.65	79.59	7.3	TF9_4	Start of acoustic transect
08/01/2011 10:22	- 53.62974	-36.48872	436.73	248.28	9.8	TF9_3	End of acoustic transect
08/01/2011 09:22	- 53.61771	-36.2043	1788.16	264.98	9.8	TF9_3	Start of acoustic transect
08/01/2011 05:34	- 53.64373	-36.48073	381.45	256.31	10.3	TF9_2	End of acoustic transect
08/01/2011 04:33	- 53.60393	-36.20912	1889.53	251.53	8.1	TF9_2	Start of acoustic transect
08/01/2011 04:27	- 53.60705	-36.20899	1916.81	78.83	10.2	TF9_1	End of acoustic transect
08/01/2011	-	-36.48111	399.71	79.46	8	TF9_1	Start of acoustic transect

03:27	53.63514						
07/01/2011 15:00	-54.61147	-35.47751	148.1	128.11	9.4	TF8_10	End of acoustic transect
07/01/2011 14:00	-54.5112	-35.70115	223.4	127.26	10.5	TF8_10	Start of acoustic transect
07/01/2011 10:02	-54.61595	-35.47275	149.31	113.57	9.5	TF8_9	End of acoustic transect
07/01/2011 09:01	-54.5051	-35.69319	231.29	129.31	10.1	TF8_9	Start of acoustic transect
07/01/2011 06:18	-54.50537	-35.70302	222.5	304.42	10	TF8_8	End of acoustic transect
07/01/2011 05:17	-54.60917	-35.47683	148.11	301.07	8.1	TF8_8	Start of acoustic transect
07/01/2011 05:12	-54.6077	-35.47229	149.11	126.26	9.9	TF8_7	End of acoustic transect
07/01/2011 04:11	-54.50923	-35.70181	224.36	130.39	8.4	TF8_7	Start of acoustic transect
07/01/2011 04:06	-54.5079	-35.70058	226.94	302.8	9.7	TF8_6	End of acoustic transect
07/01/2011 03:04	-54.60622	-35.47354	150.86	303.34	7	TF8_6	Start of acoustic transect
07/01/2011 03:00	-54.60623	-35.4657	0	143.63	9.1	TF8_5	End of acoustic transect
07/01/2011 02:00	-54.51346	-35.70585	220.12	124.32	10.4	TF8_5	Start of acoustic transect
06/01/2011 23:07	-54.50932	-35.69225	227.87	303.36	10.4	TF8_4	End of acoustic transect
06/01/2011 22:07	-54.60786	-35.47142	149.59	308.15	9.9	TF8_4	Start of acoustic transect
06/01/2011	-	-35.46119	153.89	148.57	9.6	TF8_3	End of acoustic transect

22:02	54.60806						
06/01/2011 21:02	-54.51192	-35.70575	220.92	126.15	9.7	TF8_3	Start of acoustic transect
06/01/2011 20:57	-54.50915	-35.70462	221.27	296.71	10	TF8_2	End of acoustic transect
06/01/2011 19:54	-54.60378	-35.47089	151.18	307.36	10.1	TF8_2	Start of acoustic transect
06/01/2011 19:48	-54.60238	-35.46387	150.55	118.24	9.2	TF8_1	End of acoustic transect
06/01/2011 18:46	-54.51887	-35.70986	0	125.05	9.8	TF8_1	Start of acoustic transect
05/01/2011 22:51	-54.5721	-34.91976	754.05	307.76	9	TF6_2	End of acoustic transect
05/01/2011 21:46	-54.67748	-34.6814	1040.99	282.9	5.9	TF6_2	Start of acoustic transect
05/01/2011 21:42	-54.67914	-34.68632	1025.66	122.13	10.2	TF6_1	End of acoustic transect
05/01/2011 20:42	-54.56801	-34.91353	771.6	128	11	TF6_1	Start of acoustic transect
05/01/2011 01:03	-54.49551	-35.23046		229.76	1.3		EM120 interfaced EK60 logging again. Trigger 1 EM120 to 4 EK60
05/01/2011 00:08	-54.47546	-35.243	653.57	244.83	1.2		practice interfacing EM120 in with SSU - stopped logging
04/01/2011 17:28	-54.31769	-35.25719	362.22	138.23	10	TF5_7	End of acoustic transect
04/01/2011 16:27	-54.19248	-35.44715	138.96	139.49	8.7	TF5_7	Start of acoustic transect
04/01/2011 11:42	-54.19776	-35.46181	139.9	309.33	10	TF5_6	End of acoustic transect
04/01/2011	-	-35.24745	448.45	307.54	9.8	TF5_6	Start of acoustic transect

10:43	54.31018						
04/01/2011 05:00	- 54.31702	-35.25095	401.54	136.58	10.5	TF5_5	End of acoustic transect
04/01/2011 03:58	- 54.19357	-35.45167	145.75	138.2	7.5	TF5_5	Start of acoustic transect
04/01/2011 03:52	- 54.19234	-35.44986	141.31	316.53	9.7	TF5_4	End of acoustic transect
04/01/2011 02:52	- 54.19235	-35.44503	137.18	143.22	9.8	TF5_4	Start of acoustic transect
04/01/2011 02:42	- 54.32019	-35.2632	317.3	139.95	9.8	TF5_3	End of acoustic transect
04/01/2011 01:42	- 54.19235	-35.44503	137.18	143.22	9.8	TF5_3	Start of acoustic transect
04/01/2011 01:30	- 54.19422	-35.45199	146.46	316.46	10.7	TF5_2	End of acoustic transect
04/01/2011 00:30	- 54.32132	-35.27121	274.99	316.83	10.1	TF5_2	Start of acoustic transect
04/01/2011 00:19	- 54.32105	-35.26352	311.4	140.77	10	TF5_1	End of acoustic transect
03/01/2011 23:19	- 54.19262	-35.44165	147.12	140.41	10.2	TF5_1	Start of acoustic transect
03/01/2011 21:08	- 54.19532	-35.36066	432.58	176.83	9.6	TF4_6	End of acoustic transect
03/01/2011 19:05	- 54.04413	-35.54404	147.79	143.46	10.2	TF4_6	Start of acoustic transect
03/01/2011 18:51	-54.0218	-35.53446	276.1	325.12	9.6	TF4_5	End of acoustic transect
03/01/2011 17:49	- 54.16262	-35.374	496.81	328.04	7.4	TF4_5	Start of acoustic transect
03/01/2011	-	-35.37269	0	86.35	6.1	TF4_4	End of acoustic transect

17:42	54.17104						
03/01/2011 16:39	- 54.02666	-35.53243	264.86	143.87	7.4	TF4_4	Start of acoustic transect
03/01/2011 16:32	- 54.02849	-35.53176	258.77	327.09	10.1	TF4_3	End of acoustic transect
03/01/2011 15:32	- 54.17068	-35.37394	462.62	324.12	8.6	TF4_3	Start of acoustic transect
03/01/2011 10:33	- 54.02188	-35.5065	497.42	339.08	9.8	TF4_2	End of acoustic transect
03/01/2011 09:33	- 54.17983	-35.40478	319.38	337.51	9.6	TF4_2	Start of acoustic transect
03/01/2011 06:26	- 54.16485	-35.36535	515.65	138.05	10.1	TF4_1	End of acoustic transect
03/01/2011 05:26	- 54.03834	-35.54097	181.14	139.38	9.1	TF4_1	Start of acoustic transect
02/01/2011 15:50	- 54.02351	-36.50601	176.82	247.53	10.7	TF3_7	End of acoustic transect
02/01/2011 14:50	- 53.96353	-36.2376	248.35	245.84	9.1	TF3_7	Start of acoustic transect
02/01/2011 10:12	- 54.02234	-36.2384	236.23	104.35	10.9	TF3_6	End of acoustic transect
02/01/2011 09:12	- 54.02234	-36.2384	236.23	104.35	10.9	TF3_6	Start of acoustic transect
01/01/2011 22:22	-53.996	-36.22186	251.08	93.45	9.3	TF3_5	End of acoustic transect
01/01/2011 21:20	- 53.99114	-36.51129	185.83	91.73	9.8	TF3_5	Start of acoustic transect
01/01/2011 12:37	- 54.15861	-36.69325	85.24	266.76	0.3		Change ping rate to 1 sec and log data to calibration folder
01/01/2011	-54.0392	-36.24754	226.72	121.96	9.9	TF3_4	End of acoustic transect

09:02							
01/01/2011 08:02	- 53.94983	-36.48991	185.69	120.16	7.9	TF3_4	Start of acoustic transect
01/01/2011 05:30	- 54.02804	-36.28703	199.53	125.49	9.9	TF3_3	End of acoustic transect
01/01/2011 04:39	- 53.94499	-36.48648	171.95	124.4	9.9	TF3_3	Start of acoustic transect
01/01/2011 04:30	- 53.94556	-36.48625	172.74	305.29	9.3	TF3_2	End of acoustic transect
01/01/2011 03:08	- 54.04248	-36.25308	215.85	300.49	7.9	TF3_2	Start of acoustic transect
01/01/2011 02:57	- 54.04224	-36.25453	218.04	125.94	10	TF3_1	End of acoustic transect
01/01/2011 01:57	- 53.94619	-36.48322	180.1	125.47	10.7	TF3_1	Start of transect TF3_1
31/12/2010 16:43	- 53.54613	-37.5991	0	131.93	10.4	TF2_6	End of acoustic transect TF2_6
31/12/2010 15:46	- 53.44279	-37.80115	1502.98	130.49	11.4	TF2_6	Start of acoustic transect TF2_6
31/12/2010 10:40	- 53.55699	-37.60851	0	68.52	8.5	TF2_5	End of acoustic transect TF2_5
31/12/2010 09:40	-53.4298	-37.79815	2265.6	136.95	10.1	TF2_5	Start of acoustic transect TF2_5
31/12/2010 05:52	-53.5451	-37.59953	1436.01	130.97	10	TF2_4	End of acoustic transect TF2_4
31/12/2010 04:51	- 53.43738	-37.81526	2003.71	129.93	9.9	TF2_4	Start of acoustic transect TF2_4
31/12/2010 04:41	- 53.43547	-37.8194	2034.07	309.92	10	TF2_3	End of acoustic transect TF2_3
31/12/2010	-	-37.60028	1433.18	308.09	9.9	TF2_3	Start of acoustic transect TF2_3

03:40	53.54535						
31/12/2010 03:21	- 53.54533	-37.60004	1431.48	129.77	9.7	TF2_2	End of TF2_2
31/12/2010 02:23	- 53.43829	-37.81364	2010.4	128.37	10.4	TF2_2	Start of transect TF2_2
30/12/2010 22:15	- 53.49093	-37.71076	1926.9	87.04	7.9	TF2_1	End of TF2_1 check timings. Break off to fish krill mark
30/12/2010 21:00	-53.332	-37.75502	2439.17	169.54	10.5	TF2_1	Start of transect TF2_1 (check timings)
30/12/2010 21:00	- 53.33137	-37.75521		169.79	10.7		EK60 back to logging. Ethernet switch changed to increase communication from 10mps to 100mps
30/12/2010 20:01	- 53.17043	-37.81117		167.79	10.1		EK60 crashed
30/12/2010 20:01	- 53.17043	-37.81117		167.79	10.1		EK60 crashed
30/12/2010 19:52	- 53.14575	-37.81977		167.6	10.2		EK60 returned to logging on the U drive
30/12/2010 19:24	- 53.15166	-37.83156	3356.25	348.43	7.9	W4.2	End of acoustic transect W4.2
30/12/2010 14:50	- 53.83087	-37.60161	132.35	345.94	10.4	W4.2	Start of acoustic transect W4.2
30/12/2010 14:00	- 53.87152	-37.63635	254.8	78.1	13.3		SCS crashed EK60 data logged locally. GPS to EK60 lost until 15:05
30/12/2010 13:35	- 53.86065	-37.73048	117.45	167.6	8.6	W4.1	End of acoustic transect W4.1
30/12/2010 09:00	- 53.16735	-37.98768	3569.54	16.32	12.3	W4.1	Start of acoustic transect W4.1
28/12/2010 18:55	- 53.88837	-37.90765	151.08	170.47	10.7	W3.2	End of acoustic transect W3.2

28/12/2010 18:30	-53.81892	-37.92947	295.26	170.98	10.4		EK60 back to logging
28/12/2010 18:18	-53.78518	-37.9407		169.59	10.4		EK60 crashed
28/12/2010 14:41	-53.18443	-38.14039	3712.66	167.52	9.2	W3.2	Start of acoustic transect W3.2
28/12/2010 13:34	-53.21191	-38.45104	3769.4	352.81	10.3	W3.1	End of acoustic transect W3.1
28/12/2010 09:05	-53.92565	-38.22045	103.53	348.85	7.2	W3.1	Start acoustic transect W3.1
27/12/2010 19:42	-53.25619	-38.751	3797.77	349.53	9.7	W2.2	End of W2.2 acoustic transect
27/12/2010 15:17	-53.96017	-38.52568	153.57	342.19	10.7	W2.2	Start of transect W2.2
27/12/2010 13:56	-53.99505	-38.81858	196.31	171.43	6.9	W2.1	End of W2.1 acoustic transect
27/12/2010 09:26	-53.28558	-39.03824	3991.95	175.35	6.7	W2.1	Start of W2.1 acoustic transect
26/12/2010 19:00	-54.03007	-39.08351	211.89	105.79	8.7	W1.2	End of W1.2 acoustic transect
26/12/2010 14:40	-53.31864	-39.30413	3961.11	165.49	9.5	W1.2	Start of W1.2 transect
26/12/2010 13:30	-53.34658	-39.60277	3448.17	355.08	7	W1.1	End of W1.1 transect
26/12/2010 08:58	-54.05524	-39.39175	418.52	345.71	7.2	W1.1	Start of W1.1
26/12/2010 00:13	-53.58142	-39.05952	1574.96	332.21	9.9		EK60 restarted and ping rate set to 2 secs in prep for WCB
26/12/2010 00:07	-53.59604	-39.04643		333.73	10.2		EK60 crashed again

25/12/2010 23:59	- 53.61627	-39.0282		333.36	10.1		EK60 crashed
25/12/2010 16:47	- 53.71964	-38.3492	199.2	259.06	9.4	TF1_5	End of acoustic transect TF1_5
25/12/2010 15:40	-53.6815	-38.0748	156.04	73.98	10.1	TF1_5	Acoustic transect TF1_5 start
25/12/2010 10:49	- 53.71539	-38.34808	196.36	260.54	10.6	TF1_4	Acoustic transect TF1_4 end
25/12/2010 09:53	-53.6846	-38.0818	161.47	257.56	9.5	TF1_4	Acoustic transect TF1_4 start
25/12/2010 05:05	- 53.66147	-38.33588	220.27	298.26	10.5	TF1_3	Acoustic transect TF1_3 end
25/12/2010 04:02	- 53.74132	-38.07819	298.87	303.98	7.5	TF1_3	Acoustic transect TF1_3 start
25/12/2010 03:51	- 53.73903	-38.08311	299.56	117.46	10.2	TF1_2	Acoustic transect TF1_2 end
25/12/2010 02:51	- 53.66173	-38.3335	235.17	114.16	10.6	TF1_2	TF1 acoustic transect 2 start (downwind)
24/12/2010 22:01	- 53.70995	-38.16571	286.5	101.16	9.8	TF1_1	End of TF1 first transect
24/12/2010 21:00	-53.6786	-38.44187	330.06	99.51	8.7	TF1_1	First acoustic transect of TF1
24/12/2010 11:10	- 53.43445	-39.41288	0	121.73	10.5		ER60 crashed Error lost contact with the 200 kHz GPT
24/12/2010 07:23	- 53.23865	-40.49297		101.81	10.9		ER60 restarted again after rebooting (comcontainer error given)
24/12/2010 07:17	- 53.23439	-40.52482		101.08	11.3		rebooted er60 to save settings
24/12/2010 07:09	- 53.22928	-40.56685	2774.09	99.82	11.1		ER60 rebooted

24/12/2010 02:38	-53.06353	-41.94042	2025.46	101.52	11.6		ER60 software crashed
23/12/2010 23:13	-52.9333	-43.0184	2049.44	101.14			EK60 echoview set to logging
22/12/2010 20:33	-52.19908	-49.7517	2723.23	100.82	10.9		EK60 set to record

Appendix B: Event Logs

B.1 All Events

Time	Event	Lat	Lon	Comment	Station	Type	Status	Bridge Number
22/12/2010 11:09	1	-52.25229	-51.41359	Midship Gantry Unlashed.	Test			1
22/12/2010 11:15	1	-52.25233	-51.41358	V/L stopped on full auto DP for CTD test.	Test			1
22/12/2010 11:17	1	-52.25229	-51.41354	Midship Gantry lashed. V/L off DP.	Test			1
22/12/2010 11:45	1	-52.25238	-51.4136	CTD Deployed.	Test	CTD	Start	1
22/12/2010 11:48	1	-52.25234	-51.41356	CTD to be sent to 300m. for test.	Test	CTD		1
22/12/2010 11:56	1	-52.25234	-51.41355	CTD at depth. 300m wire out.	Test	CTD		1
22/12/2010 12:35	1	-52.25232	-51.41353	CTD recovered to deck.	Test	CTD	Finish	1
22/12/2010 17:06	2	-52.17358	-50.00337	v/L on station in DP.	Test			2
22/12/2010 18:05	2	-52.17358	-50.00338	Go-Flo bottles deployed	Test	Go-flo	Start	2
22/12/2010 19:09	2	-52.17359	-50.00338	Go-Flo bottles recovered	Test	Go-flo	Finish	2
22/12/2010 19:26	3	-52.17358	-50.00332	Iron-fish deployed	Test	Iron Fish	Start	3
22/12/2010 19:38		-52.17368	-50.00545	V/L off station	Test			
23/12/2010 11:00		-52.73121	-45.12456	V/L head to wind for test deployment of net.	Test			
23/12/2010 11:19	4	-52.72198	-45.13437	K-net deployed	Test	K-net	Start	4
23/12/2010 11:21	4	-52.72129	-45.135	K-net recovered	Test	K-net	Finish	4
23/12/2010 11:27	5	-52.71868	-45.13744	K-net deployed	Test	K-net	Start	5
23/12/2010 12:06	5	-52.70304	-45.15303	K-net recovered	Test	K-net	Finish	5
23/12/2010 12:21	6	-52.69661	-45.15947	K-net deployed	Test	K-net	Start	6
23/12/2010 12:32	6	-52.69187	-45.1644	K-net recovered	Test	K-net	Finish	6
23/12/2010 12:59	7	-52.68027	-45.17473	K-net deployed	Test	K-net	Start	7

