JR17002 CRUISE REPORT

WESTERN CORE BOX

22 DEC-22 JAN 2017/18

Contents

1 INTRODUCTION

1.1 Rationale

The archipelago of South Georgia is a large, isolated land and continental shelf area in the Atlantic sector of the Southern Ocean. South Georgia has been identified as a key source of regional biodiversity, potentially supporting anomalously high levels of endemic and range-edge species and intense phytoplankton blooms supporting a rich food web that includes zooplankton, in particular large densities of Antarctic krill *(Euphausia superba*), and vertebrate predators (penguins, seals and whales). Yet the near surface waters of South Georgia are some of the fastest warming on the planet.

JR17002 is a combined science and logistics leg of the 2017-18 voyage of the RRS James Clark Ross to the Antarctic in the region of South Georgia. As part of the logistics element, the ship undertook visits of the Mare Harbour, Falkland Islands, at the beginning of the survey and the Rothera UK Antarctic Research Station at the end of the leg (base reliefs). During the science part of the cruise we undertook the Western Core Box survey to determine the distribution and biomass of krill and other plankton to the northwest of South Georgia, refurbished 2 biological moorings in the South Georgia region (WCB and P3 mooring) and recovering the mooring at P2 sites. Few days were dedicated to testing the BAS ecosystems glider to collect information on the distribution and abundance of krill. Further living zooplankton (Krill, pteropods and amphipods) were collected to undertake incubation experiment to investigate the impact of plastic debris on the polar marine ecosystem within a collaboration with Siena University, Italy (in the frame of NanoPanta NERC Project) and with Exeter University (in the frame of DTP, GW4plus). Copepod incubation were performed in the frame of a DTP PhD project in collaboration with UEA. Finally Krill egg production experiment have been undertook within a PML collaboration.

1.2 *Western Core Box Summary*

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

In addition to the acoustic survey, which covers a wide area but has limited temporal coverage, there are three moorings (one on the shelf in the Western Core Box, and two in deep water to the southwest and northwest of South Georgia) to provide a temporal, year-round set of observations. These moorings are recovered during the cruise, refurbished and data downloaded, and then redeployed later in the cruise. The shallow WCB mooring has been in position more or less continuously since 2003 while P3 and P2 since 2007

1.3 Cruise Track

Figure 1: Cruise track including the science event log stations (black dots)

1.4 Personnel

Table1: scientific and other stuff

Name	**Organisation (Funding Body)**	**Email Address**	**Scientific Interest**	**Equipment operated or used**
Manno, Clara	BAS (NERC)	clanno@bas.ac.uk	Principle Scientific Officer	Mooring sensors, collectors
Fielding, Sophie	BAS (NERC)	sof@bas.ac.uk	Krill	Acoustics, Glider
Fowler, Vicky	BAS (NERC)	vicwle19@bas.ac.uk	copepod vertical migration	MUDL
Bergami, Elisa	University of Siena	Elisa.bergami@unisi.it	nanoplastic	Cooling system
Enderlein, Peter	BAS (NERC)	pend@bas.ac.uk	Gear	Moorings
Jones-Williams, Kirstie	BAS (NERC)	kirnes79@bas.ac.uk	microplastic	NEMO neuston net
Perry, Frances	PML	frpe@pml.ac.uk	Krill egg	Krill Hotel
Robst, Jeremy	BAS (NERC)	jpro@bas.ac.uk	ICT	XBTs
Stowasser, Gabriele	BAS (NERC)	gsto@bas.ac.uk	Food web	Nets
Ten Hoopen, Petra	BAS (NERC)	peopen@bas.ac.uk	Data manager	Data log system
Ariza, Alejandro	BAS (NERC)	aletea@bas.ac.uk	Krill	Acoustics
Davies, Carwyn	BAS (NERC)	carvie@bas.ac.uk	Gear	Mocness
Apeland, Bjorg	BAS (NERC)	bjolan@bas.ac.uk	Gear	Mocness
Goodger, David	BAS (NERC)	davodg@bas.ac.uk	Electronic Engineer	CTD
McAfee, Carson	BAS (NERC)	carmca@bas.ac.uk	Electronic Engineer	CTD

Table 2: JCR Officers and Crew

1	CHAPMAN Graham P	Master
2	WALLACE Simon J	Chief Officer
3	DELPH Georgina M	2nd Officer
4	MULLER-TOLK Dominik S	2nd Officer
5	HALE George J	3rd Officer
6	WADDICOR Charlie A	ETO (Coms)
7	KUBULINS Andris	Chief Engineer
8	DONALDSON Christopher	2nd Engineer
9	HARDY Aleksandr J W	3rd Engineer
10	EADIE Steven J M	4th Engineer

11	KLEPACKI Julian Z	ETO (Eng)
12	BIGGS Thomas E	Deck Engineer
13	JACKMAN Jonathan L	Deck Engineer
14	SUTTON Lloyd S	Purser
15	MULLANEY Clifford	Bosun Science
16	FRASER Grant F	Bosun Science
17	LITTLEHALES Noel C	Bosun
18	O'DUFFY John	Bosun's mate
19	LENNON Craig T	Launchman
20	DEVITT Christopher G	SG1A
21	MUNOZ GARCIA Paula C	SG1B
22	NEILANDS Martins	SG1A
23	LEECH Robert R	SG1A
24	VARGAS LEON Carlos E	MG1
25	PICTOR Stephen J S	MG1
26	MOLLOY Padriag G	Chief Cook
27	ROBERTSON Brian	Cook
28	LEE Derek W	Senior Stwd
29	NEWALL James	Stwd
30	WINTON Brian G J	Stwd
31	PATTERSON Thomas R	Stwd
32	THOMKINSON Alicia	Doctor