23/12/2010 13:05	7	-52.67733	-45.17785	K-net recovered	Test	K-net	Finish	7
23/12/2010 13:10		-52.67634	-45.17807	Test deployment of net complete	Test	K-net	Finish	
23/12/2010 13:50		-52.67636	-45.17807	Midship Gantry Unlashed.	Test			
23/12/2010 14:05	8	-52.67638	-45.17809	Commence SAP Deployment.	Test	SAPS	Start	8
23/12/2010 14:22	8	-52.67653	-45.17784	Complete SAPs deployment	Test	SAPS		8
23/12/2010 16:05	8	-52.67655	-45.17787	SAP Deployment recovered and on deck.	Test	SAPS	Finish	8
23/12/2010 16:25		-52.67652	-45.1779	Iron-fish recovered	Test	Iron Fish	Finish	Fish - End 3
23/12/2010 16:27		-52.67647	-45.17768	V/L off DP. Proceeding to start position.	Test			
23/12/2010 17:01	9	-52.68685	-45.04208	Iron-fish deployed	Test	Iron Fish	Start	9
24/12/2010 16:05	10	-53.69137	-38.3309	Commence deployment of K-net.	Test	K-net	Start	10
24/12/2010 16:38	10	-53.69254	-38.35995	K-net recovered.	Test	K-net	Finish	10
24/12/2010 16:59	11	-53.69409	-38.39753	Commence deployment of K-net.	Test	K-net	Start	11
24/12/2010 17:18	11	-53.6939	-38.41398	K-net recovered.	Test	K-net	Finish	11
24/12/2010 17:23	12	-53.69382	-38.4183	Commence deployment of K-net.	Test	K-net	Start	12
24/12/2010 17:38	12	-53.69385	-38.4299	K-net recovered.	Test	K-net	Finish	12
24/12/2010 17:45	13	-53.69281	-38.43576	Commence deployment of K-net.	Test	K-net	Start	13
24/12/2010 18:02	13	-53.6909	-38.44931	K-net recovered.	Test	K-net	Finish	13
24/12/2010 18:06	14	-53.69034	-38.45268	Commence deployment of K-net.	Test	K-net	Start	14
24/12/2010 18:21	14	-53.68877	-38.46702	K-net recovered.	Test	K-net	Finish	14
24/12/2010 20:05	15	-53.67729	-38.45693	Deploy K-net	TF1	K-net	Start	15
24/12/2010 20:26	15	-53.67565	-38.47808	Net recovered	TF1	K-net	Finish	15
24/12/2010 22:20	16	-53.70826	-38.18314	Deploy K-net	TF1	K-net	Start	16
24/12/2010 22:43	16	-53.7053	-38.20859	Net recovered	TF1	K-net	Finish	16
24/12/2010 23:18	17	-53.70642	-38.1883	K-net Deployed.	TF1	K-net	Start	17
24/12/2010 23:45	17	-53.69941	-38.21164	K-net recovered.	TF1	K-net	Finish	17
25/12/2010 00:37	18	-53.70745	-38.18335	K-net Deployed.	TF1	K-net	Start	18

25/12/2010 01:00	18	-53.70183	-38.20442	K-net recovered.	TF1	K-net	Finish	18
25/12/2010 01:18	19	-53.69608	-38.22316	K-net Deployed.	TF1	K-net	Start	19
25/12/2010 01:44	19	-53.68942	-38.24491	K-net recovered.	TF1	K-net	Finish	19
25/12/2010 02:51		-53.6611	-38.3356	Commence 10kt Transect.	TF1	Transect	Start	10kt transect through TF1
25/12/2010 03:51		-53.73863	-38.08432	End of transect on SE course. Passing SE point.	TF1	Transect	Finish	Transit between stations
25/12/2010 04:03		-53.74018	-38.08096	Start of NW transect. Passing SE transect point on NW course.	TF1	Transect	Start	Transit between stations
25/12/2010 05:05		-53.66201	-38.33403	End of transect on NW course. Passing NW point.	TF1	Transect	Finish	Transit between stations
25/12/2010 06:00		-53.70044	-38.2111	Arrival at TF1 for deployment of CTD.	TF1			TF1
25/12/2010 07:01	20	-53.70041	-38.2097	CTD deployed	TF1	CTD	Start	20
25/12/2010 07:23	20	-53.70041	-38.20965	CTD @ depth	TF1	CTD		20
25/12/2010 07:39	20	-53.70042	-38.20968	CTD recovered	TF1	CTD	Finish	20
25/12/2010 08:27	21	-53.70045	-38.20967	Go-Flo bottles deployed	TF1	Go-flo	Start	21
25/12/2010 09:04	21	-53.70045	-38.20966	Go-Flo bottles recovered	TF1	Go-flo	Finish	21
25/12/2010 09:15	21	-53.70045	-38.20967	V/L off station	TF1			21
25/12/2010 09:51		-53.68347	-38.07315	Start transect	TF1	Transect	Start	Transect
25/12/2010 10:50		-53.71561	-38.35015	End of transect. Return to station	TF1	Transect	Finish	Transect
25/12/2010 11:45	22	-53.70041	-38.21076	V/L stopped on full auto DP for SAPs deployment.	TF1			22
25/12/2010 11:47	22	-53.70038	-38.2105	Commence SAP Deployment.	TF1	SAPS	Start	22
25/12/2010 13:49	22	-53.70025	-38.20989	Commence SAPs Recovery.	TF1	SAPS		22
25/12/2010 14:03	22	-53.70025	-38.20989	SAPs Recovered to Deck.	TF1	SAPS	Finish	22
25/12/2010 14:23	23	-53.70025	-38.20989	Commence Deployment of Go-Flo Bottles.	TF1	Go-flo	Start	23

25/12/2010 15:03	23	-53.70021	-38.2097	Recovered Go-Flo.	TF1	Go-flo	Finish	23
25/12/2010 15:12		-53.69951	-38.20339	Gantry secured				Transit between stations
25/12/2010 15:40		-53.6815	-38.0748	Passing end point of transect on NE run.		Transect	Start	Transit between stations
25/12/2010 16:47		-53.71915	-38.34591	Passing end point of transect of SW run.		Transect	Finish	Transit between stations
25/12/2010 20:00	24	-53.75139	-38.93356	K-net Deployed		K-net	Start	24
25/12/2010 20:20	24	-53.74302	-38.94402	K-net recovered.		K-net	Finish	24
25/12/2010 20:43		-53.73803	-38.96148	Start transect		Transect	Start	Transect
25/12/2010 21:40		-53.89786	-38.90412	End Transect		Transect	Finish	
25/12/2010 21:56		-53.90014	-38.8278	Start of NW transect. Co 335T		Transect	Start	Transect
26/12/2010 02:18	25	-53.59377	-39.13299	K-net Deployed.		K-net	Start	25
26/12/2010 02:47	25	-53.58015	-39.14619	K-net recovered.		K-net	Finish	25
26/12/2010 08:58	26	-54.05603	-39.39149	XBT 1 deployed. Commence transect 1.1S	WCB	XBT		26
26/12/2010 10:07	27	-53.87925	-39.44423	XBT 2 deployed	WCB	XBT		27
26/12/2010 11:18	28	-53.69359	-39.49902	XBT 3 Deployed.	WCB	XBT		28
26/12/2010 12:22	29	-53.5252	-39.54991	XBT 4 Deployed.	WCB	XBT		29
26/12/2010 13:30	30	-53.34842	-39.60244	XBT 5 Deployed.	WCB	XBT		30
26/12/2010 14:40		-53.31748	-39.3046	Commence Transect W1.2	WCB	Transect	Start	Transect
26/12/2010 19:00		-54.02881	-39.08638	Completed Transect W1.2	WCB	Transect	Finish	Transect
26/12/2010 20:10	31	-53.84614	-39.1423	V/L on station WCB 1.2S	WCB			31
26/12/2010 20:27	31	-53.84604	-39.14318	SAPS deployed at WCB 1.2S	WCB	SAPS	Start	31
26/12/2010 22:10	31	-53.84604	-39.14317	Commence haul SAPS	WCB	SAPS		31
26/12/2010 22:29	31	-53.84603	-39.14321	SAPS recovered	WCB	SAPS	Finish	31

26/12/2010 22:33	32	-53.84602	-39.1432	Go-Flo bottles deployed	WCB	Go-flo	Start	32
26/12/2010 23:10	32	-53.84604	-39.1432	Go-Flo bottles recovered.	WCB	Go-flo	Finish	32
26/12/2010 23:29	33	-53.84605	-39.14321	CTD Deployed.	WCB	CTD	Start	33
26/12/2010 23:37	33	-53.84607	-39.1432	CTD at depth	WCB	CTD		33
26/12/2010 23:57	33	-53.84604	-39.1432	CTD recovered to deck - midship gantry secure.	WCB	CTD	Finish	33
27/12/2010 00:04	33	-53.84606	-39.14321	V/L off DP. Commence target fishing.	WCB			33
27/12/2010 02:53	34	-53.7554	-38.9826	K-net Deployed.	WCB	K-net	Start	34
27/12/2010 03:23	34	-53.7553	-39.00911	K-net recovered.	WCB	K-net	Finish	34
27/12/2010 03:51	35	-53.75573	-38.97993	K-net Deployed.	WCB	K-net	Start	35
27/12/2010 04:20	35	-53.75442	-39.00658	K-net recovered.	WCB	K-net	Finish	35
27/12/2010 06:00	36	-53.49331	-39.24804	Arrival at 1.2N for deployment of CTD. V/L on DP.	WCB			36
27/12/2010 07:00	36	-53.49304	-39.25069	CTD deployed	WCB	CTD	Start	36
27/12/2010 07:23	36	-53.49305	-39.25099	CTD @ depth	WCB	CTD		36
27/12/2010 07:53	36	-53.49298	-39.25197	CTD recovered	WCB	CTD	Finish	36
27/12/2010 08:00	36	-53.49222	-39.25526	V/L off station 1.2N	WCB			36
27/12/2010 09:26	37	-53.28517	-39.03832	Start transect 2.1N to S. XBT deployed	WCB	Transect	Start	37
27/12/2010 10:34	38	-53.4635	-38.98394	XBT deployed	WCB	XBT		38
27/12/2010 11:42	39	-53.64071	-38.92879	XBT Deployed.	WCB	XBT		39
27/12/2010 12:48	40	-53.81697	-38.87321	XBT Deployed.	WCB	XBT		40
27/12/2010 13:56	41	-53.99399	-38.81895	XBT Deployed.	WCB	XBT		41
27/12/2010 13:58		-53.99763	-38.81774	Complete transect.	WCB	Transect	Finish	Transect
27/12/2010 15:17		-53.96022	-38.52565	Start transect 2.2S to N.	WCB	Transect	Start	Transect
27/12/2010 19:43		-53.25462	-38.75144	End of transect 2.2	WCB	Transect	Finish	Transect
27/12/2010 20:52	42	-53.43149	-38.69812	V/L on station 2.2N	WCB			42
27/12/2010 21:00	42	-53.43131	-38.69836	CTD deployed	WCB	CTD	Start	42
27/12/2010 21:23	42	-53.43152	-38.69732	CTD @ depth	WCB	CTD		42

27/12/2010 21:57	42	-53.43158	-38.6969	CTD recovered	WCB	CTD	Finish	42
27/12/2010 22:05	9	-53.43162	-38.69689	Iron-fish recovered for maintenance	WCB	Iron Fish		Fish maintenanc e - End 9
27/12/2010 22:26	43	-53.43159	-38.69691	Iron fish re-deployed. V/L off station 2.2N	WCB	Iron Fish		43
28/12/2010 01:25	44	-53.61288	-38.22129	K-net Deployed.	WCB	K-net	Start	44
28/12/2010 01:57	44	-53.60306	-38.24584	K-net recovered.	WCB	K-net	Finish	44
28/12/2010 02:45	45	-53.61699	-38.23129	K-net Deployed.	WCB	K-net	Start	45
28/12/2010 03:12	45	-53.60783	-38.25176	K-net recovered.	WCB	K-net	Finish	45
28/12/2010 04:50	46	-53.7864	-38.57846	V/L on station 2.2S	WCB			46
28/12/2010 07:00	46	-53.78513	-38.58397	CTD deployed	WCB	CTD	Start	46
28/12/2010 07:11	46	-53.78508	-38.58394	CTD @ depth	WCB	CTD		46
28/12/2010 07:25	46	-53.7851	-38.58393	CTD recovered	WCB	CTD	Finish	46
28/12/2010 07:35	46	-53.78346	-38.58805	V/L off station 2.2S	WCB			46
28/12/2010 09:05	47	-53.92688	-38.22016	XBT deployed	WCB	XBT		47
28/12/2010 10:10	48	-53.75553	-38.27587	XBT deployed	WCB	XBT		48
28/12/2010 11:22	49	-53.57355	-38.33461	XBT Deployed (failed).	WCB	XBT		49
28/12/2010 11:24	50	-53.56989	-38.33568	XBT Deployed.	WCB	XBT		50
28/12/2010 12:28	51	-53.39742	-38.39089	XBT Deployed.	WCB	XBT		51
28/12/2010 13:34	52	-53.2146	-38.45049	XBT Deployed	WCB	XBT		52
28/12/2010 14:41		-53.18357	-38.14066	Commence transect 3.2	WCB	Transect	Start	Transect
28/12/2010 18:56		-53.88957	-37.90726	Completed Transect 3.2	WCB	Transect	Finish	Transect
28/12/2010 20:05	53	-53.71438	-37.96401	V/L on station 3.2S	WCB			53
28/12/2010 20:11	53	-53.71427	-37.96501	CTD deployed	WCB	CTD	Start	53
28/12/2010 20:19	53	-53.71427	-37.96499	CTD @ depth	WCB	CTD		53
28/12/2010 20:35	53	-53.71425	-37.96506	CTD recovered	WCB	CTD	Finish	53
28/12/2010 20:38	53	-53.71426	-37.96504	V/L off station 3.2S.	WCB			53

28/12/2010 21:17	54	-53.74209	-37.94547	K-net Deployed	WCB	K-net	Start	54
28/12/2010 21:58	54	-53.72808	-37.97953	K-net recovered.	WCB	K-net	Finish	54
30/12/2010 07:00	55	-53.3608	-38.08286	CTD deployed at 3.2N	WCB	CTD	Start	55
30/12/2010 07:22	55	-53.36081	-38.08288	CTD @ depth	WCB	CTD		55
30/12/2010 07:52	55	-53.36082	-38.08287	CTD recovered	WCB	CTD	Finish	55
30/12/2010 07:57	55	-53.36173	-38.0856	V/L off station 3.2N	WCB			55
30/12/2010 09:10	56	-53.16373	-37.965	XBT deployed. Start transect 4.1N to S	WCB	XBT		56
30/12/2010 10:15	57	-53.33427	-37.90474	XBT deployed	WCB	XBT		57
30/12/2010 11:28	58	-53.51924	-37.84529	XBT Deployed.	WCB	XBT		58
30/12/2010 12:34	59	-53.69285	-37.78706	XBT Deployed.	WCB	XBT		59
30/12/2010 13:40	60	-53.87027	-37.7269	XBT Deployed.	WCB	XBT		60
30/12/2010 14:50	61	- 53.853666	-37.593	XBT Deployed	WCB	XBT		61
30/12/2010 15:58	62	-53.67663	-37.65353	XBT Deployed.	WCB	XBT		62
30/12/2010 17:06	63	-53.49904	-37.71439	XBT Deployed.	WCB	XBT		63
30/12/2010 18:10	43	-53.33906	-37.76832	Iron-fish recovered for maintenance	WCB	Iron Fish	Finish	Fish maintenanc e - End 43
30/12/2010 18:18	64	-53.32394	-37.77313	XBT Deployed.	WCB	XBT		64
30/12/2010 19:25	65	-53.14974	-37.83219	XBT deployed. End transect 4.2	WCB	XBT		65
30/12/2010 19:35	66	-53.13174	-37.83854	Iron-fish deployed	TF2	Iron Fish	Start	66
30/12/2010 22:32	67	-53.49141	-37.69341	K-net Deployed	TF2	K-net	Start	67
30/12/2010 22:56	67	-53.49121	-37.71719	K-net recovered.	TF2	K-net	Finish	67
30/12/2010 22:56	67	-53.49121	-37.71719	K-net recovered.	TF2	K-net	Finish	67
30/12/2010 23:22	68	-53.49174	-37.69547	K-NET deployed	TF2	K-net	Start	68
30/12/2010 23:43	68	-53.49104	-37.71434	K-NET recovered	TF2	K-net	Finish	68
31/12/2010 01:07	69	-53.48319	-37.71209	K-NET deployed	TF2	K-net	Start	69