1.5 Acknowledgements

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

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

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

1.6 Station summary

Table 3: Station Visits (in chronological and event number order)

Date	Event	Station	Equipment
31 Dec-01 Jan	1 to 3	Microplastic	NEMO net
01-Jan	4 to 8	Test	CTD, MUDL, MOCNESS, RMT8
01-Jan	9 to10	Microplastic	NEMO net
2Jan-5Jan	11 to 32	P3	NEMO, CTD, MUDL, MOCNESS, BONGO, GLIDER, Mooring
5Jan-13Jan	22 to 101	WCB	CTD, BONGO, MUDL, RMT, MOORING, MOCNESS, XBT
13Jan-14Jan	102 to 106	P3	Glider, Mooring, CTD, MUDL, BONGO
16Jan-17 Jan	107 to 119	P2	Mooring, CTD, NEMO, MUDL, BONGO
18Jan-22 Jan	120 to 128	Microplastic	NEMO

2 CTD and XBT

2. 1 CTD deployment

Goodger David, McAfee Carson, Jeremy Robst

CTD instrumentation and deployment A Conductivity-Temperature-Depth (CTD) unit was used to vertically profile the water column. 19 casts were carried out in total, as part of the Western Core Box, at mooring locations, at target fishing locations and other survey stations. The CTD was operated by Carson McAfee and David Goodger, assisted by Petra ten Hoopen who also maintained the CTD event logs.

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

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

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

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

Bottle firing depths were determined by sampling requirements. Basic CTD processing was undertaken using the SBE software.

2.2 Data acquisition and preliminary processing

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

JR17002_[NNN].hex binary data file

JR17002_[NNN].XMLCON ascii configuration file with calibration information
JR17002_[NNN].hdr ascii header file containing sensor information
JR17002_[NNN].bl ascii file containing bottle fire information
where NNN is the CTD number (column 1 in Table 3). The *.hex* file was then converted from binary to ascii using the SBE Data Processing software *Data Conversion* module. The output was a file named *JR17002_[NNN].cnv*. The *Data Conversion* module calculates parameters using the coefficients detailed in Appendix H as follows:

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

where *P* is the pressure (dbar), *T* is the pressure period in µsec, $D = D_1 + D_2 U$,

$C = C_1 + C_2 U + C_3 U$ and $T_0 = T_1 + T_2 U + T_3 U_2 + T_4 U_3 + T_5 U_4$ are calculated from the coefficients detailed in Appendix H, where *U* is the temperature in ˚C.

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

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

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

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

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

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

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

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

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

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

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

where light transmission is measured in % and *M* and *B* are derived from measured voltages through air and water in light and darkness, and are included in Appendix H.The SBE Data Processing *Cell thermal mass* module was then used to remove the conductivity cell thermal mass effects from the measured conductivity. This reads in the *JR17002_[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 *JR17002_[NNN]_ctm.cnv*. The correction applied to the CTD data is detailed below:

Corrected conductivity = conductivity + ctm

where

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

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

α = 0.03 and β = 7.0.

Basic CTD processing was undertaken using the SBE software.

2.3 CTD casts

Table 4: CTD stations

Time	Latitude	Longitude	Ev.	Station	depth	CTD depth	Comment
16/01/2018 19:42	-55.2485	-41.2251	113	P2	3294.32		CTD on deck
16/01/2018 18:17	-55.2485	-41.2251	113	P2	3293.86	3248	CTD at depth
16/01/2018 17:14	-55.2485	-41.2251	113	P2	3294.17		CTD in water
16/01/2018 04:37	-55.2436	-41.2123	107	P2	3247.63		CTD on deck
16/01/2018 04:23	-55.2436	-41.2123	107	P2	3247.65	100	CTD at depth
16/01/2018 04:16	-55.2436	-41.2123	107	P2	3247.71		CTD in water
13/01/2018 17:39	-52.8125	-40.1644	102	P3	3783.99		CTD on deck
13/01/2018 15:45	-52.8125	-40.1643	102	P3	3793.58	3736	CTD at depth
13/01/2018 14:37	-52.8121	-40.1641	102	P3	3789.98		CTD in water
13/01/2018 03:33	-53.361	-38.0828	101	W3.2N	2659.55		CTD on deck
13/01/2018 03:13	-53.361	-38.0828	101	W3.2N	2659.85	1000	CTD at depth
13/01/2018 02:52	-53.361	-38.0828	101	W3.2N	2659.08		CTD in water

12/01/2018 19:33	-53.7983	-37.9332	96	WCB shallow mooring	290.06		CTD on deck
12/01/2018 18:55	-53.7983	-37.9332	96	WCB shallow mooring	287.62	279	CTD at depth
12/01/2018 18:43	-53.7983	-37.9332	96	WCB shallow mooring	286.82		CTD in water
11/01/2018 22:52	-53.7983	-37.9333	87	WCB shallow mooring	289.01		CTD on deck
11/01/2018 22:20	-53.7984	-37.9333	87	WCB shallow mooring	285.99	280	CTD at depth
11/01/2018 22:09	-53.7983	-37.9333	87	WCB shallow mooring	284.89		CTD in water
10/01/2018 20:50	-53.7132	-37.9658	70	W3.2S	131.32		CTD on deck
10/01/2018 20:36	-53.7132	-37.9659	70	W3.2S	131.22	118	CTD at depth
10/01/2018 20:30	-53.7132	-37.9659	70	W3.2S	131.32		CTD in water
10/01/2018 07:12	-53.7852	-38.5839	64	W2.2S	206.41		CTD on deck
10/01/2018 07:05	-53.7852	-38.5839	64	W2.2S	207.29	190	CTD at depth
10/01/2018 06:55	-53.7852	-38.5839	64	W2.2S	205.56		CTD in water
09/01/2018 21:42	-53.432	-38.693	61	W2.2N	3491.88		CTD on deck
09/01/2018 21:05	-53.4319	-38.693	61	W2.2N	3492.02	1000	CTD at depth
09/01/2018 20:43	-53.4319	-38.693	61	W2.2N	3491.79		CTD in water
07/01/2018 08:54	-54.1589	-36.6955	44	Stromness	73.26		CTD on deck
07/01/2018 08:47	-54.1589	-36.6955	44	Stromness	73.64	60	CTD at depth
07/01/2018 08:39	-54.1589	-36.6955	44	Stromness	75.18		CTD in water
06/01/2018 18:08	-53.7983	-37.9333	43	WCB shallow mooring	287.01		CTD on deck
06/01/2018 17:50	-53.7984	-37.9333	43	WCB shallow mooring	286.74	246	CTD at depth
06/01/2018 17:38	-53.7983	-37.9333	43	WCB shallow mooring	287.23		CTD in water

06/01/2018 13:44	-53.7987	-37.9448	38	WCB shallow mooring	319.48		CTD on deck
06/01/2018 13:24	-53.7987	-37.9448	38	WCB shallow mooring	321.79	100	CTD at depth
06/01/2018 13:17	-53.7987	-37.9448	38	WCB shallow mooring	318.71		CTD in water
05/01/2018 20:54	-53.847	-39.1454	34	W1.2S	291.72		CTD on deck
05/01/2018 20:44	-53.847	-39.1454	34	W1.2S	291.1	283	CTD at depth
05/01/2018 20:34	-53.847	-39.1454	34	W1.2S	291.43		CTD in water
05/01/2018 17:57	-53.4955	-39.2521	33	W1.2N	3160.97		CTD on deck
05/01/2018 17:35	-53.4955	-39.2521	33	W1.2N	3161.06	1000	CTD at depth
05/01/2018 17:12	-53.4955	-39.2522	33	W1.2N	3160.14		CTD in water
04/01/2018 18:04	-52.8288	-40.1634	25	P3	3792.52		CTD on deck
04/01/2018 17:09	-52.8288	-40.1634	25	P3	3796.59	1000	CTD at depth
04/01/2018 16:42	-52.8288	-40.1634	25	P3	3796.67		CTD in water
03/01/2018 22:55	-52.8126	-40.1643	19	P3	3794.49		CTD on deck
03/01/2018 22:38	-52.8126	-40.1643	19	P3	3790.83	100	CTD at depth
03/01/2018 22:30	-52.8126	-40.1643	19	P3	3787.58		CTD in water
03/01/2018 20:13	-52.8126	-40.1643	15	P3	3793.55		CTD on deck, bottle firing failed
03/01/2018 18:55	-52.8126	-40.1643	15	P3	3789.88	3737	CTD at depth
03/01/2018 17:45	-52.8126	-40.1643	15	P3	3665.32		CTD in water
01/01/2018 17:50	-52.3802	-49.2581	8		3237.65		CTD on deck
01/01/2018 17:42	-52.3802	-49.2581	8		3237.95	150	CTD at depth
01/01/2018 17:35	-52.3802	-49.2581	8		3237.95		CTD in water
01/01/2018 12:53	-52.3605	-49.0787	4	TEST	3207.56		CTD on deck
01/01/2018 12:39	-52.3605	-49.0787	4	TEST	3207.28	50	CTD at depth

01/01/2018 12:29	-52.3605	-49.0787	4	TEST	3206.97		CTD in water

2.4 XBT DEPLOYMENT

Expendable bathythermographs (XBTs) were used to vertically profile the temperature through the water column on transects in the Western Core Box. There were 25 deployments. On each occasion, the probe was launched at a pre-defined location which has been done on previous surveys in the Western Core Box.

Each deployment was made using a launcher in which the expendable probe was mounted before deployment. When the probe was locked in position, an electrical connection was made between the probe and recorder. An operator then confirmed that the ship-based recording programme was ready for launch. Following the launch of the probe, copper wire de-reeled from inside the launch canister as well as inside the probe to compensate for ship movement. As the probe descended through the water column, depth and temperature data were recorded and displayed in real time (the design of the probe with precision weighting and spin-stabilisation allows a predictable rate of descent and therefore a depth accuracy of 2%). When the probe reached the sea floor (if shallower than the length of the wire), the wire was cut. In deeper water the wire de-reeled to its full length, then dropped into the water column or was cut.