31/12/2010 01:32	69	-53.47388	-37.73248	K-NET recovered	TF2	K-net	Finish	69
31/12/2010 02:23		-53.43765	-37.81489	Commence 10kt transect TF2.	TF2	Transect	Start	Transect TF2
31/12/2010 03:22		-53.54548	-37.59977	Completed Transect TF2	TF2	Transect	Finish	Transect TF2
31/12/2010 03:41		-53.54417	-37.60261	Commence transect TF2 SE-NW	TF2	Transect	Start	Transect TF2
31/12/2010 04:41		-53.43717	-37.81608	Completed Transect TF2	TF2	Transect	Finish	Transect TF2
31/12/2010 04:52		-53.43795	-37.81413	Commence transect TF2 NW-SE	TF2	Transect	Start	Transect TF2
31/12/2010 05:52		-53.54473	-37.60025	Completed transect TF2 NW-SE	TF2	Transect	Finish	Transect TF2
31/12/2010 06:46	70	-53.49124	-37.70703	V/L on station	TF2			70
31/12/2010 07:05	70	-53.4911	-37.70732	CTD deployed	TF2	CTD	Start	70
31/12/2010 07:31	70	-53.49112	-37.7073	CTD @ depth	TF2	CTD		70
31/12/2010 08:09	70	-53.49112	-37.70735	CTD recovered	TF2	CTD	Finish	70
31/12/2010 08:25	71	-53.49108	-37.70731	Go-Flo bottles deployed	TF2	Go-flo	Start	71
31/12/2010 09:00	71	-53.49112	-37.70731	Go-Flo bottles recovered	TF2	Go-flo	Finish	71
31/12/2010 09:03	71	-53.49106	-37.70738	V/L off station	TF2			71
31/12/2010 09:40		-53.42815	-37.80055	Start transect	TF2	Transect	Start	Transect
31/12/2010 10:38		-53.55295	-37.61637	End of transect	TF2	Transect	Finish	Transect
31/12/2010 11:22	72	-53.4923	-37.70525	V/L on station	TF2			72
31/12/2010 11:55	72	-53.49103	-37.70743	Complete SAPs deployment.	TF2	SAPS	Finish	72
31/12/2010 13:15	72	-53.49106	-37.70763	Commence SAPs Recovery.	TF2	SAPS		72
31/12/2010 13:30	72	-53.49104	-37.70761	SAPs Recovered to Deck.	TF2	SAPS	Finish	72
31/12/2010 13:39	73	-53.49105	-37.70753	Go-Flo Bottles Deployed.	TF2	Go-flo	Start	73
31/12/2010 14:48	73	-53.4911	-37.70765	Go-Flo bottles recovered.	TF2	Go-flo	Finish	73
31/12/2010 15:00	73	-53.49095	-37.70769	V/L off station.	TF2			73

31/12/2010 15:46		-53.44092	-37.80466	Commence transect TF2 NW-SE	TF2	Transect	Start	Transect
31/12/2010 16:43		-53.54489	-37.60145	Completed Transect TF2	TF2	Transect	Finish	Transect
01/01/2011 00:19	74	-53.99936	-36.33885	K-NET deployed	TF3	K-net	Start	74
01/01/2011 00:44	74	-53.99471	-36.36495	K-NET recovered	TF3	K-net	Finish	74
01/01/2011 01:07	66	-53.98945	-36.4001	Iron towfish onboard	TF3	Iron Fish	Finish	Fish maintenanc e - End 66
01/01/2011 01:57		-53.94529	-36.48529	Commence 10kt Transect. TF3	TF3	Transect	Start	Transect
01/01/2011 02:57		-54.04188	-36.25539	Completed 10kt Transect. TF3	TF3	Transect	Finish	Transect
01/01/2011 03:08		-54.04289	-36.252	Commence Transect. TF3 SE-NW	TF3	Transect	Start	Transect
01/01/2011 04:30		-53.94683	-36.48328	Complete transect TF3 SE-NW	TF3	Transect	Finish	Transect
01/01/2011 04:39		-53.94465	-36.48731	Commence Transect TF3. NW-SE	TF3	Transect	Start	Transect
01/01/2011 05:39		-54.04187	-36.25552	Complete transect TF3 NW-SE	TF3	Transect	Finish	Transect
01/01/2011 06:18	75	-53.9933	-36.3706	V/L on station	TF3			75
01/01/2011 07:05	75	-53.99387	-36.37066	CTD deployed	TF3	CTD	Start	75
01/01/2011 07:09	75	-53.99388	-36.37066	CTD @ depth	TF3	CTD		75
01/01/2011 07:24	75	-53.9939	-36.37071	CTD recovered	TF3	CTD	Finish	75
01/01/2011 08:02		-53.94913	-36.49191	Commence transect	TF3	Transect	Start	Transect
01/01/2011 09:02		-54.03892	-36.24827	Complete transect.	TF3	Transect	Finish	Transect
01/01/2011 11:30		-54.15847	-36.69447	V/L stopped on Auto DP in Stromness Harbour.	TF3			Calibration
01/01/2011 12:46	76	-54.15862	-36.69299	CTD Deployed.	TF3	CTD	Start	76
01/01/2011 12:52	76	-54.15862	-36.69301	CTD @ depth	TF3	CTD		76
01/01/2011 12:56	76	-54.15863	-36.69302	CTD recovered to deck.	TF3	CTD	Finish	76
01/01/2011 14:25		-54.15788	-36.69431	Commence Calibration.	TF3	Acoustic	Start	Calibration
01/01/2011 17:49		-54.15897	-36.69282	Completed calibration.	TF3	Acoustic	Finish	Calibration
01/01/2011 19:50	77	-54.1066	-36.59439	Iron-fish deployed	TF3	Iron Fish	Start	77
01/01/2011 21:20		-53.99111	-36.51369	Commence transect	TF3	Transect	Start	Transect

								TF3
01/01/2011 22:22		-53.99603	-36.22008	End of transect	TF3	Transect	Finish	Transect TF3
02/01/2011 07:12	78	-53.99385	-36.37063	CTD deployed	TF3	CTD	Start	78
02/01/2011 07:22	78	-53.99384	-36.37064	CTD @ depth	TF3	CTD		78
02/01/2011 07:36	78	-53.99384	-36.37065	CTD recovered	TF3	CTD	Finish	78
02/01/2011 07:54	79	-53.99383	-36.37066	Go-Flo bottles deployed	TF3	Go-flo	Start	79
02/01/2011 08:31	79	-53.99382	-36.37078	Go-Flo bottles recovered	TF3	Go-flo	Finish	79
02/01/2011 09:12		-53.96507	-36.50602	Start transect	TF3	Transect	Start	Transect TF3
02/01/2011 10:12		-54.0223	-36.23859	End of transect	TF3	Transect	Finish	Transect TF3
02/01/2011 10:55	80	-53.99398	-36.37054	V/L stopped on Auto DP.	TF3			80
02/01/2011 11:10	80	-53.99406	-36.3715	SAPs Deployed.	TF3	SAPS	Start	80
02/01/2011 12:55	80	-53.99402	-36.37143	Commence hauling SAPs.	TF3	SAPS		80
02/01/2011 13:10	80	-53.99402	-36.37143	SAPs Recovered to Deck.	TF3	SAPS	Finish	80
02/01/2011 13:20	80	-53.99402	-36.37143	V/L off DP. Proceeding to start position.	TF3			80
02/01/2011 14:50		-53.96166	-36.23333	Commence 10kt Transect.	TF3	Transect	Start	Transect TF3
02/01/2011 15:50		-54.02326	-36.50489	Transect complete. Values updated after SCS up and running again	TF3	Transect	Finish	Transect TF3
02/01/2011 20:15	81	-53.73791	-35.5098	K-net Deployed	TF4	K-net	Start	81
02/01/2011 20:50	81	-53.73862	-35.47291	K-net recovered.	TF4	K-net	Finish	81
02/01/2011 20:50	81	-53.73862	-35.47291	K-net recovered.	TF4	K-net	Finish	81
02/01/2011 23:45	82	-54.02773	-35.55216	K-NET deployed	TF4	K-net	Start	82
03/01/2011 00:22	82	-54.0426	-35.53401	K-NET recovered	TF4	K-net	Finish	82
03/01/2011 00:25	83	-54.04345	-35.53237	K-NET deployed	TF4	K-net	Start	83
03/01/2011 00:36	83	-54.04797	-35.52391	K-NET recovered	TF4	K-net	Finish	83

03/01/2011 01:28	84	-54.03113	-35.54937	K-NET deployed	TF4	K-net	Start	84
03/01/2011 02:04	84	-54.04775	-35.52509	K-NET recovered	TF4	K-net	Finish	84
03/01/2011 04:21	85	-53.99667	-35.59981	K-net Deployed.	TF4	K-net	Start	85
03/01/2011 05:04	85	-54.01019	-35.58063	K-net recovered.	TF4	K-net	Finish	85
03/01/2011 05:26		-54.03662	-35.54331	Start of transect TF4	TF4	Transect	Start	Transect
03/01/2011 06:26		-54.16601	-35.3637	End of transect TF4.	TF4	Transect	Finish	Transect
03/01/2011 07:22	86	-54.10044	-35.45598	V/L on station TF4	TF4			86
03/01/2011 07:27	86	-54.10066	-35.45568	CTD deployed	TF4	CTD	Start	86
03/01/2011 07:37	86	-54.1006	-35.45547	CTD @ depth	TF4	CTD		86
03/01/2011 07:52	86	-54.10057	-35.45547	CTD recovered	TF4	CTD	Finish	86
03/01/2011 08:07	87	-54.10056	-35.45553	Go-Flo bottles deployed	TF4	Go-flo	Start	87
03/01/2011 08:49	87	-54.10059	-35.45552	Go-Flo bottles recovered	TF4	Go-flo	Finish	87
03/01/2011 08:57	87	-54.10058	-35.45546	V/L off station TF4	TF4			87
03/01/2011 09:33		-54.17983	-35.40478	Start transect	TF4	Transect	Start	Transect TF4
03/01/2011 10:33		-54.02313	-35.50566	Complete transect.	TF4	Transect	Finish	Transect TF4
03/01/2011 11:16		-54.10006	-35.45457	V/L stopped on full auto DP for SAPs deployment.	TF4			TF4 Station
03/01/2011 11:38	88	-54.10059	-35.45502	SAPs Deployed.	TF4	SAPS	Start	88
03/01/2011 13:05	88	-54.10059	-35.45501	Commence SAPs Recovery.	TF4	SAPS		88
03/01/2011 13:15	88	-54.10058	-35.45502	SAPs Recovered to Deck.	TF4	SAPS	Finish	88
03/01/2011 13:25	89	-54.10059	-35.45499	Go-Flo Bottles Deployed.	TF4	Go-flo	Start	89
03/01/2011 13:52	89	-54.10052	-35.45509	Go-Flo bottles recovered.	TF4	Go-flo	Finish	89
03/01/2011 14:30	90	-54.09984	-35.45589	CTD Deployed.	TF4	CTD	Start	90
03/01/2011 14:38	90	-54.09996	-35.45588	CTD @ depth. 150m.	TF4	CTD		90
03/01/2011 14:44	90	-54.09998	-35.45585	CTD recovered to deck.	TF4	CTD	Finish	90
03/01/2011 15:32		-54.17081	-35.37377	Commence Transect TF4.	TF4	Transect	Start	Transect

03/01/2011 16:32		-54.02996	-35.53022	Complete transect TF4	TF4	Transect	Finish	Transect
03/01/2011 16:39		-54.02654	-35.53258	Commence Transect TF4		Transect	Start	Transect
03/01/2011 17:42		-54.17043	-35.3741	Complete transect TF4		Transect	Finish	Transect
03/01/2011 17:49		-54.16399	-35.37226	Commence transect TF4		Transect	Start	Transect
03/01/2011 18:51		-54.02272	-35.53343	Completed Transect TF4.		Transect	Finish	Transect
03/01/2011 19:05		-54.04206	-35.54663	Commence transect		Transect	Start	Transect by TF4
03/01/2011 19:53	91	-54.12808	-35.44312	K-net Deployed		K-net	Start	91
03/01/2011 20:20	91	-54.11779	-35.45471	K-net recovered.		K-net	Finish	91
03/01/2011 21:08		-54.19437	-35.36111	End of transect		Transect	Finish	Transect by TF4
03/01/2011 21:44	92	-54.26445	-35.35293	K-net Deployed	TF5	K-net	Start	92
03/01/2011 22:04	92	-54.25255	-35.35546	K-net recovered.	TF5	K-net	Finish	92
03/01/2011 22:20	93	-54.26342	-35.35322	K-net Deployed	TF5	K-net	Start	93
03/01/2011 22:38	93	-54.25186	-35.35557	K-net recovered.	TF5	K-net	Finish	93
03/01/2011 23:19		-54.19055	-35.44468	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect TF 5
04/01/2011 00:19		-54.32016	-35.26478	Complete transect. TF5.	TF5	Transect	Finish	Transect TF 5
04/01/2011 00:30		-54.32213	-35.26999	Commence 10kt Transect.	TF5	Transect	Start	Transect
04/01/2011 01:30		-54.19484	-35.4511	Complete transect.	TF5	Transect	Finish	Transect
04/01/2011 01:42		-54.1911	-35.44682	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect TF 5
04/01/2011 02:42		-54.3193	-35.26452	Complete transect. TF5.	TF5	Transect	Finish	Transect TF 5
04/01/2011 02:52		-54.31801	-35.26073	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect TF 5
04/01/2011 03:52		-54.19246	-35.44969	Completed transect TF5	TF5	Transect	Finish	Transect
04/01/2011 03:58		-54.19325	-35.45219	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect

04/01/2011 05:00		-54.31573	-35.25313	Complete transect TF5	TF5	Transect	Finish	Transect
04/01/2011 05:07		-54.31537	-35.25897	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect
04/01/2011 06:07		-54.19437	-35.45491	Complete transect TF5	TF5	Transect	Finish	Transect
04/01/2011 07:02	94	-54.25531	-35.35523	CTD deployed	TF5	CTD	Start	94
04/01/2011 07:11	94	-54.25531	-35.35525	CTD @ depth	TF5	CTD		94
04/01/2011 07:28	94	-54.25532	-35.35526	CTD recovered	TF5	CTD	Finish	94
04/01/2011 08:05	95	-54.2553	-35.35528	Delay in deployment due Engine room alarm	TF5			95
04/01/2011 09:15	95	-54.25539	-35.35503	Go-Flo bottles deployed	TF5	Go-flo	Start	95
04/01/2011 10:03	95	-54.2555	-35.35479	Go-Flo bottles recovered	TF5	Go-flo	Finish	95
04/01/2011 10:07	95	-54.25562	-35.35453	V/L off station TF5	TF5			95
04/01/2011 10:43		-54.31015	-35.24751	Commence transect	TF5	Transect	Start	Transect TF5
04/01/2011 11:42		-54.19857	-35.46023	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect TF 5
04/01/2011 13:20	96	-54.25582	-35.35358	V/L stopped on full auto DP for SAPs deployment.	TF5			96
04/01/2011 13:30	96	-54.25522	-35.35457	Commence SAPs Deployment.	TF5	SAPS	Start	96
04/01/2011 13:40	96	-54.25523	-35.35454	Complete SAPs deployment.	TF5	SAPS		96
04/01/2011 15:19	96	-54.25522	-35.35454	SAPs Recovered to Deck.	TF5	SAPS	Finish	96
04/01/2011 15:29	97	-54.25518	-35.3545	Commence Deployment of Go-Flo Bottles.	TF5	Go-flo	Start	97
04/01/2011 15:39	97	-54.2552	-35.35449	Go-Flo bottles recovered	TF5	Go-flo	Finish	97
04/01/2011 15:50	97	-54.25516	-35.35455	Gantry secured	TF5			97
04/01/2011 16:27		-54.19092	-35.44938	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect
04/01/2011 17:28		-54.31713	-35.25803	Completed transect TF5	TF5	Transect	Finish	Transect
04/01/2011 17:35		-54.33823	-35.25943	Vessel drifting in order to assess shaft bearing problem.				
05/01/2011 06:45		-54.41516	-35.38024	Vessel moving at 5 kts for shaft trials.				
05/01/2011 14:45	98	-54.62087	-34.80383	V/L stopped on station for TF6.	TF6			98
05/01/2011 15:03	98	-54.62123	-34.80511	Commence Deployment of Go-Flo Bottles.	TF6	Go-flo	Start	98

05/01/2011 15:26	98	-54.62121	-34.80512	Commence haul Go-Flo bottles.	TF6	Go-flo		98
05/01/2011 15:38	98	-54.62122	-34.80511	Go-Flo bottles recovered	TF6	Go-flo	Finish	98
05/01/2011 15:50	99	-54.6212	-34.80513	CTD deployed	TF6	CTD	Start	99
05/01/2011 16:09	99	-54.6212	-34.80516	CTD @ depth	TF6	CTD		99
05/01/2011 16:29	99	-54.62124	-34.80514	CTD recovered	TF6	CTD	Finish	99
05/01/2011 16:44	100	-54.62124	-34.80517	SAPs Deployed.	TF6	SAPS	Start	100
05/01/2011 18:20	100	-54.62121	-34.80513	Commence hauling SAPs.	TF6	SAPS		100
05/01/2011 18:32	100	-54.6212	-34.8051	SAPs Recovered to Deck.	TF6	SAPS	Finish	100
05/01/2011 18:39	101	-54.62123	-34.80514	Go-Flo bottles deployed	TF6	Go-flo	Start	101
05/01/2011 19:54	101	-54.62122	-34.80514	Go-Flo bottles recovered	TF6	Go-flo	Finish	101
05/01/2011 20:03	101	-54.62119	-34.80523	V/L off station	TF6			101
05/01/2011 20:42		-54.56798	-34.91361	Start transect	TF6	Transect	Start	Transect TF6
05/01/2011 21:42		-54.67802	-34.68874	End of transect	TF6	Transect	Finish	Transect TF6
05/01/2011 21:46		-54.67758	-34.68096	Start transect	TF6	Transect	Start	Transect TF6
05/01/2011 22:51		-54.57251	-34.91888	End transect	TF6	Transect	Finish	Transect TF6
05/01/2011 23:50	102	-54.53232	-35.02	K-net Deployed.	TF6	K-net	Start	102
06/01/2011 00:20	102	-54.53226	-35.02306	K-net recovered.	TF6	K-net	Finish	102
06/01/2011 00:50	103	-54.57471	-34.87946	K-net Deployed.	TF6	K-net	Start	103
06/01/2011 01:05	103	-54.56972	-34.8925	K-net recovered.	TF6	K-net	Finish	103
06/01/2011 04:00		-54.51957	-35.2889	Abandont attempts of scientific ops for the night. Awaiting ease in the weather.				
06/01/2011 08:45	104	-54.53075	-35.27068	V/L on station	TF7			104
06/01/2011 09:03	104	-54.53087	-35.27057	CTD deployed	TF7	CTD	Start	104
06/01/2011 09:11	104	-54.53092	-35.27059	CTD @ depth	TF7	CTD		104