Time	Latitude	Longitude	Ev	Depth	Salinity	Temp	Sound_vel	Flowr.	Wind	Comment
11/01/2018 18:42	-53.8609	-37.591	85	107.76	33.64	4.27	1468.80	0.56	8.67	XBT25 (W4.2)
11/01/2018 17:35	-53.6854	-37.651	84	121.23	33.72	3.92	1467.93	0.52	9.49	XBT24 (W4.2)
11/01/2018 16:28	-53.5097	-37.7105	83	1819.63	33.81	4.69	1470.97	0.58	12.87	XBT23 (W4.2)
112018 15:20	-53.3329	-37.772	82	2546.05	33.82	4.50	1470.23	0.57	8.84	XBT22 (W4.2)
11/01/2018 14:13	-53.1564	-37.8296	81	3348.69	33.81	4.58	1470.32	0.58	11.86	XBT21 (W4.2)
11/01/2018 13:32	-53.1552	-37.9672	80	3501.34	33.82	4.76	1471.11	0.56	15.90	XBT20 (W4.1)
11/01/2018 12:26	-53.3271	-37.9071	79	0	33.81	4.56	1470.22	0.57	9.91	XBT19 (W4.1)
11/01/2018 11:17	-53.5086	-37.8492	78	1337.65	33.77	4.26	1469.67	0.40	3.07	XBT18 (W4.1)
11/01/2018 10:11	-53.6821	-37.7908	77	112.43	33.73	3.64	1467.84	0.36	5.89	XBT17 (W4.1)
11/01/2018 09:05	-53.8579	-37.7317	76	117.22	33.65	3.73	1468.26	0.37	6.03	XBT16 (W4.1)
10/01/2018 13:34	-53.2085	-38.4528	69	3770.02	33.81	4.94	1472.15	0.56	10.96	XBT15 (W3.1)
10/01/2018 12:24	-53.39	-38.3944	68	2965.22	33.80	4.62	1470.64	0.56	4.28	XBT14 (W3.1)
10/01/2018 11:17	-53.5655	-38.3378	67	2205.76	33.82	4.65	1470.94	0.57	5.91	XBT13 (W3.1)
10/01/2018 10:11	-53.7394	-38.2815	66	243.29	33.80	4.00	1468.67	0.47	14.42	XBT12 (W3.1)
10/01/2018 09:04	-53.9182	-38.2235	65	99.82	33.73	3.69	1467.47	0.47	21.73	XBT11 (W3.1)
09/01/2018 13:41	-54.0012	-38.8129	60	194.29	33.78	4.21	1469.05	0.57	5.56	XBT10 (W2.1)
09/01/2018 12:35	-53.8277	-38.8707	59	206.94	33.81	3.73	1467.39	0.57	10.77	XBT9 (W2.1)
09/01/2018 11:27	-53.6486	-38.9265	58	1774.11	33.84	4.52	1470.58	0.55	11.80	XBT8 (W2.1)
09/01/2018 10:19	-53.4717	-38.9811	57	2961.94	33.83	4.55	1470.45	0.69	15.05	XBT7 (W2.1)
09/01/2018 09:12	-53.2984	-39.033	56	3600.46	33.84	4.61	1470.64	0.68	17.57	XBT6 (W2.1)
08/01/2018 14:06	-53.3375	-39.6051	53	4012.8	33.84	4.44	1470.31	0.49	10.46	XBT5 (W1.1)
08/01/2018 12:58	-53.5155	-39.5527	52	3169.38	33.82	4.13	1469.09	0.48	14.56	XBT4 (W1.1)
08/01/2018 11:50	-53.6919	-39.5002	51	2000.64	33.81	3.56	1466.96	0.48	9.80	XBT3 (W1.1)

08/01/2018 10:42	- 53.8712	-39.4467	50	300.63	33.77	3.20	1465.46	0.49	3.19	XBT2 (W1.1)
08/01/2018 09:37	- 54.0409	-39.3963	49	428.99	33.78	3.19	1465.38	0.49	10.50	XBT1 (W1.1)

3 CTD sampling from Niskin Bottles

3.1 DIC samples

Gabi Stowasser

DIC samples were taken from two CTDs to support the calibration of ARGOS float sensors which were deployed during COMICS I (Nov – Dec 2018) as a contribution to the Orchestra project. Samples will be analysed by the University of Exeter as part of the SONATA project funded by ROSES.

Table 6: DIC dataset

Event number	date	latitude	longitude	depth	Bottle number
25	04.01.2018	-52.8288	-40.1634	10	373
25	04.01.2018	-52.8288	-40.1634	25	374
25	04.01.2018	-52.8288	-40.1634	34	375
25	04.01.2018	-52.8288	-40.1634	37	376
25	04.01.2018	-52.8288	-40.1634	54	377
25	04.01.2018	-52.8288	-40.1634	74	378
25	04.01.2018	-52.8288	-40.1634	104	379
25	04.01.2018	-52.8288	-40.1634	129	380
25	04.01.2018	-52.8288	-40.1634	154	381
25	04.01.2018	-52.8288	-40.1634	204	382
25	04.01.2018	-52.8288	-40.1634	254	383
25	04.01.2018	-52.8288	-40.1634	352	388
25	04.01.2018	-52.8288	-40.1634	502	384
25	04.01.2018	-52.8288	-40.1634	751	385
25	04.01.2018	-52.8288	-40.1634	751	386
25	04.01.2018	-52.8288	-40.1634	1001	387
102	13.01.2018	-52.8125	-40.1643	6	583
102	13.01.2018	-52.8125	-40.1643	21	589
102	13.01.2018	-52.8125	-40.1643	31	579
102	13.01.2018	-52.8125	-40.1643	37	508
102	13.01.2018	-52.8125	-40.1643	53	507
102	13.01.2018	-52.8125	-40.1643	78	506
102	13.01.2018	-52.8125	-40.1643	103	499
102	13.01.2018	-52.8125	-40.1643	152	498
102	13.01.2018	-52.8125	-40.1643	203	496
102	13.01.2018	-52.8125	-40.1643	253	495
102	13.01.2018	-52.8125	-40.1643	352	494
102	13.01.2018	-52.8125	-40.1643	502	493
102	13.01.2018	-52.8125	-40.1643	755	492
102	13.01.2018	-52.8125	-40.1643	1005	491
102	13.01.2018	-52.8125	-40.1643	2003	490
102	13.01.2018	-52.8125	-40.1643	103	500

102	13.01.2018	-52.8125	-40.1643	103	501
102	13.01.2018	-52.8125	-40.1643	103	502
102	13.01.2018	-52.8125	-40.1643	103	503
102	13.01.2018	-52.8125	-40.1643	103	504
102	13.01.2018	-52.8125	-40.1643	78	505

3.2 Nutrient sampling for future grant scoping

Sophie Fielding

A request was received from the University of Lancaster (from Imke Grefe and Ben Surridge) to opportunistically collect water samples from P3, P2, the WCB mooring and Stromness. They are interested in the nutrient release from South Georgia waters and desired some test samples to set up future research.

Method: Collect seawater samples from CTD. Don't touch the spigot. Wear nitrile (supplied) or other clean gloves at all times. The sampling only takes a minute or so, unless there's a lot of dissolved matter in the water, which slows the filtration down a bit. The tip of the syringe should **not** be touched at all, same goes for the top and bottom connectors of the filter! The red filter disc housing itself is ok to touch with gloves.

Fig 2. Sampling bottle and filter

1. It's probably easiest to remove the plunger from the syringe and attach the filter to the tip of the syringe. **Don't let the tip of the plunger touch any surface, it will be contaminated!**
2. Fill the syringe from the spigot of the Nalgene bottle.
3. Insert the plunger and discard the first few millilitres from the filter.
4. Collect the filtered water in the plastic bottle. It should be approximately ¾ full. **Don't fill the bottle completely, the water will expand during freezing.**
5. Store the sample in a freezer.

If a filter clogs up, it can be replaced with one of the spares spare. Just rinse the new filter with a couple of millilitres before continuing to sample in the bottle.

Table 7: Nutrients data set

Event No.	Location	Latitude	Longitude	Bottle No.	Depth (m)	Comment
25	P3	-52.829	-40.163	24	9	
43	WCB mooring	-53.798	-37.933	1	249	

43	WCB mooring			5	53	
43	WCB mooring			7	8	
44	Stromness	-54.159	-36.696	1	63	Water stayed in CTD for a while
44				2	7	Water stayed in CTD for a while
70	WCB3.2S	-53.713	-37.965	1	122	
70				2	40	
70				4	9	
96	WCB mooring	-53.798	-37.933	1	279	
96				11	53	
96				20	9	
113	P2	-55.248	-41.225	24	3	

4 ACOUSTICS EK60/EK80

Sophie Fielding

4.1 *Acoustic instrumentation*

Introduction

The EK60 and the EK80 were run throughout JR17002 to collect information on the horizontal and vertical distribution of krill and to derive estimates of krill biomass for the Western Core Box and to contribute data from transects from the Falklands to South Georgia.

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

Methods/System specification

Acoustic data were collected using either the EK60 (38, 70, 120 and 200 kHz) or EK80 (120 kHz) echosounders. Two echosounders are mentioned here, but they both use the same set of transducers – so cannot be used at the same frequency at the same time. The EK80 (120 kHz) was used when it was realised the EK60 120 kHz GPT had malfunctioned during the calibration (07/01/2018).

Software versions
Simrad ER60 v. 2.4.3
Simrad EK80 v. 1.8.3

The echosounder pcs EK60/80 PU1 and PU2 are integrated into the ship's LAN. EK80 and ER60 .raw data files were logged to a Linux virtual server, using a Samba connection, which is backed up at regular intervals. All raw data were collected to 1300 m except during calibration. Occasionally EK80 120 kHz data were collected to 800m to examine whether this solved the network issue that caused the software to crash frequently.

File locations
All raw data were saved in a general folder JR17002/raw and all files were prefixed with JR17002_. Calibration data were additionally saved to the calibration folder.

EK60 (ER60) settings
The EK60 (38, 70, 120 and 200 kHz) GPTs were found not to have the transducers connected to them on arrival at the ship, the transducers were still connected to the EK80 WBTs presumably from last season. As a result, any data prior to this cruise is unlikely to have collected anything if the EK60 was being used.
The EK60 was run initially using default settings (Table default settings), although the environmental settings were updated at the start of the cruise to a temperature of and salinity of 34 PSU and 2°C these resulted in new settings for c and alpha. The transducer settings were left at the default settings that reflected last year's calibration.
The EK60 was calibrated on the 7/01/2018 where problems were identified with the 120 kHz GPT. As a result all 120 kHz data prior to 07/01/2018 is not viable and shouldn't be used. Fortuitously due to weather, the calibration occurred prior to the WCB. The spare GPT was installed and calibrated, but found to be running a different version of the firmware. It is suspected that this was unable to deal with network instability and proved not to be stable enough to operate through the cruise. Therefore, it was decided to operate the 120 kHz transducer through the EK80. As a result, the EK80 120 kHz WBT was also calibrated.

Table 8: default settings

Variable	38 kHz	70 kHz	120 kHz	200 kHz
Ping interval (per sec)	2	2	2	2
Sound velocity (m/s)	1456	1456	1456	1456
Mode	Active	Active	Active	Active
Transducer type	ES38	ES70-7C	ES120-7C	ES200-7
Transceiver Serial no.	009072033fa5	0090720770eb2	00907203422d	009072033f91
Transducer depth (m)	0	0	0	0
Absorption coef. (dB/km)	10.00	18.03	26.14	39.66
Pulse length (ms)	1.024	1.024	1.024	1.024
Max Power (W)	1000	750	250	300
2-way beam angle (dB)	-20.70	-20.60	-20.40	-19.60
Sv transducer gain (dB)	25.73	26.4	23.72	22.09
Sa correction (dB)	-0.45	-0.36	-0.27	-0.30

Angle sensitivity along	22	22	21	23
Angle sensitivity athwart	22	22	21	23
3 dB Beam along	7.08	6.54	6.41	6.67
3 dB Beam athwart	7.07	6.50	6.33	6.60
Along offset	-0.04	0.06	-0.01	0.05
Athwart offset	-0.06	-0.05	-0.04	0.11