06/01/2011 09:24	104	-54.53089	-35.27059	CTD recovered	TF7	CTD	Finish	104
06/01/2011 09:45	105	-54.53085	-35.2706	Go-Flo bottles deployed	TF7	Go-flo	Start	105
06/01/2011 10:18	105	-54.53087	-35.27062	Go-Flo bottles recovered	TF7	Go-flo	Finish	105
06/01/2011 11:35	106	-54.53086	-35.27058	Commence SAPs Deployment.	TF7	SAPS	Start	106
06/01/2011 11:54	106	-54.53088	-35.27059	Complete SAPs deployment.	TF7	SAPS		106
06/01/2011 13:15	106	-54.53095	-35.27051	Commence hauling SAPs.	TF7	SAPS		106
06/01/2011 13:29	106	-54.53089	-35.27063	SAPs Recovered to Deck.	TF7	SAPS	Finish	106
06/01/2011 13:52	106	-54.57999	-35.3822	V/L off DP. Proceeding to start position.	TF7			106
06/01/2011 14:38		-54.58189	-35.38629	Commence 10kt Transect.		Transect	Start	Transect
06/01/2011 14:50		-54.56241	-35.34148	Transect aborted.		Transect	Abort	Transect
06/01/2011 16:25	107	-54.56134	-35.56983	K-net Deployed	TF8	K-net	Start	107
06/01/2011 16:42	107	-54.55839	-35.58536	K-net recovered.	TF8	K-net	Finish	107
06/01/2011 16:45	108	-54.55796	-35.58793	K-net Deployed	TF8	K-net	Start	108
06/01/2011 17:04	108	-54.55493	-35.6045	K-net recovered.	TF8	K-net	Finish	108
06/01/2011 17:33	109	-54.56152	-35.57037	K-net Deployed	TF8	K-net	Start	109
06/01/2011 18:02	109	-54.55624	-35.59642	K-net recovered.	TF8	K-net	Finish	109
06/01/2011 18:46		-54.51803	-35.71232	Commence Transect TF8	TF8	Transect	Start	Transect
06/01/2011 19:48		-54.60196	-35.465	End transect	TF8	Transect	Finish	Transect TF8
06/01/2011 19:54		-54.60488	-35.46817	Start transect	TF8	Transect	Start	Transect TF8
06/01/2011 20:57		-54.50926	-35.70432	End transect	TF8	Transect	Finish	Transect TF8
06/01/2011 21:02		-54.51123	-35.70747	Start transect	TF8	Transect	Start	Transect TF8
06/01/2011 22:02		-54.60659	-35.46442	End of transect	TF8	Transect	Finish	Transect TF8
06/01/2011 22:07		-54.60845	-35.47003	Start transect	TF8	Transect	Start	Transect TF8

06/01/2011 23:07		-54.51076	-35.6891	Complete transect.	TF8	Transect	Finish	Transect TF8
06/01/2011 23:15		-54.50298	-35.69807	Commence Transect TF8	TF8	Transect	Start	Transect TF8
07/01/2011 00:00		-54.58572	-35.52912	Transect aborted.	TF8	Transect	Abort	Transect TF8
07/01/2011 00:45	110	-54.57021	-35.561	K-net Deployed.	TF8	K-net	Start	110
07/01/2011 00:56	110	-54.56594	-35.57166	K-net recovered.	TF8	K-net	Finish	110
07/01/2011 01:04	111	-54.56229	-35.57974	K-net Deployed.	TF8	K-net	Start	111
07/01/2011 01:18	111	-54.55596	-35.59253	K-net recovered.	TF8	K-net	Finish	111
07/01/2011 02:00		-54.51312	-35.70675	Commence Transect TF8	TF8	Transect	Start	Transect TF8
07/01/2011 03:00		-54.60536	-35.46773	Complete transect.	TF8	Transect	Finish	Transect TF8
07/01/2011 03:04		-54.60721	-35.47095	Commence 10kt Transect. TF8	TF8	Transect	Start	Transect
07/01/2011 04:06		-54.5083	-35.69972	Complete transect TF8	TF8	Transect	Finish	Transect
07/01/2011 04:11		-54.50847	-35.70382	Commence 10kt Transect. TF8	TF8	Transect	Start	Transect
07/01/2011 05:12		-54.60764	-35.47243	Complete transect TF8	TF8	Transect	Finish	Transect
07/01/2011 05:17		-54.60865	-35.47817	Commence 10kt Transect. TF8	TF8	Transect	Start	Transect
07/01/2011 06:18		-54.507	-35.69936	Complete transect TF8	TF8	Transect	Finish	Transect
07/01/2011 07:00		-54.55907	-35.58591	Vessel on station TF8 on DP.	TF8			TF8
07/01/2011 07:05	112	-54.5583	-35.58745	CTD deployed	TF8	CTD	Start	112
07/01/2011 07:17	112	-54.55831	-35.58749	CTD @ depth	TF8	CTD		112
07/01/2011 07:33	112	-54.5583	-35.5875	CTD recovered	TF8	CTD	Finish	112
07/01/2011 07:43	113	-54.5583	-35.5875	Go-Flo bottles deployed	TF8	Go-flo	Start	113
07/01/2011 08:18	113	-54.55828	-35.5875	Go-Flo bottles recovered	TF8	Go-flo	Finish	113
07/01/2011 08:24	113	-54.55827	-35.58749	V/L off station TF8	TF8			113
07/01/2011 09:01		-54.50442	-35.69457	Start transect	TF8	Transect	Start	Transect TF8

07/01/2011 10:02		-54.6147	-35.47539	End of transect	TF8	Transect	Finish	Transect TF8
07/01/2011 10:45		-54.55815	-35.58756	V/L on station TF8	TF8			TF8
07/01/2011 11:10	114	-54.55817	-35.58757	Commence SAPs Deployment.	TF8	SAPS	Start	114
07/01/2011 11:35	114	-54.55817	-35.58757	Complete SAPs deployment.	TF8	SAPS		114
07/01/2011 12:50	114	-54.55824	-35.58757	Commence SAPs Recovery.	TF8	SAPS		114
07/01/2011 13:10	114	-54.5581	-35.58766	SAPs Recovered to Deck.	TF8	SAPS	Finish	114
07/01/2011 13:15	114	-54.55808	-35.58764	V/L off DP. Proceeding to start position.	TF8			114
07/01/2011 14:00		-54.51096	-35.70183	Commence 10kt Transect.		Transect	Start	Transect
07/01/2011 15:00		-54.61052	-35.47938	Complete transect.		Transect	Finish	Transect
07/01/2011 22:57	115	-53.63853	-36.37064	K-net Deployed	TF9	K-net	Start	115
07/01/2011 23:39	115	-53.63616	-36.41709	K-net recovered.	TF9	K-net	Finish	115
08/01/2011 00:47	116	-53.61759	-36.29134	K-net Deployed.	TF9	K-net	Start	116
08/01/2011 01:48	116	-53.6252	-36.36467	K-net recovered.	TF9	K-net	Finish	116
08/01/2011 02:22	117	-53.62077	-36.32094	K-net Deployed.	TF9	K-net	Start	117
08/01/2011 02:54	117	-53.62427	-36.35641	K-net recovered.	TF9	K-net	Finish	117
08/01/2011 03:27		-53.6353	-36.48306	Commence 10kt Transect. TF9	TF9	Transect	Start	Transect
08/01/2011 04:27		-53.60716	-36.20979	Complete transect TF9	TF9	Transect	Finish	Transect
08/01/2011 04:33		-53.6036	-36.2067	Commence 10kt Transect. TF9	TF9	Transect	Start	Transect
08/01/2011 05:34		-53.64368	-36.48036	Complete transect TF9	TF9	Transect	Finish	Transect
08/01/2011 06:17		-53.62352	-36.34512	Vessel on station TF9 on DP.	TF9			TF9
08/01/2011 07:00	118	-53.62333	-36.34435	CTD deployed	TF9	CTD	Start	118
08/01/2011 07:19	118	-53.62337	-36.34444	CTD @ depth	TF9	CTD		118
08/01/2011 07:45	118	-53.62329	-36.34436	CTD recovered	TF9	CTD	Finish	118
08/01/2011 07:55	119	-53.62327	-36.34443	Go-Flo bottles deployed	TF9	Go-flo	Start	119
08/01/2011 08:37	119	-53.62325	-36.34439	Go-Flo bottles recovered	TF9	Go-flo	Finish	119
08/01/2011 09:22		-53.61761	-36.20219	Start transect	TF9	Transect	Start	Transect

								TF9
08/01/2011 10:22		-53.62953	-36.48466	End of transect	TF9	Transect	Finish	Transect TF9
08/01/2011 10:30	77	-53.63231	-36.47978	Iron fish recovered	TF9	Iron Fish	Finish	Fish maintenanc e - End 77
08/01/2011 11:10		-53.62306	-36.3445	V/L on station TF9. Auto DP.	TF9			TF9
08/01/2011 11:15	120	-53.62304	-36.34446	Commence SAPs Deployment.	TF9	SAPS	Start	120
08/01/2011 11:35	120	-53.62318	-36.34425	Complete SAPs deployment.	TF9	SAPS		120
08/01/2011 13:29	120	-53.62326	-36.34442	Commence hauling SAPs.	TF9	SAPS		120
08/01/2011 13:42	120	-53.62322	-36.34437	SAPs Recovered to Deck.	TF9	SAPS	Finish	120
08/01/2011 13:45	121	-53.62307	-36.34435	Iron-fish deployed.	TF9	Iron Fish	Start	121
08/01/2011 13:56	122	-53.62314	-36.34414	Go-Flo Bottles Deployed.	TF9	Go-flo	Start	122
08/01/2011 15:18	122	-53.62316	-36.3443	Go-Flo bottles recovered	TF9	Go-flo	Finish	122
08/01/2011 15:27		-53.6228	-36.34398	Gantry secured				
08/01/2011 15:57		-53.63713	-36.48472	Commence 10kt Transect. TF9		Transect	Start	Transect
08/01/2011 16:58		-53.60632	-36.20493	Complete transect TF9		Transect	Finish	Transect
08/01/2011 20:45		-54.20761	-35.70852	Start transect		Transect	Start	Transect TF10
08/01/2011 21:45		-54.29092	-35.95829	End of transect		Transect	Finish	Transect TF10
08/01/2011 21:50		-54.29504	-35.95564	Start transect		Transect	Start	Transect TF10
08/01/2011 22:52		-54.21107	-35.70166	End of transect		Transect	Finish	Transect TF10
08/01/2011 22:57		-54.21638	-35.70002	Start transect		Transect	Start	Transect TF10
08/01/2011 23:57		-54.29877	-35.94816	End of transect.		Transect	Finish	Transect TF10
09/01/2011 00:05		-54.30258	-35.94429	Start transect.		Transect	Start	Transect

								TF10
09/01/2011 00:54	123	-54.27419	-35.87488	K-net Deployed.	TF10	K-net	Start	123
09/01/2011 01:19	123	-54.26281	-35.85779	K-net recovered.	TF10	K-net	Finish	123
09/01/2011 01:48	124	-54.27473	-35.87499	K-net Deployed.	TF10	K-net	Start	124
09/01/2011 02:12	124	-54.27396	-35.8738	K-net recovered.	TF10	K-net	Finish	124
09/01/2011 02:40	125	-54.27547	-35.87598	K-net Deployed.	TF10	K-net	Start	125
09/01/2011 03:06	125	-54.26507	-35.86002	K-net recovered.	TF10	K-net	Finish	125
09/01/2011 03:52		-54.20839	-35.7732	Commence 10kt Transect. TF10	TF10	Transect	Start	Transect
09/01/2011 04:52		-54.32956	-35.96158	Complete transect TF10	TF10	Transect	Finish	Transect
09/01/2011 04:58		-54.32836	-35.96652	Commence 10kt Transect. TF10	TF10	Transect	Start	Transect
09/01/2011 06:02		-54.20965	-35.77231	Complete transect TF10	TF10	Transect	Finish	Transect
09/01/2011 07:05	126	-54.26947	-35.86774	CTD deployed	TF10	CTD	Start	126
09/01/2011 07:17	126	-54.26936	-35.86759	CTD @ depth	TF10	CTD		126
09/01/2011 07:34	126	-54.26936	-35.86758	CTD recovered	TF10	CTD	Finish	126
09/01/2011 08:21		-54.22094	-35.75086	Start transect		Transect	Start	Transect TF10
09/01/2011 09:21		-54.31854	-35.98062	End of transect		Transect	Finish	Transect TF10
09/01/2011 09:30		-54.31168	-35.98673	Start transect		Transect	Start	Transect TF10
09/01/2011 10:30		-54.22728	-35.74345	End of transect		Transect	Finish	Transect TF10
09/01/2011 11:00		-54.32891	-35.86355	Start transect.		Transect	Start	Transect TF10
09/01/2011 12:02		-54.35183	-35.86465	End transect.		Transect	Finish	Transect TF10
09/01/2011 12:08		-54.35248	-35.86093	Start transect.		Transect	Start	Transect TF10
09/01/2011 13:08		-54.15526	-35.8701	End of transect.		Transect	Finish	Transect

								TF10
09/01/2011 17:21		-53.88303	-36.74835	Arrival at TF11				Transect
09/01/2011 17:39		-53.88958	-36.79025	Commence 10kt Transect. TF11		Transect	Start	Transect
09/01/2011 18:39		-53.87377	-36.51647	Complete transect TF11		Transect	Finish	Transect
09/01/2011 18:46		-53.87796	-36.511	Commence 10kt Transect. TF11		Transect	Start	Transect
09/01/2011 19:46		-53.89802	-36.78577	End of transect		Transect	Finish	Transect
09/01/2011 23:08	127	-53.87725	-36.71003	K-net Deployed.	TF11	K-net	Start	127
09/01/2011 23:18	127	-53.87622	-36.72001	K-net recovered.	TF11	K-net	Finish	127
10/01/2011 00:20	128	-53.89871	-36.55917	K-net Deployed.	TF11	K-net	Start	128
10/01/2011 00:52	128	-53.89344	-36.59237	K-net recovered.	TF11	K-net	Finish	128
10/01/2011 02:23	129	-53.86131	-36.77117	K-net recovered.	TF11	K-net	Finish	129
10/01/2011 02:30	129	-53.85703	-36.77664	K-net Deployed.	TF11	K-net	Start	129
10/01/2011 03:48	130	-53.87795	-36.73645	K-net Deployed.	TF11	K-net	Start	130
10/01/2011 04:08	130	-53.86993	-36.74914	K-net recovered.	TF11	K-net	Finish	130
10/01/2011 04:43	131	-53.88437	-36.72585	K-net Deployed.	TF11	K-net	Start	131
10/01/2011 05:10	131	-53.87323	-36.74337	K-net recovered.	TF11	K-net	Finish	131
10/01/2011 05:36		-53.87244	-36.70501	Commence 10kt Transect. TF11	TF11	Transect	Start	Transect
10/01/2011 06:37		-53.9207	-36.43586	Complete transect TF11	TF11	Transect	Finish	Transect
10/01/2011 07:13	132	-53.89647	-36.57258	V/L on station TF11	TF11			132
10/01/2011 07:21	132	-53.89641	-36.57295	CTD deployed	TF11	CTD	Start	132
10/01/2011 07:29	132	-53.89636	-36.57266	CTD @ depth	TF11	CTD		132
10/01/2011 07:44	132	-53.89629	-36.57278	CTD recovered	TF11	CTD	Finish	132
10/01/2011 07:50	133	-53.89632	-36.57287	Go-Flo bottles deployed	TF11	Go-flo	Start	133
10/01/2011 08:29	133	-53.89639	-36.57299	Go-Flo bottles recovered	TF11	Go-flo	Finish	133
10/01/2011 08:38	133	-53.89632	-36.57304	V/L off station TF11	TF11			133
10/01/2011 09:20		-53.87276	-36.70893	Start transect	TF11	Transect	Start	Transect TF11