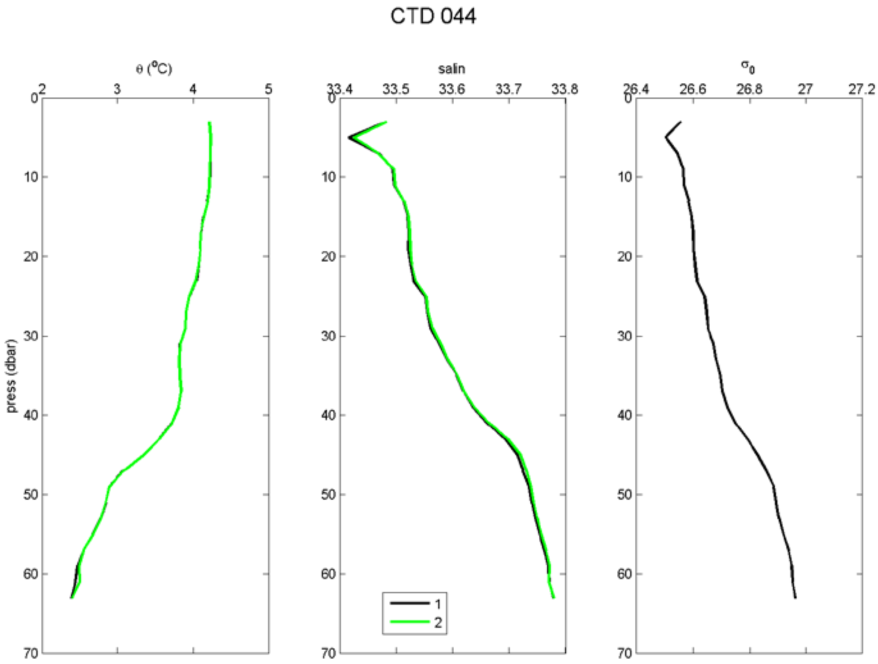
The EK60 was controlled through the k-sync along with the ADCP and EA600 on a 2 second ping rate. Due to the k-sync switching the EK60 into standby several times after 3 triggers without reply, the reply function was.

4.2 Calibration

An acoustic calibration was carried out in Stromness Harbour, South Georgia on 07/01/2018. The ship was anchored, its movement balanced by minimal DP usage. The EK60 was triggered through the k-sync, the EA600 was still running and ADCP was switched off. Each transducer was calibrated in turn, although all transducers were operating at the time. Standard ER60 calibration procedures were used as documented for previous cruises. In this case, after last year's comparison between copper and tungsten carbide sphere showing little difference, only the tungsten carbide (38.1 mm) sphere was used for the EK60.

A CTD (Event 44) was undertaken on the morning of the calibration. Temperature and salinity were averaged from the surface to 30 m (depth of the calibration sphere) and were 4.09 °C and 33.6 PSU resulting in a speed of sound constant of 1469 m/s (Kongsberg software calculation).

Fig 3a Calibration CTD



Each transducer was calibrated at the settings used in Table 8 default. Parameters from the ER60 lobes calibration were updated onto the ER60 software (Table calibrated settings), except in the case of the 120 kHz.

Table 9 Acoustics_ EK60 Calibration

Date (dd/mm/yyyy)	07/01/2018	07/01/2018	07/01/2018	07/01/2018
Location	Stromness	Stromness	Stromness	Stromness
Time (GMT)	10:00	00:11	12:03	13:55
Frequency (kHz)	38	70	120	200
GPT serial no	009072033fa5	0090720770eb2	009072033ff3*	9072033191
Comments	EA600 on through Ksync	EA600 on through Ksync	EA600 on through Ksync	EA600 on through Ksync
Transducer serial no	23080	280	1236	240
Water temperature (°C)	4.09	4.09	4.09	4.09
Salinity (PSU)	33.6	33.6	33.6	33.6
Sound velocity (m/s)	1469	1469	1469	1469
Absorption coeff (dB/km)	10.0	19.7	29.5	42.2

Ping rate (sec^{-1})	1	1	1	1
Transmit Power (W)	1000	750	250	300
Pulse length (ms)	1.024	1.024	1.024	1.024
Bandwidth (kHz)	2.43	2.86	3.03	3.09
Sample Interval (m)	0.186	0.186	0.186	0.186
Original gain (dB)	25.73	26.4	23.72	22.09
Original Sa correction (dB)	-0.45	-0.36	-0.27	-0.3
Theoretical TS of sphere (dB)	-42.24	-40.84	-39.61	-39.53
New gain (dB)	25.66	26.47	23.4	21.87
New Sa correction (dB)	-0.52	-0.37	-0.24	-0.3

* Note spare GPT used for calibration - also note that the GPT was running a different firmware version from the other three.

Table 10 EK80 calibration

Date (dd/mm/yyyy)	07/01/2018
Location	Stromness
Time (GMT)	10:00
Frequency (kHz)	120
Comments	EA600 on through Ksync
Transducer serial no	1236
Water temperature (°C)	4.09
Salinity (PSU)	33.6
Sound velocity (m/s)	1466
Absorption coeff (dB/km)	29.5

Ping rate (sec^{-1})	1
Transmit Power (W)	250
Pulse length (ms)	1.024
New gain (dB)	25.79
New Sa correction (dB)	0.01

4.3 Data coverage

Acoustic transects

The WCB was run in a west to east direction starting at the Southern end. The W1.1 CTDs were undertaken before the WCB was started which allowed extra fishing time the first night. However, no targets were seen during the first 2 nights. On the third night it was decided to defer station W3.2N and relocate to an on-shelf krill target seen when departing Stromness. This was successfully fished with 4 hauls on the third night and sampled once again on the fourth day. As a result the fourth transect also started at the southern end. No other krill targets were seen during the WCB.

Table 11a Acoustics_5 Transect times, directions and speeds.

Transect	Date	Start time (GMT)	End time (GMT)	Comments
WCB1.1	08/01/2018	09:30	14:06	
WCB1.2	08/01/2018	15:15	19:37	
WCB2.1	09/01/2018	09:08	13:36	
WCB2.2	09/01/2018	14:45	19:21	WCB suspended 17:30 – 17:54 due to prop motor failure
WCB3.1	10/01/2018	09:00	13:28	
WCB3.2	10/01/2018	14:48	19:08	
WCB4.1	11/01/2018	09:00	13:27	
WCB4.2	11/01/2018	14:08	18:38	

4.4 Problems encountered

There are continual network problems with both the EK60 and EK80. Whilst the program didn’t crash, it did report errors with regularity (~2 times a day). A solution or cause has yet to be identified.