10/01/2011 10:20		-53.91886	-36.43708	End of transect	TF11	Transect	Finish	Transect TF11
10/01/2011 11:10	134	-53.89633	-36.57333	V/L on station TF11.	TF11			134
10/01/2011 11:15	134	-53.89633	-36.57333	Commence SAPs Deployment.	TF11	SAPS	Start	134
10/01/2011 11:35	134	-53.89628	-36.57301	Complete SAPs deployment.	TF11	SAPS		134
10/01/2011 13:20	134	-53.89633	-36.57352	Commence hauling SAPs.	TF11	SAPS		134
10/01/2011 13:35	134	-53.89633	-36.57338	SAPs Recovered to Deck.	TF11	SAPS	Finish	134
10/01/2011 14:28		-53.92387	-36.71951	Commence 10kt Transect. TF11		Transect	Start	Transect TF11
10/01/2011 15:30		-53.87399	-36.43805	Complete transect TF11		Transect	Finish	Transect
10/01/2011 22:32	135	-54.09325	-36.29219	K-net Deployed	TF12	K-net	Start	135
10/01/2011 23:05	135	-54.08693	-36.32396	K-net recovered.	TF12	K-net	Finish	135
10/01/2011 23:48	136	-54.08588	-36.33014	K-net Deployed.	TF12	K-net	Start	136
11/01/2011 00:10	136	-54.08206	-36.35203	K-net recovered.	TF12	K-net	Finish	136
11/01/2011 07:40	137	-54.10058	-36.24951	V/L on station TF12	TF12			137
11/01/2011 07:50	137	-54.10057	-36.24978	CTD deployed	TF12	CTD	Start	137
11/01/2011 07:59	137	-54.10053	-36.24989	CTD @ depth	TF12	CTD		137
11/01/2011 08:15	137	-54.10043	-36.24979	CTD recovered	TF12	CTD	Finish	137
11/01/2011 09:11	138	-54.10046	-36.24975	Go-Flo bottles deployed	TF12	Go-flo	Start	138
11/01/2011 09:47	138	-54.10046	-36.24978	Go-Flo bottles recovered	TF12	Go-flo	Finish	138
11/01/2011 11:20	139	-54.10049	-36.24963	Commence SAPs Deployment.	TF12	SAPS	Start	139
11/01/2011 11:38	139	-54.10051	-36.24961	Complete SAPs deployment.	TF12	SAPS		139
11/01/2011 13:20	139	-54.10046	-36.24962	Commence hauling SAPs.	TF12	SAPS		139
11/01/2011 13:35	139	-54.10048	-36.24964	SAPs Recovered to Deck.	TF12	SAPS	Finish	139
11/01/2011 14:00	139	-54.08096	-36.31548	V/L off Auto DP. Hove to until further notice.	TF12			139
12/01/2011 13:37	140	-53.54003	-38.1092	V/L stopped on station	TF13			140
12/01/2011 13:55	140	-53.54004	-38.10928	CTD Deployed.	TF13	CTD	Start	140

12/01/2011 14:22	140	-53.54003	-38.10936	CTD @ depth	TF13	CTD		140
12/01/2011 15:00	140	-53.54	-38.10933	CTD recovered to deck.	TF13	CTD	Finish	140
12/01/2011 15:13	141	-53.54005	-38.10934	Commence Deployment of Go-Flo Bottles.	TF13	Go-flo	Start	141
12/01/2011 15:54	141	-53.54005	-38.10944	Commence haul Go-Flo bottles.	TF13	Go-flo		141
12/01/2011 16:28	141	-53.54006	-38.10936	Go-Flo bottles recovered	TF13	Go-flo	Finish	141
12/01/2011 16:30	142	-53.54007	-38.10936	Commence SAPs Deployment.	TF13	SAPS	Start	142
12/01/2011 16:51	142	-53.54001	-38.10937	SAPs Deployed.	TF13	SAPS		142
12/01/2011 18:36	142	-53.54008	-38.10937	Commence hauling SAPs.	TF13	SAPS		142
12/01/2011 18:51	142	-53.54006	-38.10942	SAPs Recovered to Deck.	TF13	SAPS	Finish	142
12/01/2011 18:57	143	-53.54005	-38.10941	Commence Deployment of Go-Flo Bottles.	TF13	Go-flo	Start	143
12/01/2011 19:30	143	-53.54005	-38.10933	Go-Flo bottles recovered	TF13	Go-flo	Finish	143
12/01/2011 19:49		-53.53631	-38.06688	Start transect	TF13	Transect	Start	Transect
12/01/2011 20:48		-53.5375	-37.83116	End of transect	TF13	Transect	Finish	Transect
12/01/2011 20:58		-53.54207	-37.80799	Start transect	TF13	Transect	Start	Transect
12/01/2011 22:17		-53.54171	-38.10811	End of transect	TF13	Transect	Finish	Transect
12/01/2011 22:32		-53.55639	-38.11309	Start transect	TF13	Transect	Start	Transect
12/01/2011 23:32		-53.55498	-37.83121	End of transect.	TF13	Transect	Finish	Transect
13/01/2011 00:30	144	-53.59232	-37.62814	K-net Deployed.	TF13	K-net	Start	144
13/01/2011 00:46	144	-53.5912	-37.6461	K-net recovered.	TF13	K-net	Finish	144
13/01/2011 01:15	145	-53.59185	-37.62341	K-net Deployed.	TF13	K-net	Start	145
13/01/2011 01:30	145	-53.59171	-37.63766	K-net recovered.	TF13	K-net	Finish	145
13/01/2011 02:15	146	-53.59231	-37.61314	K-net Deployed.	TF13	K-net	Start	146
13/01/2011 02:30	146	-53.59227	-37.62827	K-net recovered.	TF13	K-net	Finish	146
13/01/2011 03:54	147	-53.59059	-37.70168	K-net Deployed.	TF13	K-net	Start	147
13/01/2011 04:17	147	-53.59835	-37.71913	K-net recovered.	TF13	K-net	Finish	147
13/01/2011 04:39	148	-53.59942	-37.72206	K-net Deployed.	TF13	K-net	Start	148

13/01/2011 05:02	148	-53.5914	-37.70489	K-net recovered.	TF13	K-net	Finish	148
13/01/2011 05:22	149	-53.59051	-37.70318	K-net Deployed.	TF13	K-net	Start	149
13/01/2011 05:46	149	-53.59892	-37.72033	K-net recovered. Completed fishing. Heading for new location.	TF13	K-net	Finish	149
13/01/2011 10:40	150	-53.75052	-38.98328	V/L on station				150
13/01/2011 11:10	150	-53.75064	-38.9833	CTD Deployed.	TF14	CTD	Start	150
13/01/2011 11:20	150	-53.7506	-38.98323	CTD @ depth	TF14	CTD		150
13/01/2011 11:35	150	-53.75058	-38.98335	CTD recovered to deck.	TF14	CTD	Finish	150
13/01/2011 11:45	151	-53.75056	-38.98331	Go-Flo Bottles Deployed.	TF14	Go-flo	Start	151
13/01/2011 12:30	151	-53.75057	-38.98324	Go-Flo bottles recovered.	TF14	Go-flo	Finish	151
13/01/2011 13:15	152	-53.75058	-38.98321	Commence SAPs Deployment.	TF14	SAPS	Start	152
13/01/2011 13:35	152	-53.75059	-38.98321	SAPs Deployed.	TF14	SAPS		152
13/01/2011 15:26	152	-53.75056	-38.98324	Commence hauling SAPs.	TF14	SAPS		152
13/01/2011 15:41	152	-53.75055	-38.98324	SAPs Recovered to Deck.	TF14	SAPS	Finish	152
13/01/2011 15:52		-53.75056	-38.98324	Gantry secured	TF14			
13/01/2011 16:27		-53.71707	-38.85524	Commence 10kt Transect.	TF14	Transect	Start	Transect
13/01/2011 17:29		-53.78236	-39.10965	Complete transect.	TF14	Transect	Finish	Transect
13/01/2011 17:35		-53.78102	-39.11513	Commence 10kt Transect.	TF14	Transect	Start	Transect
13/01/2011 18:13	121	-53.74682	-38.96942	Iron-fish recovered for maintenance	TF14	Iron Fish	Finish	Fish maintenanc e - End 121
13/01/2011 18:41		-53.72049	-38.85466	Complete transect.	TF14	Transect	Finish	Transect
13/01/2011 18:45		-53.72242	-38.85075	Commence 10kt Transect.	TF14	Transect	Start	Transect
13/01/2011 19:47		-53.7773	-39.11869	End of transect	TF14	Transect	Finish	Transect
13/01/2011 19:52		-53.77444	-39.11835	Start transect	TF14	Transect	Start	Transect
13/01/2011 20:53		-53.72541	-38.85261	End of transect	TF14	Transect	Finish	Transect
13/01/2011 21:29	153	-53.81122	-38.87084	Iron-fish deployed	TF14	Iron Fish	Start	153

13/01/2011 21:44		-53.82192	-38.91479	Start transect	TF14	Transect	Start	Transect
13/01/2011 22:45		-53.67942	-39.05544	End of transect	TF14	Transect	Finish	Transect
13/01/2011 22:52		-53.67115	-39.04413	Start transect	TF14	Transect	Start	Transect
13/01/2011 23:54		-53.82888	-38.90318	End of transect.	TF14	Transect	Finish	Transect
14/01/2011 01:54	154	-53.6945	-38.70657	K-net Deployed.	TF14	K-net	Start	154
14/01/2011 02:20	154	-53.69414	-38.73535	K-net recovered.	TF14	K-net	Finish	154
14/01/2011 02:47	155	-53.6943	-38.69996	K-net Deployed.		K-net	Start	155
14/01/2011 03:22	155	-53.69416	-38.73153	K-net recovered.		K-net	Finish	155
14/01/2011 04:27	156	-53.71021	-38.54747	K-net Deployed.		K-net	Start	156
14/01/2011 04:56	156	-53.70795	-38.57339	K-net recovered.		K-net	Finish	156
14/01/2011 13:36		-53.80283	-36.1315	Start transect.		Transect	Start	Transect
14/01/2011 14:36		-53.87046	-35.85283	End of transect.		Transect	Finish	Transect
14/01/2011 15:32		-53.91144	-36.04913	Commence 10kt Transect.		Transect	Start	Transect
14/01/2011 16:34		-53.7554	-35.94943	Complete transect.		Transect	Finish	Transect
14/01/2011 17:14	157	-53.77144	-35.95892	Bongo Net deployed.		Bongo	Start	157
14/01/2011 17:15	157	-53.77087	-35.95861	Hydrophone deloyed.				157
14/01/2011 17:34	157	-53.76103	-35.95272	Hydrophone recovered.				157
14/01/2011 17:43	157	-53.7563	-35.94994	Bongo Net recovered.		Bongo	Finish	157
14/01/2011 18:31	158	-53.8427	-36.00662	Bongo Net deployed.		Bongo	Start	158
14/01/2011 18:47	158	-53.83418	-36.00069	Bongo Net recovered.		Bongo	Finish	158
14/01/2011 18:54	159	-53.8306	-35.99832	Bongo Net deployed.		Bongo	Start	159
14/01/2011 19:20	159	-53.81913	-35.99128	Bongo Net recovered.		Bongo	Finish	159
14/01/2011 19:58		-53.76283	-35.92584	Start transect		Transect	Start	Transect
14/01/2011 20:35	153	-53.82986	-35.99691	Fish recovered due kelp fouling		Iron Fish		Fish maintenanc e - End 153
14/01/2011 20:40	160	-53.83613	-36.00327	Iron fish deployed		Iron Fish	Start	160

14/01/2011 21:20		-53.90773	-36.07353	End of transect		Transect	Finish	Transect
15/01/2011 00:11	161	-54.05049	-36.1699	K-net Deployed.		K-net	Start	161
15/01/2011 00:35	161	-54.03768	-36.16028	K-net recovered.		K-net	Finish	161
15/01/2011 00:45	160	-54.03079	-36.15432	Iron fish recovered.		Iron Fish	Finish	End 160
15/01/2011 19:10	162	-54.28708	-36.48366	Iron fish deployed		Iron Fish	Start	162

B.2 CTD Events

Time	Event	Lat	Lon	Comment	Station	Type	Status	Bridge Number
22/12/2010 11:45	1	-52.25238	-51.4136	CTD Deployed.	Test	CTD	Start	1
22/12/2010 11:48	1	-52.25234	-51.41356	CTD to be sent to 300m. for test.	Test	CTD		1
22/12/2010 11:56	1	-52.25234	-51.41355	CTD at depth. 300m wire out.	Test	CTD		1
22/12/2010 12:35	1	-52.25232	-51.41353	CTD recovered to deck.	Test	CTD	Finish	1
25/12/2010 07:01	20	-53.70041	-38.2097	CTD deployed	TF1	CTD	Start	20
25/12/2010 07:23	20	-53.70041	-38.20965	CTD @ depth	TF1	CTD		20
25/12/2010 07:39	20	-53.70042	-38.20968	CTD recovered	TF1	CTD	Finish	20
26/12/2010 23:29	33	-53.84605	-39.14321	CTD Deployed.	WCB	CTD	Start	33
26/12/2010 23:37	33	-53.84607	-39.1432	CTD at depth	WCB	CTD		33
26/12/2010 23:57	33	-53.84604	-39.1432	CTD recovered to deck - midship gantry secure.	WCB	CTD	Finish	33
27/12/2010 07:00	36	-53.49304	-39.25069	CTD deployed	WCB	CTD	Start	36
27/12/2010 07:23	36	-53.49305	-39.25099	CTD @ depth	WCB	CTD		36
27/12/2010 07:53	36	-53.49298	-39.25197	CTD recovered	WCB	CTD	Finish	36
27/12/2010 21:00	42	-53.43131	-38.69836	CTD deployed	WCB	CTD	Start	42
27/12/2010 21:23	42	-53.43152	-38.69732	CTD @ depth	WCB	CTD		42
27/12/2010 21:57	42	-53.43158	-38.6969	CTD recovered	WCB	CTD	Finish	42
28/12/2010 07:00	46	-53.78513	-38.58397	CTD deployed	WCB	CTD	Start	46

28/12/2010 07:11	46	-53.78508	-38.58394	CTD @ depth	WCB	CTD		46
28/12/2010 07:25	46	-53.7851	-38.58393	CTD recovered	WCB	CTD	Finish	46
28/12/2010 20:11	53	-53.71427	-37.96501	CTD deployed	WCB	CTD	Start	53
28/12/2010 20:19	53	-53.71427	-37.96499	CTD @ depth	WCB	CTD		53
28/12/2010 20:35	53	-53.71425	-37.96506	CTD recovered	WCB	CTD	Finish	53
30/12/2010 07:00	55	-53.3608	-38.08286	CTD deployed at 3.2N	WCB	CTD	Start	55
30/12/2010 07:22	55	-53.36081	-38.08288	CTD @ depth	WCB	CTD		55
30/12/2010 07:52	55	-53.36082	-38.08287	CTD recovered	WCB	CTD	Finish	55
31/12/2010 07:05	70	-53.4911	-37.70732	CTD deployed	TF2	CTD	Start	70
31/12/2010 07:31	70	-53.49112	-37.7073	CTD @ depth	TF2	CTD		70
31/12/2010 08:09	70	-53.49112	-37.70735	CTD recovered	TF2	CTD	Finish	70
01/01/2011 07:05	75	-53.99387	-36.37066	CTD deployed	TF3	CTD	Start	75
01/01/2011 07:09	75	-53.99388	-36.37066	CTD @ depth	TF3	CTD		75
01/01/2011 07:24	75	-53.9939	-36.37071	CTD recovered	TF3	CTD	Finish	75
01/01/2011 12:46	76	-54.15862	-36.69299	CTD Deployed.	TF3	CTD	Start	76
01/01/2011 12:52	76	-54.15862	-36.69301	CTD @ depth	TF3	CTD		76
01/01/2011 12:56	76	-54.15863	-36.69302	CTD recovered to deck.	TF3	CTD	Finish	76
02/01/2011 07:12	78	-53.99385	-36.37063	CTD deployed	TF3	CTD	Start	78
02/01/2011 07:22	78	-53.99384	-36.37064	CTD @ depth	TF3	CTD		78
02/01/2011 07:36	78	-53.99384	-36.37065	CTD recovered	TF3	CTD	Finish	78
03/01/2011 07:27	86	-54.10066	-35.45568	CTD deployed	TF4	CTD	Start	86
03/01/2011 07:37	86	-54.1006	-35.45547	CTD @ depth	TF4	CTD		86
03/01/2011 07:52	86	-54.10057	-35.45547	CTD recovered	TF4	CTD	Finish	86
03/01/2011 14:30	90	-54.09984	-35.45589	CTD Deployed.	TF4	CTD	Start	90
03/01/2011 14:38	90	-54.09996	-35.45588	CTD @ depth. 150m.	TF4	CTD		90
03/01/2011 14:44	90	-54.09998	-35.45585	CTD recovered to deck.	TF4	CTD	Finish	90

04/01/2011 07:02	94	-54.25531	-35.35523	CTD deployed	TF5	CTD	Start	94
04/01/2011 07:11	94	-54.25531	-35.35525	CTD @ depth	TF5	CTD		94
04/01/2011 07:28	94	-54.25532	-35.35526	CTD recovered	TF5	CTD	Finish	94
05/01/2011 15:50	99	-54.6212	-34.80513	CTD deployed	TF6	CTD	Start	99
05/01/2011 16:09	99	-54.6212	-34.80516	CTD @ depth	TF6	CTD		99
05/01/2011 16:29	99	-54.62124	-34.80514	CTD recovered	TF6	CTD	Finish	99
06/01/2011 09:03	104	-54.53087	-35.27057	CTD deployed	TF7	CTD	Start	104
06/01/2011 09:11	104	-54.53092	-35.27059	CTD @ depth	TF7	CTD		104
06/01/2011 09:24	104	-54.53089	-35.27059	CTD recovered	TF7	CTD	Finish	104
07/01/2011 07:05	112	-54.5583	-35.58745	CTD deployed	TF8	CTD	Start	112
07/01/2011 07:17	112	-54.55831	-35.58749	CTD @ depth	TF8	CTD		112
07/01/2011 07:33	112	-54.5583	-35.5875	CTD recovered	TF8	CTD	Finish	112
08/01/2011 07:00	118	-53.62333	-36.34435	CTD deployed	TF9	CTD	Start	118
08/01/2011 07:19	118	-53.62337	-36.34444	CTD @ depth	TF9	CTD		118
08/01/2011 07:45	118	-53.62329	-36.34436	CTD recovered	TF9	CTD	Finish	118
09/01/2011 07:05	126	-54.26947	-35.86774	CTD deployed	TF10	CTD	Start	126
09/01/2011 07:17	126	-54.26936	-35.86759	CTD @ depth	TF10	CTD		126
09/01/2011 07:34	126	-54.26936	-35.86758	CTD recovered	TF10	CTD	Finish	126
10/01/2011 07:21	132	-53.89641	-36.57295	CTD deployed	TF11	CTD	Start	132
10/01/2011 07:29	132	-53.89636	-36.57266	CTD @ depth	TF11	CTD		132
10/01/2011 07:44	132	-53.89629	-36.57278	CTD recovered	TF11	CTD	Finish	132
11/01/2011 07:50	137	-54.10057	-36.24978	CTD deployed	TF12	CTD	Start	137
11/01/2011 07:59	137	-54.10053	-36.24989	CTD @ depth	TF12	CTD		137
11/01/2011 08:15	137	-54.10043	-36.24979	CTD recovered	TF12	CTD	Finish	137
12/01/2011 13:55	140	-53.54004	-38.10928	CTD Deployed.	TF13	CTD	Start	140
12/01/2011 14:22	140	-53.54003	-38.10936	CTD @ depth	TF13	CTD		140