The 120 kHz GPT failed, identified during the calibration. The spare was put in and identified that it was the GPT that had failed and not the transducer. It was calibrated, however it could not cope with the network timeouts and crashed frequently. Finally the EK80 was used. This also suffers crashes that appear to be associated with network timeouts. In this case they were infrequent enough to make the data usable. Noticeably the EK80 had an echo just above the seabed, which is suspected to result from synchronisation, however the cause is unknown.

4.5 Krill length

Sophie Fielding

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.

Method

Krill samples were taken from RMT8 samples where there were sufficient numbers of krill to select 100 decent state specimens for length frequency and maturity. 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).

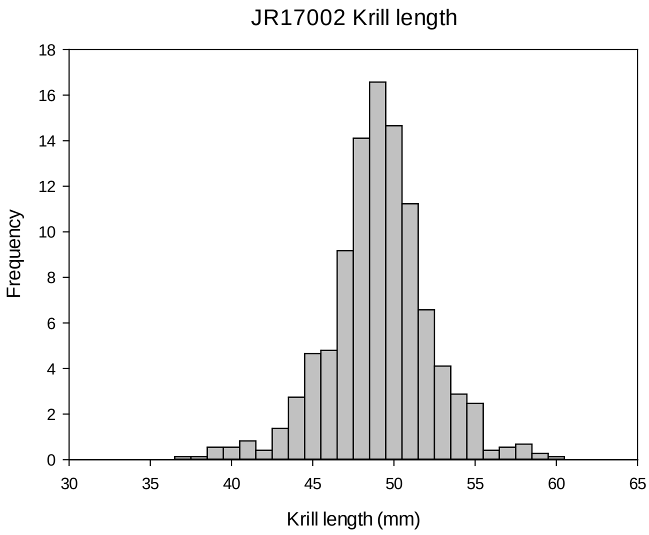
Results

Krill length frequency data were input into a spreadsheet on the L drive "JR17002_krill_length_V2.xls". The Net event numbers from which krill were measured is identified in Table 11b with the mean length of those events. The krill length frequency pdf for the whole cruise are shown in Figure 3b

Table 11b: Krill length frequency mean length per station#

Fig.3b Krill length frequency for JR17002

Event Number	Mean length (mm)
72_2	48.7
73_1	49.2
73_2	47.8
74_2	48.0
75_1	48.4
75_2	47.9
86_1	51.2
86_2	51.4



5 Glider deployment

Sophie Fielding, Jeremy Robst, Alejandro Ariza

5.1 Objectives:

Glider operations in JR17002 consisted of testing the BAS ecosystems glider SG565 (aka James Slesser Marr) to collect information on the distribution and abundance of krill in the vicinity of South Georgia. The initial objective was to deploy the glider within the boundaries of the Western Core Box acoustic survey. However, due to time constraints it was decided this would result in a very short deployment and the objective was changed to deploy the glider at the P3 mooring site following a triangle trajectory that two NOC gliders are currently undertaking to support the NERC grant COMICS (Controls On Mesopelagic Interior Carbon Storage).

Three waypoints were set within the glider: GC1, GC2 and GC3. The distance the glider needed to get to the waypoint was set initially to 300m but changed later on dive 6 to 500m.

/Waypoints for JR17002
GC2 lat=-5242.06 lon=-4015.22 radius=500 goto=GC3
GC3 lat=-5242.06 lon=-4004.50 radius=500 goto=GC1
GC1 lat=-5247.67 lon=-4009.86 radius=500 goto=GC2