12/01/2011 15:00	140	-53.54	-38.10933	CTD recovered to deck.	TF13	CTD	Finish	140
13/01/2011 11:10	150	-53.75064	-38.9833	CTD Deployed.	TF14	CTD	Start	150
13/01/2011 11:20	150	-53.7506	-38.98323	CTD @ depth	TF14	CTD		150
13/01/2011 11:35	150	-53.75058	-38.98335	CTD recovered to deck.	TF14	CTD	Finish	150

B.3 Bongo Events

Time	Event	Lat	Lon	Comment	Station	Type	Status	Bridge Number
14/01/2011 17:14	157	-53.77144	-35.95892	Bongo Net deployed.		Bongo	Start	157
14/01/2011 17:43	157	-53.7563	-35.94994	Bongo Net recovered.		Bongo	Finish	157
14/01/2011 18:31	158	-53.8427	-36.00662	Bongo Net deployed.		Bongo	Start	158
14/01/2011 18:47	158	-53.83418	-36.00069	Bongo Net recovered.		Bongo	Finish	158
14/01/2011 18:54	159	-53.8306	-35.99832	Bongo Net deployed.		Bongo	Start	159
14/01/2011 19:20	159	-53.81913	-35.99128	Bongo Net recovered.		Bongo	Finish	159

B.4 Go-flo Events

Time	Event	Lat	Lon	Comment	Station	Type	Status	Bridge Number
22/12/2010 18:05	2	-52.17358	-50.00338	Go-Flo bottles deployed	Test	Go-flo	Start	2
22/12/2010 19:09	2	-52.17359	-50.00338	Go-Flo bottles recovered	Test	Go-flo	Finish	2
25/12/2010 08:27	21	-53.70045	-38.20967	Go-Flo bottles deployed	TF1	Go-flo	Start	21
25/12/2010 09:04	21	-53.70045	-38.20966	Go-Flo bottles recovered	TF1	Go-flo	Finish	21
25/12/2010 14:23	23	-53.70025	-38.20989	Commence Deployment of Go-Flo Bottles.	TF1	Go-flo	Start	23
25/12/2010 15:03	23	-53.70021	-38.2097	Recovered Go-Flo.	TF1	Go-flo	Finish	23
26/12/2010 22:33	32	-53.84602	-39.1432	Go-Flo bottles deployed	WCB	Go-flo	Start	32
26/12/2010 23:10	32	-53.84604	-39.1432	Go-Flo bottles recovered.	WCB	Go-flo	Finish	32

31/12/2010 08:25	71	-53.49108	-37.70731	Go-Flo bottles deployed	TF2	Go-flo	Start	71
31/12/2010 09:00	71	-53.49112	-37.70731	Go-Flo bottles recovered	TF2	Go-flo	Finish	71
31/12/2010 13:39	73	-53.49105	-37.70753	Go-Flo Bottles Deployed.	TF2	Go-flo	Start	73
31/12/2010 14:48	73	-53.4911	-37.70765	Go-Flo bottles recovered.	TF2	Go-flo	Finish	73
02/01/2011 07:54	79	-53.99383	-36.37066	Go-Flo bottles deployed	TF3	Go-flo	Start	79
02/01/2011 08:31	79	-53.99382	-36.37078	Go-Flo bottles recovered	TF3	Go-flo	Finish	79
03/01/2011 08:07	87	-54.10056	-35.45553	Go-Flo bottles deployed	TF4	Go-flo	Start	87
03/01/2011 08:49	87	-54.10059	-35.45552	Go-Flo bottles recovered	TF4	Go-flo	Finish	87
03/01/2011 13:25	89	-54.10059	-35.45499	Go-Flo Bottles Deployed.	TF4	Go-flo	Start	89
03/01/2011 13:52	89	-54.10052	-35.45509	Go-Flo bottles recovered.	TF4	Go-flo	Finish	89
04/01/2011 09:15	95	-54.25539	-35.35503	Go-Flo bottles deployed	TF5	Go-flo	Start	95
04/01/2011 10:03	95	-54.2555	-35.35479	Go-Flo bottles recovered	TF5	Go-flo	Finish	95
04/01/2011 15:29	97	-54.25518	-35.3545	Commence Deployment of Go-Flo Bottles.	TF5	Go-flo	Start	97
04/01/2011 15:39	97	-54.2552	-35.35449	Go-Flo bottles recovered	TF5	Go-flo	Finish	97
05/01/2011 15:03	98	-54.62123	-34.80511	Commence Deployment of Go-Flo Bottles.	TF6	Go-flo	Start	98
05/01/2011 15:26	98	-54.62121	-34.80512	Commence haul Go-Flo bottles.	TF6	Go-flo		98
05/01/2011 15:38	98	-54.62122	-34.80511	Go-Flo bottles recovered	TF6	Go-flo	Finish	98
05/01/2011 18:39	101	-54.62123	-34.80514	Go-Flo bottles deployed	TF6	Go-flo	Start	101
05/01/2011 19:54	101	-54.62122	-34.80514	Go-Flo bottles recovered	TF6	Go-flo	Finish	101
06/01/2011 09:45	105	-54.53085	-35.2706	Go-Flo bottles deployed	TF7	Go-flo	Start	105
06/01/2011 10:18	105	-54.53087	-35.27062	Go-Flo bottles recovered	TF7	Go-flo	Finish	105
07/01/2011 07:43	113	-54.5583	-35.5875	Go-Flo bottles deployed	TF8	Go-flo	Start	113
07/01/2011 08:18	113	-54.55828	-35.5875	Go-Flo bottles recovered	TF8	Go-flo	Finish	113
08/01/2011 07:55	119	-53.62327	-36.34443	Go-Flo bottles deployed	TF9	Go-flo	Start	119
08/01/2011 08:37	119	-53.62325	-36.34439	Go-Flo bottles recovered	TF9	Go-flo	Finish	119
08/01/2011 13:56	122	-53.62314	-36.34414	Go-Flo Bottles Deployed.	TF9	Go-flo	Start	122

08/01/2011 15:18	122	-53.62316	-36.3443	Go-Flo bottles recovered	TF9	Go-flo	Finish	122
10/01/2011 07:50	133	-53.89632	-36.57287	Go-Flo bottles deployed	TF11	Go-flo	Start	133
10/01/2011 08:29	133	-53.89639	-36.57299	Go-Flo bottles recovered	TF11	Go-flo	Finish	133
11/01/2011 09:11	138	-54.10046	-36.24975	Go-Flo bottles deployed	TF12	Go-flo	Start	138
11/01/2011 09:47	138	-54.10046	-36.24978	Go-Flo bottles recovered	TF12	Go-flo	Finish	138
12/01/2011 15:13	141	-53.54005	-38.10934	Commence Deployment of Go-Flo Bottles.	TF13	Go-flo	Start	141
12/01/2011 15:54	141	-53.54005	-38.10944	Commence haul Go-Flo bottles.	TF13	Go-flo		141
12/01/2011 16:28	141	-53.54006	-38.10936	Go-Flo bottles recovered	TF13	Go-flo	Finish	141
12/01/2011 18:57	143	-53.54005	-38.10941	Commence Deployment of Go-Flo Bottles.	TF13	Go-flo	Start	143
12/01/2011 19:30	143	-53.54005	-38.10933	Go-Flo bottles recovered	TF13	Go-flo	Finish	143
13/01/2011 11:45	151	-53.75056	-38.98331	Go-Flo Bottles Deployed.	TF14	Go-flo	Start	151
13/01/2011 12:30	151	-53.75057	-38.98324	Go-Flo bottles recovered.	TF14	Go-flo	Finish	151

B.5 Iron Fish Events

Time	Event	Lat	Lon	Comment	Station	Type	Status	Bridge Number
22/12/2010 19:26	3	-52.17358	-50.00332	Iron-fish deployed	Test	Iron Fish	Start	3
23/12/2010 16:25		-52.67652	-45.1779	Iron-fish recovered	Test	Iron Fish	Finish	Fish - End 3
23/12/2010 17:01	9	-52.68685	-45.04208	Iron-fish deployed	Test	Iron Fish	Start	9
27/12/2010 22:05	9	-53.43162	-38.69689	Iron-fish recovered for maintenance	WCB	Iron Fish		Fish maintenance - End 9
27/12/2010 22:26	43	-53.43159	-38.69691	Iron fish re-deployed. V/L off station 2.2N	WCB	Iron Fish		43
30/12/2010 18:10	43	-53.33906	-37.76832	Iron-fish recovered for maintenance	WCB	Iron Fish	Finish	Fish maintenance - End 43
30/12/2010 19:35	66	-53.13174	-37.83854	Iron-fish deployed	TF2	Iron Fish	Start	66
01/01/2011 01:07	66	-53.98945	-36.4001	Iron towfish onboard	TF3	Iron Fish	Finish	Fish maintenance - End

								66
01/01/2011 19:50	77	-54.1066	-36.59439	Iron-fish deployed	TF3	Iron Fish	Start	77
08/01/2011 10:30	77	-53.63231	-36.47978	Iron fish recovered	TF9	Iron Fish	Finish	Fish maintenance - End 77
08/01/2011 13:45	121	-53.62307	-36.34435	Iron-fish deployed.	TF9	Iron Fish	Start	121
13/01/2011 18:13	121	-53.74682	-38.96942	Iron-fish recovered for maintenance	TF14	Iron Fish	Finish	Fish maintenance - End 121
13/01/2011 21:29	153	-53.81122	-38.87084	Iron-fish deployed	TF14	Iron Fish	Start	153
14/01/2011 20:35	153	-53.82986	-35.99691	Fish recovered due kelp fouling		Iron Fish		Fish maintenance - End 153
14/01/2011 20:40	160	-53.83613	-36.00327	Iron fish deployed		Iron Fish	Start	160
15/01/2011 00:45	160	-54.03079	-36.15432	Iron fish recovered.		Iron Fish	Finish	End 160
15/01/2011 19:10	162	-54.28708	-36.48366	Iron fish deployed		Iron Fish	Start	162

B.6 K-net Events

Time	Event	Lat	Lon	Comment	Station	Type	Status	Bridge Number
23/12/2010 11:19	4	-52.72198	-45.13437	K-net deployed	Test	K-net	Start	4
23/12/2010 11:21	4	-52.72129	-45.135	K-net recovered	Test	K-net	Finish	4
23/12/2010 11:27	5	-52.71868	-45.13744	K-net deployed	Test	K-net	Start	5
23/12/2010 12:06	5	-52.70304	-45.15303	K-net recovered	Test	K-net	Finish	5
23/12/2010 12:21	6	-52.69661	-45.15947	K-net deployed	Test	K-net	Start	6
23/12/2010 12:32	6	-52.69187	-45.1644	K-net recovered	Test	K-net	Finish	6
23/12/2010 12:59	7	-52.68027	-45.17473	K-net deployed	Test	K-net	Start	7
23/12/2010 13:05	7	-52.67733	-45.17785	K-net recovered	Test	K-net	Finish	7
23/12/2010 13:10		-52.67634	-45.17807	Test deployment of net complete	Test	K-net	Finish	
24/12/2010 16:05	10	-53.69137	-38.3309	Commence deployment of K-net.	Test	K-net	Start	10

24/12/2010 16:38	10	-53.69254	-38.35995	K-net recovered.	Test	K-net	Finish	10
24/12/2010 16:59	11	-53.69409	-38.39753	Commence deployment of K-net.	Test	K-net	Start	11
24/12/2010 17:18	11	-53.6939	-38.41398	K-net recovered.	Test	K-net	Finish	11
24/12/2010 17:23	12	-53.69382	-38.4183	Commence deployment of K-net.	Test	K-net	Start	12
24/12/2010 17:38	12	-53.69385	-38.4299	K-net recovered.	Test	K-net	Finish	12
24/12/2010 17:45	13	-53.69281	-38.43576	Commence deployment of K-net.	Test	K-net	Start	13
24/12/2010 18:02	13	-53.6909	-38.44931	K-net recovered.	Test	K-net	Finish	13
24/12/2010 18:06	14	-53.69034	-38.45268	Commence deployment of K-net.	Test	K-net	Start	14
24/12/2010 18:21	14	-53.68877	-38.46702	K-net recovered.	Test	K-net	Finish	14
24/12/2010 20:05	15	-53.67729	-38.45693	Deploy K-net	TF1	K-net	Start	15
24/12/2010 20:26	15	-53.67565	-38.47808	Net recovered	TF1	K-net	Finish	15
24/12/2010 22:20	16	-53.70826	-38.18314	Deploy K-net	TF1	K-net	Start	16
24/12/2010 22:43	16	-53.7053	-38.20859	Net recovered	TF1	K-net	Finish	16
24/12/2010 23:18	17	-53.70642	-38.1883	K-net Deployed.	TF1	K-net	Start	17
24/12/2010 23:45	17	-53.69941	-38.21164	K-net recovered.	TF1	K-net	Finish	17
25/12/2010 00:37	18	-53.70745	-38.18335	K-net Deployed.	TF1	K-net	Start	18
25/12/2010 01:00	18	-53.70183	-38.20442	K-net recovered.	TF1	K-net	Finish	18
25/12/2010 01:18	19	-53.69608	-38.22316	K-net Deployed.	TF1	K-net	Start	19
25/12/2010 01:44	19	-53.68942	-38.24491	K-net recovered.	TF1	K-net	Finish	19
25/12/2010 20:00	24	-53.75139	-38.93356	K-net Deployed		K-net	Start	24
25/12/2010 20:20	24	-53.74302	-38.94402	K-net recovered.		K-net	Finish	24
26/12/2010 02:18	25	-53.59377	-39.13299	K-net Deployed.		K-net	Start	25
26/12/2010 02:47	25	-53.58015	-39.14619	K-net recovered.		K-net	Finish	25
27/12/2010 02:53	34	-53.7554	-38.9826	K-net Deployed.	WCB	K-net	Start	34
27/12/2010 03:23	34	-53.7553	-39.00911	K-net recovered.	WCB	K-net	Finish	34
27/12/2010 03:51	35	-53.75573	-38.97993	K-net Deployed.	WCB	K-net	Start	35

27/12/2010 04:20	35	-53.75442	-39.00658	K-net recovered.	WCB	K-net	Finish	35
28/12/2010 01:25	44	-53.61288	-38.22129	K-net Deployed.	WCB	K-net	Start	44
28/12/2010 01:57	44	-53.60306	-38.24584	K-net recovered.	WCB	K-net	Finish	44
28/12/2010 02:45	45	-53.61699	-38.23129	K-net Deployed.	WCB	K-net	Start	45
28/12/2010 03:12	45	-53.60783	-38.25176	K-net recovered.	WCB	K-net	Finish	45
28/12/2010 21:17	54	-53.74209	-37.94547	K-net Deployed	WCB	K-net	Start	54
28/12/2010 21:58	54	-53.72808	-37.97953	K-net recovered.	WCB	K-net	Finish	54
30/12/2010 22:32	67	-53.49141	-37.69341	K-net Deployed	TF2	K-net	Start	67
30/12/2010 22:56	67	-53.49121	-37.71719	K-net recovered.	TF2	K-net	Finish	67
30/12/2010 22:56	67	-53.49121	-37.71719	K-net recovered.	TF2	K-net	Finish	67
30/12/2010 23:22	68	-53.49174	-37.69547	K-NET deployed	TF2	K-net	Start	68
30/12/2010 23:43	68	-53.49104	-37.71434	K-NET recovered	TF2	K-net	Finish	68
31/12/2010 01:07	69	-53.48319	-37.71209	K-NET deployed	TF2	K-net	Start	69
31/12/2010 01:32	69	-53.47388	-37.73248	K-NET recovered	TF2	K-net	Finish	69
01/01/2011 00:19	74	-53.99936	-36.33885	K-NET deployed	TF3	K-net	Start	74
01/01/2011 00:44	74	-53.99471	-36.36495	K-NET recovered	TF3	K-net	Finish	74
02/01/2011 20:15	81	-53.73791	-35.5098	K-net Deployed	TF4	K-net	Start	81
02/01/2011 20:50	81	-53.73862	-35.47291	K-net recovered.	TF4	K-net	Finish	81
02/01/2011 20:50	81	-53.73862	-35.47291	K-net recovered.	TF4	K-net	Finish	81
02/01/2011 23:45	82	-54.02773	-35.55216	K-NET deployed	TF4	K-net	Start	82
03/01/2011 00:22	82	-54.0426	-35.53401	K-NET recovered	TF4	K-net	Finish	82
03/01/2011 00:25	83	-54.04345	-35.53237	K-NET deployed	TF4	K-net	Start	83
03/01/2011 00:36	83	-54.04797	-35.52391	K-NET recovered	TF4	K-net	Finish	83
03/01/2011 01:28	84	-54.03113	-35.54937	K-NET deployed	TF4	K-net	Start	84
03/01/2011 02:04	84	-54.04775	-35.52509	K-NET recovered	TF4	K-net	Finish	84
03/01/2011 04:21	85	-53.99667	-35.59981	K-net Deployed.	TF4	K-net	Start	85

03/01/2011 05:04	85	-54.01019	-35.58063	K-net recovered.	TF4	K-net	Finish	85
03/01/2011 19:53	91	-54.12808	-35.44312	K-net Deployed		K-net	Start	91
03/01/2011 20:20	91	-54.11779	-35.45471	K-net recovered.		K-net	Finish	91
03/01/2011 21:44	92	-54.26445	-35.35293	K-net Deployed	TF5	K-net	Start	92
03/01/2011 22:04	92	-54.25255	-35.35546	K-net recovered.	TF5	K-net	Finish	92
03/01/2011 22:20	93	-54.26342	-35.35322	K-net Deployed	TF5	K-net	Start	93
03/01/2011 22:38	93	-54.25186	-35.35557	K-net recovered.	TF5	K-net	Finish	93
05/01/2011 23:50	102	-54.53232	-35.02	K-net Deployed.	TF6	K-net	Start	102
06/01/2011 00:20	102	-54.53226	-35.02306	K-net recovered.	TF6	K-net	Finish	102
06/01/2011 00:50	103	-54.57471	-34.87946	K-net Deployed.	TF6	K-net	Start	103
06/01/2011 01:05	103	-54.56972	-34.8925	K-net recovered.	TF6	K-net	Finish	103
06/01/2011 16:25	107	-54.56134	-35.56983	K-net Deployed	TF8	K-net	Start	107
06/01/2011 16:42	107	-54.55839	-35.58536	K-net recovered.	TF8	K-net	Finish	107
06/01/2011 16:45	108	-54.55796	-35.58793	K-net Deployed	TF8	K-net	Start	108
06/01/2011 17:04	108	-54.55493	-35.6045	K-net recovered.	TF8	K-net	Finish	108
06/01/2011 17:33	109	-54.56152	-35.57037	K-net Deployed	TF8	K-net	Start	109
06/01/2011 18:02	109	-54.55624	-35.59642	K-net recovered.	TF8	K-net	Finish	109
07/01/2011 00:45	110	-54.57021	-35.561	K-net Deployed.	TF8	K-net	Start	110
07/01/2011 00:56	110	-54.56594	-35.57166	K-net recovered.	TF8	K-net	Finish	110
07/01/2011 01:04	111	-54.56229	-35.57974	K-net Deployed.	TF8	K-net	Start	111
07/01/2011 01:18	111	-54.55596	-35.59253	K-net recovered.	TF8	K-net	Finish	111
07/01/2011 22:57	115	-53.63853	-36.37064	K-net Deployed	TF9	K-net	Start	115
07/01/2011 23:39	115	-53.63616	-36.41709	K-net recovered.	TF9	K-net	Finish	115
08/01/2011 00:47	116	-53.61759	-36.29134	K-net Deployed.	TF9	K-net	Start	116
08/01/2011 01:48	116	-53.6252	-36.36467	K-net recovered.	TF9	K-net	Finish	116
08/01/2011 02:22	117	-53.62077	-36.32094	K-net Deployed.	TF9	K-net	Start	117

08/01/2011 02:54	117	-53.62427	-36.35641	K-net recovered.	TF9	K-net	Finish	117
09/01/2011 00:54	123	-54.27419	-35.87488	K-net Deployed.	TF10	K-net	Start	123
09/01/2011 01:19	123	-54.26281	-35.85779	K-net recovered.	TF10	K-net	Finish	123
09/01/2011 01:48	124	-54.27473	-35.87499	K-net Deployed.	TF10	K-net	Start	124
09/01/2011 02:12	124	-54.27396	-35.8738	K-net recovered.	TF10	K-net	Finish	124
09/01/2011 02:40	125	-54.27547	-35.87598	K-net Deployed.	TF10	K-net	Start	125
09/01/2011 03:06	125	-54.26507	-35.86002	K-net recovered.	TF10	K-net	Finish	125
09/01/2011 23:08	127	-53.87725	-36.71003	K-net Deployed.	TF11	K-net	Start	127
09/01/2011 23:18	127	-53.87622	-36.72001	K-net recovered.	TF11	K-net	Finish	127
10/01/2011 00:20	128	-53.89871	-36.55917	K-net Deployed.	TF11	K-net	Start	128
10/01/2011 00:52	128	-53.89344	-36.59237	K-net recovered.	TF11	K-net	Finish	128
10/01/2011 02:23	129	-53.86131	-36.77117	K-net recovered.	TF11	K-net	Finish	129
10/01/2011 02:30	129	-53.85703	-36.77664	K-net Deployed.	TF11	K-net	Start	129
10/01/2011 03:48	130	-53.87795	-36.73645	K-net Deployed.	TF11	K-net	Start	130
10/01/2011 04:08	130	-53.86993	-36.74914	K-net recovered.	TF11	K-net	Finish	130
10/01/2011 04:43	131	-53.88437	-36.72585	K-net Deployed.	TF11	K-net	Start	131
10/01/2011 05:10	131	-53.87323	-36.74337	K-net recovered.	TF11	K-net	Finish	131
10/01/2011 22:32	135	-54.09325	-36.29219	K-net Deployed	TF12	K-net	Start	135
10/01/2011 23:05	135	-54.08693	-36.32396	K-net recovered.	TF12	K-net	Finish	135
10/01/2011 23:48	136	-54.08588	-36.33014	K-net Deployed.	TF12	K-net	Start	136
11/01/2011 00:10	136	-54.08206	-36.35203	K-net recovered.	TF12	K-net	Finish	136
13/01/2011 00:30	144	-53.59232	-37.62814	K-net Deployed.	TF13	K-net	Start	144
13/01/2011 00:46	144	-53.5912	-37.6461	K-net recovered.	TF13	K-net	Finish	144
13/01/2011 01:15	145	-53.59185	-37.62341	K-net Deployed.	TF13	K-net	Start	145
13/01/2011 01:30	145	-53.59171	-37.63766	K-net recovered.	TF13	K-net	Finish	145
13/01/2011 02:15	146	-53.59231	-37.61314	K-net Deployed.	TF13	K-net	Start	146

13/01/2011 02:30	146	-53.59227	-37.62827	K-net recovered.	TF13	K-net	Finish	146
13/01/2011 03:54	147	-53.59059	-37.70168	K-net Deployed.	TF13	K-net	Start	147
13/01/2011 04:17	147	-53.59835	-37.71913	K-net recovered.	TF13	K-net	Finish	147
13/01/2011 04:39	148	-53.59942	-37.72206	K-net Deployed.	TF13	K-net	Start	148
13/01/2011 05:02	148	-53.5914	-37.70489	K-net recovered.	TF13	K-net	Finish	148
13/01/2011 05:22	149	-53.59051	-37.70318	K-net Deployed.	TF13	K-net	Start	149
13/01/2011 05:46	149	-53.59892	-37.72033	K-net recovered. Completed fishing. Heading for new location.	TF13	K-net	Finish	149
14/01/2011 01:54	154	-53.6945	-38.70657	K-net Deployed.	TF14	K-net	Start	154
14/01/2011 02:20	154	-53.69414	-38.73535	K-net recovered.	TF14	K-net	Finish	154
14/01/2011 02:47	155	-53.6943	-38.69996	K-net Deployed.		K-net	Start	155
14/01/2011 03:22	155	-53.69416	-38.73153	K-net recovered.		K-net	Finish	155
14/01/2011 04:27	156	-53.71021	-38.54747	K-net Deployed.		K-net	Start	156
14/01/2011 04:56	156	-53.70795	-38.57339	K-net recovered.		K-net	Finish	156
15/01/2011 00:11	161	-54.05049	-36.1699	K-net Deployed.		K-net	Start	161
15/01/2011 00:35	161	-54.03768	-36.16028	K-net recovered.		K-net	Finish	161

B.7 SAPS Events

Time	Event	Lat	Lon	Comment	Station	Type	Status	Bridge Number
23/12/2010 14:05	8	-52.67638	-45.17809	Commence SAP Deployment.	Test	SAPS	Start	8
23/12/2010 14:22	8	-52.67653	-45.17784	Complete SAPs deployment	Test	SAPS		8
23/12/2010 16:05	8	-52.67655	-45.17787	SAP Deployment recovered and on deck.	Test	SAPS	Finish	8
25/12/2010 11:47	22	-53.70038	-38.2105	Commence SAP Deployment.	TF1	SAPS	Start	22
25/12/2010 13:49	22	-53.70025	-38.20989	Commence SAPs Recovery.	TF1	SAPS		22
25/12/2010 14:03	22	-53.70025	-38.20989	SAPs Recovered to Deck.	TF1	SAPS	Finish	22
26/12/2010 20:27	31	-53.84604	-39.14318	SAPS deployed at WCB 1.2S	WCB	SAPS	Start	31

26/12/2010 22:10	31	-53.84604	-39.14317	Commence haul SAPS	WCB	SAPS		31
26/12/2010 22:29	31	-53.84603	-39.14321	SAPS recovered	WCB	SAPS	Finish	31
31/12/2010 11:55	72	-53.49103	-37.70743	Complete SAPs deployment.	TF2	SAPS	Finish	72
31/12/2010 13:15	72	-53.49106	-37.70763	Commence SAPs Recovery.	TF2	SAPS		72
31/12/2010 13:30	72	-53.49104	-37.70761	SAPs Recovered to Deck.	TF2	SAPS	Finish	72
02/01/2011 11:10	80	-53.99406	-36.3715	SAPs Deployed.	TF3	SAPS	Start	80
02/01/2011 12:55	80	-53.99402	-36.37143	Commence hauling SAPs.	TF3	SAPS		80
02/01/2011 13:10	80	-53.99402	-36.37143	SAPs Recovered to Deck.	TF3	SAPS	Finish	80
03/01/2011 11:38	88	-54.10059	-35.45502	SAPs Deployed.	TF4	SAPS	Start	88
03/01/2011 13:05	88	-54.10059	-35.45501	Commence SAPs Recovery.	TF4	SAPS		88
03/01/2011 13:15	88	-54.10058	-35.45502	SAPs Recovered to Deck.	TF4	SAPS	Finish	88
04/01/2011 13:30	96	-54.25522	-35.35457	Commence SAPs Deployment.	TF5	SAPS	Start	96
04/01/2011 13:40	96	-54.25523	-35.35454	Complete SAPs deployment.	TF5	SAPS		96
04/01/2011 15:19	96	-54.25522	-35.35454	SAPs Recovered to Deck.	TF5	SAPS	Finish	96
05/01/2011 16:44	100	-54.62124	-34.80517	SAPs Deployed.	TF6	SAPS	Start	100
05/01/2011 18:20	100	-54.62121	-34.80513	Commence hauling SAPs.	TF6	SAPS		100
05/01/2011 18:32	100	-54.6212	-34.8051	SAPs Recovered to Deck.	TF6	SAPS	Finish	100
06/01/2011 11:35	106	-54.53086	-35.27058	Commence SAPs Deployment.	TF7	SAPS	Start	106
06/01/2011 11:54	106	-54.53088	-35.27059	Complete SAPs deployment.	TF7	SAPS		106
06/01/2011 13:15	106	-54.53095	-35.27051	Commence hauling SAPs.	TF7	SAPS		106
06/01/2011 13:29	106	-54.53089	-35.27063	SAPs Recovered to Deck.	TF7	SAPS	Finish	106
07/01/2011 11:10	114	-54.55817	-35.58757	Commence SAPs Deployment.	TF8	SAPS	Start	114
07/01/2011 11:35	114	-54.55817	-35.58757	Complete SAPs deployment.	TF8	SAPS		114
07/01/2011 12:50	114	-54.55824	-35.58757	Commence SAPs Recovery.	TF8	SAPS		114
07/01/2011 13:10	114	-54.5581	-35.58766	SAPs Recovered to Deck.	TF8	SAPS	Finish	114
08/01/2011 11:15	120	-53.62304	-36.34446	Commence SAPs Deployment.	TF9	SAPS	Start	120

08/01/2011 11:35	120	-53.62318	-36.34425	Complete SAPs deployment.	TF9	SAPS		120
08/01/2011 13:29	120	-53.62326	-36.34442	Commence hauling SAPs.	TF9	SAPS		120
08/01/2011 13:42	120	-53.62322	-36.34437	SAPs Recovered to Deck.	TF9	SAPS	Finish	120
10/01/2011 11:15	134	-53.89633	-36.57333	Commence SAPs Deployment.	TF11	SAPS	Start	134
10/01/2011 11:35	134	-53.89628	-36.57301	Complete SAPs deployment.	TF11	SAPS		134
10/01/2011 13:20	134	-53.89633	-36.57352	Commence hauling SAPs.	TF11	SAPS		134
10/01/2011 13:35	134	-53.89633	-36.57338	SAPs Recovered to Deck.	TF11	SAPS	Finish	134
11/01/2011 11:20	139	-54.10049	-36.24963	Commence SAPs Deployment.	TF12	SAPS	Start	139
11/01/2011 11:38	139	-54.10051	-36.24961	Complete SAPs deployment.	TF12	SAPS		139
11/01/2011 13:20	139	-54.10046	-36.24962	Commence hauling SAPs.	TF12	SAPS		139
11/01/2011 13:35	139	-54.10048	-36.24964	SAPs Recovered to Deck.	TF12	SAPS	Finish	139
12/01/2011 16:30	142	-53.54007	-38.10936	Commence SAPs Deployment.	TF13	SAPS	Start	142
12/01/2011 16:51	142	-53.54001	-38.10937	SAPs Deployed.	TF13	SAPS		142
12/01/2011 18:36	142	-53.54008	-38.10937	Commence hauling SAPs.	TF13	SAPS		142
12/01/2011 18:51	142	-53.54006	-38.10942	SAPs Recovered to Deck.	TF13	SAPS	Finish	142
13/01/2011 13:15	152	-53.75058	-38.98321	Commence SAPs Deployment.	TF14	SAPS	Start	152
13/01/2011 13:35	152	-53.75059	-38.98321	SAPs Deployed.	TF14	SAPS		152
13/01/2011 15:26	152	-53.75056	-38.98324	Commence hauling SAPs.	TF14	SAPS		152
13/01/2011 15:41	152	-53.75055	-38.98324	SAPs Recovered to Deck.	TF14	SAPS	Finish	152

B.8 Transect Events

Time	Event	Lat	Lon	Comment	Station	Type	Status	Bridge Number
25/12/2010 02:51		-53.6611	-38.3356	Commence 10kt Transect.	TF1	Transect	Start	10kt transect through TF1
25/12/2010 03:51		-53.73863	-38.08432	End of transect on SE course. Passing SE point.	TF1	Transect	Finish	Transit between

								stations
25/12/2010 04:03		-53.74018	-38.08096	Start of NW transect. Passing SE transect point on NW course.	TF1	Transect	Start	Transit between stations
25/12/2010 05:05		-53.66201	-38.33403	End of transect on NW course. Passing NW point.	TF1	Transect	Finish	Transit between stations
25/12/2010 09:51		-53.68347	-38.07315	Start transect	TF1	Transect	Start	Transect
25/12/2010 10:50		-53.71561	-38.35015	End of transect. Return to station	TF1	Transect	Finish	Transect
25/12/2010 15:40		-53.6815	-38.0748	Passing end point of transect on NE run.		Transect	Start	Transit between stations
25/12/2010 16:47		-53.71915	-38.34591	Passing end point of transect of SW run.		Transect	Finish	Transit between stations
25/12/2010 20:43		-53.73803	-38.96148	Start transect		Transect	Start	Transect
25/12/2010 21:40		-53.89786	-38.90412	End Transect		Transect	Finish	
25/12/2010 21:56		-53.90014	-38.8278	Start of NW transect. Co 335T		Transect	Start	Transect
26/12/2010 14:40		-53.31748	-39.3046	Commence Transect W1.2	WCB	Transect	Start	Transect
26/12/2010 19:00		-54.02881	-39.08638	Completed Transect W1.2	WCB	Transect	Finish	Transect
27/12/2010 09:26	37	-53.28517	-39.03832	Start transect 2.1N to S. XBT deployed	WCB	Transect	Start	37
27/12/2010 13:58		-53.99763	-38.81774	Complete transect.	WCB	Transect	Finish	Transect
27/12/2010 15:17		-53.96022	-38.52565	Start transect 2.2S to N.	WCB	Transect	Start	Transect
27/12/2010 19:43		-53.25462	-38.75144	End of transect 2.2	WCB	Transect	Finish	Transect
28/12/2010 14:41		-53.18357	-38.14066	Commence transect 3.2	WCB	Transect	Start	Transect
28/12/2010 18:56		-53.88957	-37.90726	Completed Transect 3.2	WCB	Transect	Finish	Transect
31/12/2010 02:23		-53.43765	-37.81489	Commence 10kt transect TF2.	TF2	Transect	Start	Transect TF2
31/12/2010 03:22		-53.54548	-37.59977	Completed Transect TF2	TF2	Transect	Finish	Transect TF2
31/12/2010 03:41		-53.54417	-37.60261	Commence transect TF2 SE-NW	TF2	Transect	Start	Transect TF2

31/12/2010 04:41		-53.43717	-37.81608	Completed Transect TF2	TF2	Transect	Finish	Transect TF2
31/12/2010 04:52		-53.43795	-37.81413	Commence transect TF2 NW-SE	TF2	Transect	Start	Transect TF2
31/12/2010 05:52		-53.54473	-37.60025	Completed transect TF2 NW-SE	TF2	Transect	Finish	Transect TF2
31/12/2010 09:40		-53.42815	-37.80055	Start transect	TF2	Transect	Start	Transect
31/12/2010 10:38		-53.55295	-37.61637	End of transect	TF2	Transect	Finish	Transect
31/12/2010 15:46		-53.44092	-37.80466	Commence transect TF2 NW-SE	TF2	Transect	Start	Transect
31/12/2010 16:43		-53.54489	-37.60145	Completed Transect TF2	TF2	Transect	Finish	Transect
01/01/2011 01:57		-53.94529	-36.48529	Commence 10kt Transect. TF3	TF3	Transect	Start	Transect
01/01/2011 02:57		-54.04188	-36.25539	Completed 10kt Transect. TF3	TF3	Transect	Finish	Transect
01/01/2011 03:08		-54.04289	-36.252	Commence Transect. TF3 SE-NW	TF3	Transect	Start	Transect
01/01/2011 04:30		-53.94683	-36.48328	Complete transect TF3 SE-NW	TF3	Transect	Finish	Transect
01/01/2011 04:39		-53.94465	-36.48731	Commence Transect TF3. NW-SE	TF3	Transect	Start	Transect
01/01/2011 05:39		-54.04187	-36.25552	Complete transect TF3 NW-SE	TF3	Transect	Finish	Transect
01/01/2011 08:02		-53.94913	-36.49191	Commence transect	TF3	Transect	Start	Transect
01/01/2011 09:02		-54.03892	-36.24827	Complete transect.	TF3	Transect	Finish	Transect
01/01/2011 21:20		-53.99111	-36.51369	Commence transect	TF3	Transect	Start	Transect TF3
01/01/2011 22:22		-53.99603	-36.22008	End of transect	TF3	Transect	Finish	Transect TF3
02/01/2011 09:12		-53.96507	-36.50602	Start transect	TF3	Transect	Start	Transect TF3
02/01/2011 10:12		-54.0223	-36.23859	End of transect	TF3	Transect	Finish	Transect TF3
02/01/2011 14:50		-53.96166	-36.23333	Commence 10kt Transect.	TF3	Transect	Start	Transect TF3
02/01/2011 15:50		-54.02326	-36.50489	Transect complete. Values updated after SCS up and running again	TF3	Transect	Finish	Transect TF3
03/01/2011 05:26		-54.03662	-35.54331	Start of transect TF4	TF4	Transect	Start	Transect
03/01/2011 06:26		-54.16601	-35.3637	End of transect TF4.	TF4	Transect	Finish	Transect
03/01/2011 09:33		-54.17983	-35.40478	Start transect	TF4	Transect	Start	Transect TF4
03/01/2011 10:33		-54.02313	-35.50566	Complete transect.	TF4	Transect	Finish	Transect TF4
03/01/2011 15:32		-54.17081	-35.37377	Commence Transect TF4.	TF4	Transect	Start	Transect

03/01/2011 16:32		-54.02996	-35.53022	Complete transect TF4	TF4	Transect	Finish	Transect
03/01/2011 16:39		-54.02654	-35.53258	Commence Transect TF4		Transect	Start	Transect
03/01/2011 17:42		-54.17043	-35.3741	Complete transect TF4		Transect	Finish	Transect
03/01/2011 17:49		-54.16399	-35.37226	Commence transect TF4		Transect	Start	Transect
03/01/2011 18:51		-54.02272	-35.53343	Completed Transect TF4.		Transect	Finish	Transect
03/01/2011 19:05		-54.04206	-35.54663	Commence transect		Transect	Start	Transect by TF4
03/01/2011 21:08		-54.19437	-35.36111	End of transect		Transect	Finish	Transect by TF4
03/01/2011 23:19		-54.19055	-35.44468	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect TF 5
04/01/2011 00:19		-54.32016	-35.26478	Complete transect. TF5.	TF5	Transect	Finish	Transect TF 5
04/01/2011 00:30		-54.32213	-35.26999	Commence 10kt Transect.	TF5	Transect	Start	Transect
04/01/2011 01:30		-54.19484	-35.4511	Complete transect.	TF5	Transect	Finish	Transect
04/01/2011 01:42		-54.1911	-35.44682	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect TF 5
04/01/2011 02:42		-54.3193	-35.26452	Complete transect. TF5.	TF5	Transect	Finish	Transect TF 5
04/01/2011 02:52		-54.31801	-35.26073	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect TF 5
04/01/2011 03:52		-54.19246	-35.44969	Completed transect TF5	TF5	Transect	Finish	Transect
04/01/2011 03:58		-54.19325	-35.45219	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect
04/01/2011 05:00		-54.31573	-35.25313	Complete transect TF5	TF5	Transect	Finish	Transect
04/01/2011 05:07		-54.31537	-35.25897	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect
04/01/2011 06:07		-54.19437	-35.45491	Complete transect TF5	TF5	Transect	Finish	Transect
04/01/2011 10:43		-54.31015	-35.24751	Commence transect	TF5	Transect	Start	Transect TF5
04/01/2011 11:42		-54.19857	-35.46023	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect TF 5
04/01/2011 16:27		-54.19092	-35.44938	Commence 10kt Transect. TF5.	TF5	Transect	Start	Transect
04/01/2011 17:28		-54.31713	-35.25803	Completed transect TF5	TF5	Transect	Finish	Transect
05/01/2011 20:42		-54.56798	-34.91361	Start transect	TF6	Transect	Start	Transect TF6
05/01/2011 21:42		-54.67802	-34.68874	End of transect	TF6	Transect	Finish	Transect TF6

05/01/2011 21:46		-54.67758	-34.68096	Start transect	TF6	Transect	Start	Transect TF6
05/01/2011 22:51		-54.57251	-34.91888	End transect	TF6	Transect	Finish	Transect TF6
06/01/2011 14:38		-54.58189	-35.38629	Commence 10kt Transect.		Transect	Start	Transect
06/01/2011 14:50		-54.56241	-35.34148	Transect aborted.		Transect	Abort	Transect
06/01/2011 18:46		-54.51803	-35.71232	Commence Transect TF8	TF8	Transect	Start	Transect
06/01/2011 19:48		-54.60196	-35.465	End transect	TF8	Transect	Finish	Transect TF8
06/01/2011 19:54		-54.60488	-35.46817	Start transect	TF8	Transect	Start	Transect TF8
06/01/2011 20:57		-54.50926	-35.70432	End transect	TF8	Transect	Finish	Transect TF8
06/01/2011 21:02		-54.51123	-35.70747	Start transect	TF8	Transect	Start	Transect TF8
06/01/2011 22:02		-54.60659	-35.46442	End of transect	TF8	Transect	Finish	Transect TF8
06/01/2011 22:07		-54.60845	-35.47003	Start transect	TF8	Transect	Start	Transect TF8
06/01/2011 23:07		-54.51076	-35.6891	Complete transect.	TF8	Transect	Finish	Transect TF8
06/01/2011 23:15		-54.50298	-35.69807	Commence Transect TF8	TF8	Transect	Start	Transect TF8
07/01/2011 00:00		-54.58572	-35.52912	Transect aborted.	TF8	Transect	Abort	Transect TF8
07/01/2011 02:00		-54.51312	-35.70675	Commence Transect TF8	TF8	Transect	Start	Transect TF8
07/01/2011 03:00		-54.60536	-35.46773	Complete transect.	TF8	Transect	Finish	Transect TF8
07/01/2011 03:04		-54.60721	-35.47095	Commence 10kt Transect. TF8	TF8	Transect	Start	Transect
07/01/2011 04:06		-54.5083	-35.69972	Complete transect TF8	TF8	Transect	Finish	Transect
07/01/2011 04:11		-54.50847	-35.70382	Commence 10kt Transect. TF8	TF8	Transect	Start	Transect
07/01/2011 05:12		-54.60764	-35.47243	Complete transect TF8	TF8	Transect	Finish	Transect
07/01/2011 05:17		-54.60865	-35.47817	Commence 10kt Transect. TF8	TF8	Transect	Start	Transect
07/01/2011 06:18		-54.507	-35.69936	Complete transect TF8	TF8	Transect	Finish	Transect
07/01/2011 09:01		-54.50442	-35.69457	Start transect	TF8	Transect	Start	Transect TF8
07/01/2011 10:02		-54.6147	-35.47539	End of transect	TF8	Transect	Finish	Transect TF8
07/01/2011 14:00		-54.51096	-35.70183	Commence 10kt Transect.		Transect	Start	Transect
07/01/2011 15:00		-54.61052	-35.47938	Complete transect.		Transect	Finish	Transect

08/01/2011 03:27		-53.6353	-36.48306	Commence 10kt Transect. TF9	TF9	Transect	Start	Transect
08/01/2011 04:27		-53.60716	-36.20979	Complete transect TF9	TF9	Transect	Finish	Transect
08/01/2011 04:33		-53.6036	-36.2067	Commence 10kt Transect. TF9	TF9	Transect	Start	Transect
08/01/2011 05:34		-53.64368	-36.48036	Complete transect TF9	TF9	Transect	Finish	Transect
08/01/2011 09:22		-53.61761	-36.20219	Start transect	TF9	Transect	Start	Transect TF9
08/01/2011 10:22		-53.62953	-36.48466	End of transect	TF9	Transect	Finish	Transect TF9
08/01/2011 15:57		-53.63713	-36.48472	Commence 10kt Transect. TF9		Transect	Start	Transect
08/01/2011 16:58		-53.60632	-36.20493	Complete transect TF9		Transect	Finish	Transect
08/01/2011 20:45		-54.20761	-35.70852	Start transect		Transect	Start	Transect TF10
08/01/2011 21:45		-54.29092	-35.95829	End of transect		Transect	Finish	Transect TF10
08/01/2011 21:50		-54.29504	-35.95564	Start transect		Transect	Start	Transect TF10
08/01/2011 22:52		-54.21107	-35.70166	End of transect		Transect	Finish	Transect TF10
08/01/2011 22:57		-54.21638	-35.70002	Start transect		Transect	Start	Transect TF10
08/01/2011 23:57		-54.29877	-35.94816	End of transect.		Transect	Finish	Transect TF10
09/01/2011 00:05		-54.30258	-35.94429	Start transect.		Transect	Start	Transect TF10
09/01/2011 03:52		-54.20839	-35.7732	Commence 10kt Transect. TF10	TF10	Transect	Start	Transect
09/01/2011 04:52		-54.32956	-35.96158	Complete transect TF10	TF10	Transect	Finish	Transect
09/01/2011 04:58		-54.32836	-35.96652	Commence 10kt Transect. TF10	TF10	Transect	Start	Transect
09/01/2011 06:02		-54.20965	-35.77231	Complete transect TF10	TF10	Transect	Finish	Transect
09/01/2011 08:21		-54.22094	-35.75086	Start transect		Transect	Start	Transect TF10
09/01/2011 09:21		-54.31854	-35.98062	End of transect		Transect	Finish	Transect TF10

09/01/2011 09:30		-54.31168	-35.98673	Start transect		Transect	Start	Transect TF10
09/01/2011 10:30		-54.22728	-35.74345	End of transect		Transect	Finish	Transect TF10
09/01/2011 11:00		-54.32891	-35.86355	Start transect.		Transect	Start	Transect TF10
09/01/2011 12:02		-54.35183	-35.86465	End transect.		Transect	Finish	Transect TF10
09/01/2011 12:08		-54.35248	-35.86093	Start transect.		Transect	Start	Transect TF10
09/01/2011 13:08		-54.15526	-35.8701	End of transect.		Transect	Finish	Transect TF10
09/01/2011 17:39		-53.88958	-36.79025	Commence 10kt Transect. TF11		Transect	Start	Transect
09/01/2011 18:39		-53.87377	-36.51647	Complete transect TF11		Transect	Finish	Transect
09/01/2011 18:46		-53.87796	-36.511	Commence 10kt Transect. TF11		Transect	Start	Transect
09/01/2011 19:46		-53.89802	-36.78577	End of transect		Transect	Finish	Transect
10/01/2011 05:36		-53.87244	-36.70501	Commence 10kt Transect. TF11	TF11	Transect	Start	Transect
10/01/2011 06:37		-53.9207	-36.43586	Complete transect TF11	TF11	Transect	Finish	Transect
10/01/2011 09:20		-53.87276	-36.70893	Start transect	TF11	Transect	Start	Transect TF11
10/01/2011 10:20		-53.91886	-36.43708	End of transect	TF11	Transect	Finish	Transect TF11
10/01/2011 14:28		-53.92387	-36.71951	Commence 10kt Transect. TF11		Transect	Start	Transect TF11
10/01/2011 15:30		-53.87399	-36.43805	Complete transect TF11		Transect	Finish	Transect
12/01/2011 19:49		-53.53631	-38.06688	Start transect	TF13	Transect	Start	Transect
12/01/2011 20:48		-53.5375	-37.83116	End of transect	TF13	Transect	Finish	Transect
12/01/2011 20:58		-53.54207	-37.80799	Start transect	TF13	Transect	Start	Transect
12/01/2011 22:17		-53.54171	-38.10811	End of transect	TF13	Transect	Finish	Transect
12/01/2011 22:32		-53.55639	-38.11309	Start transect	TF13	Transect	Start	Transect

12/01/2011 23:32		-53.55498	-37.83121	End of transect.	TF13	Transect	Finish	Transect
13/01/2011 16:27		-53.71707	-38.85524	Commence 10kt Transect.	TF14	Transect	Start	Transect
13/01/2011 17:29		-53.78236	-39.10965	Complete transect.	TF14	Transect	Finish	Transect
13/01/2011 17:35		-53.78102	-39.11513	Commence 10kt Transect.	TF14	Transect	Start	Transect
13/01/2011 18:41		-53.72049	-38.85466	Complete transect.	TF14	Transect	Finish	Transect
13/01/2011 18:45		-53.72242	-38.85075	Commence 10kt Transect.	TF14	Transect	Start	Transect
13/01/2011 19:47		-53.7773	-39.11869	End of transect	TF14	Transect	Finish	Transect
13/01/2011 19:52		-53.77444	-39.11835	Start transect	TF14	Transect	Start	Transect
13/01/2011 20:53		-53.72541	-38.85261	End of transect	TF14	Transect	Finish	Transect
13/01/2011 21:44		-53.82192	-38.91479	Start transect	TF14	Transect	Start	Transect
13/01/2011 22:45		-53.67942	-39.05544	End of transect	TF14	Transect	Finish	Transect
13/01/2011 22:52		-53.67115	-39.04413	Start transect	TF14	Transect	Start	Transect
13/01/2011 23:54		-53.82888	-38.90318	End of transect.	TF14	Transect	Finish	Transect
14/01/2011 13:36		-53.80283	-36.1315	Start transect.		Transect	Start	Transect
14/01/2011 14:36		-53.87046	-35.85283	End of transect.		Transect	Finish	Transect
14/01/2011 15:32		-53.91144	-36.04913	Commence 10kt Transect.		Transect	Start	Transect
14/01/2011 16:34		-53.7554	-35.94943	Complete transect.		Transect	Finish	Transect
14/01/2011 19:58		-53.76283	-35.92584	Start transect		Transect	Start	Transect
14/01/2011 21:20		-53.90773	-36.07353	End of transect		Transect	Finish	Transect

B.9 XBT Events

Time	Event	Lat	Lon	Comment	Station	Type	Status	Bridge Number
26/12/2010 08:58	26	-54.05603	-39.39149	XBT 1 deployed. Commence transect 1.1S	WCB	XBT		26
26/12/2010 10:07	27	-53.87925	-39.44423	XBT 2 deployed	WCB	XBT		27

26/12/2010 11:18	28	-53.69359	-39.49902	XBT 3 Deployed.	WCB	XBT		28
26/12/2010 12:22	29	-53.5252	-39.54991	XBT 4 Deployed.	WCB	XBT		29
26/12/2010 13:30	30	-53.34842	-39.60244	XBT 5 Deployed.	WCB	XBT		30
27/12/2010 10:34	38	-53.4635	-38.98394	XBT deployed	WCB	XBT		38
27/12/2010 11:42	39	-53.64071	-38.92879	XBT Deployed.	WCB	XBT		39
27/12/2010 12:48	40	-53.81697	-38.87321	XBT Deployed.	WCB	XBT		40
27/12/2010 13:56	41	-53.99399	-38.81895	XBT Deployed.	WCB	XBT		41
28/12/2010 09:05	47	-53.92688	-38.22016	XBT deployed	WCB	XBT		47
28/12/2010 10:10	48	-53.75553	-38.27587	XBT deployed	WCB	XBT		48
28/12/2010 11:22	49	-53.57355	-38.33461	XBT Deployed (failed).	WCB	XBT		49
28/12/2010 11:24	50	-53.56989	-38.33568	XBT Deployed.	WCB	XBT		50
28/12/2010 12:28	51	-53.39742	-38.39089	XBT Deployed.	WCB	XBT		51
28/12/2010 13:34	52	-53.2146	-38.45049	XBT Deployed	WCB	XBT		52
30/12/2010 09:10	56	-53.16373	-37.965	XBT deployed. Start transect 4.1N to S	WCB	XBT		56
30/12/2010 10:15	57	-53.33427	-37.90474	XBT deployed	WCB	XBT		57
30/12/2010 11:28	58	-53.51924	-37.84529	XBT Deployed.	WCB	XBT		58
30/12/2010 12:34	59	-53.69285	-37.78706	XBT Deployed.	WCB	XBT		59
30/12/2010 13:40	60	-53.87027	-37.7269	XBT Deployed.	WCB	XBT		60
30/12/2010 14:50	61	-53.853666	-37.593	XBT Deployed	WCB	XBT		61
30/12/2010 15:58	62	-53.67663	-37.65353	XBT Deployed.	WCB	XBT		62
30/12/2010 17:06	63	-53.49904	-37.71439	XBT Deployed.	WCB	XBT		63
30/12/2010 18:18	64	-53.32394	-37.77313	XBT Deployed.	WCB	XBT		64
30/12/2010 19:25	65	-53.14974	-37.83219	XBT deployed. End transect 4.2	WCB	XBT		65

B.10 Calibration Events

Time	Event	Lat	Lon	Comment	Station	Type	Status	Bridge Number
01/01/2011 14:25		-54.15788	-36.69431	Commence Calibration.	TF3	Acoustic	Start	Calibration
01/01/2011 17:49		-54.15897	-36.69282	Completed calibration.	TF3	Acoustic	Finish	Calibration