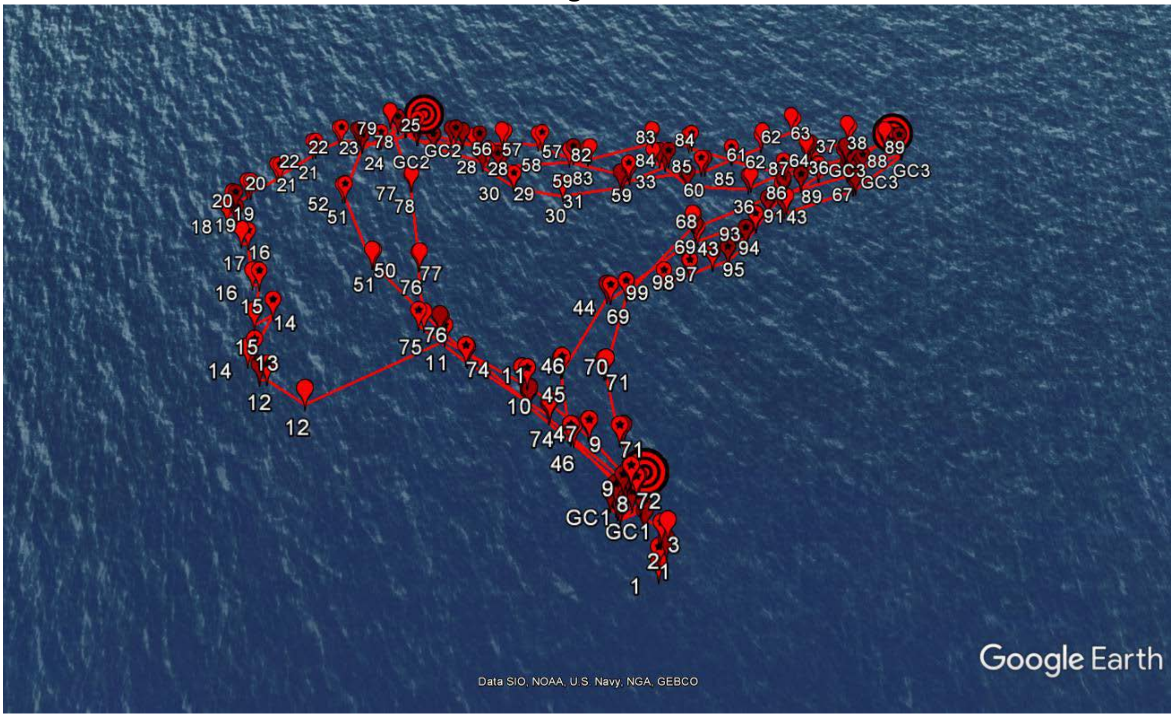


Fig 4 Glider trajectory

SG565 was recently upgraded and now sports the following sensors. A CT sail (SN 0201, calibrated 9/3/2017), a contros Hydroflash O2 optode (SN DO-0816-005, calibrated 20/12/2016), a Wetlabs Eco Puck, WL_BBFL2 (SN1406, calibrated 23/3/2016). In addition it had an ES853 120 kHz logger installed (SN 5706).

5.2 Deployment operations.

The seaglider firmware had been upgraded to Clownfish (Version 66.12 CLOWNFISH) in July 2017 by Sophie Fielding at NOC working with Steve Woodward. It was noted then that the echosounder cnf file caused a critical error, but this was thought to be because the echosounder wasn't connected. On undertaking the self-tests onboard the JCR it became evident that the glider was not triggering the echosounder. A new ies.cnf file was obtained from Kongsberg and UEA and on uploading was found to command the echosounder to record.

As per the manual 5 sim dives were undertaken before the deployment and no errors were recorded during these checks.

The glider was deployed on the 4th January at P3. The weather was sufficiently calm to allow deployment from a small boat. The glider loaded into the boat, and due to movement of the vessel the rib was driven a few tens of metres from the ship before deployment. SG565 was tethered and deployed to check its ballasting prior to release, riding a little high and horizontal the decision was made that communications were good so good to deploy.

SG565 undertook 99 dives before being recovered on the 13th January. The glider was set to undertake 150 m dives around 6 hours before recovery so that there was a short period between calls. The glider was spotted immediately on arrival at the surfaced position aided by a friendly albatross who pecked repeatedly at it.

Recovery was undertaken using the slightly modified glider pole recovery system, because it was lacking the piano wire that keeps the noose open. Instead stiff mooring wire was used to keep a noose open. The pole snapped at the thick end, but recovery was still successful with no damage to the glider. The glider was rinsed in fresh water after retrieval.

Fig 5 Glider operations

5.3 Iridium communications:

The seaglider was originally set up to call in as the primary number the BAS rudics basestation (881600005182), and the secondary number the BAS pstn basestation. However, the BAS pstn base station had to be rebuilt – and it also turned out that the phone number had been claimed for somewhere else (new BAS basestation number is 441223. As a backup because the BAS number could not be sorted before deployment, Karen Heywood at UEA kindly allowed us to use the UEA pstn as the secondary number (441603506993). Both basestation communications were checked prior to deployment (by putting them in as the primary and running a self-test) and worked well. SG565 only called the UEA base station twice during the deployment, both times downloading two dives. This did not occur after dive 20.

5.4 Dive decisions:

Glider deployment 04/01/2018
Glider deployed from rib from JCR as very good weather and least likely method of damaging it. Deployment went well, glider lying a little flat possibly, although good comms received.
PRM file checked and all looked okay. Decision made to go ahead with deployment
cmdfile.0.2
$SM_CC,400 # standard setting for dive, conservatively high
$MAX_BUOY,150 # standard setting for dive
cmdfile.0.5
$T_RSLEEP,5 # set call frequency to slower as making decisions

cmdfile0.17 # set dive parameters
$N_DIVES,0 # dive until say not to
$D_TGT,45 # 45 m dive
$T_DIVE,15
$T_MISSION,25
$NAV_MODE,2 # recommended by Gareth, using ferry angle correction
$FERRY_MAX,0 # recommended by Gareth
$KALMAN_USE,2 # recommended by Gareth
$SM_CC,400
$MAX_BUOY,150
$USE_BATHY,0
$TGT_DEFAULT_LON,-4006.78
$TGT_DEFAULT_LAT,-5246.00
$C_VBD,2851 # from trim sheet
$C_PITCH,2475 # from trim sheet
$C_ROLL_DIVE,2200 # from trim sheet
$C_ROLL_CLIMB,2200 # from trim sheet
$CAPUPLOAD,1 #whilst making sure all is okay
$STOP_T,01161812 # set for estimated last day in area
$QUIT
cmdfile.0.19
$T_RSLEEP,1
$RESUME
Send on dive
cmdfile.1.2
$T_RSLEEP,5 # slow rate of dialling in whilst making decisions
$QUIT

Looking through the cap and log file there are no errors. One warning about pps
cmdfile.1.5
$RESUME # send on another 45 m dive whilst looking at previous dive

Going for a deeper dive to 150 m
cmdfile.2.5 and cmdfile.2.6
$N_DIVES,0 # Want to keep diving until stay stop
$D_TGT,150 #
$T_DIVE,50 #
$T_MISSION,80 #
$T_ABORT,200 #
$D_ABORT,175 #
$SM_CC,350 # Changed as the glider was coming out of the water well
$QUIT

Diagram shows that C_PITCH is okay, but pitch gain is a little high. Discussed changing pitch gain so decided to reset SM_CC to 400 and reduce pitch gain by 2
cmdfile.2.7
$N_DIVES,0

$D_TGT,150
$T_DIVE,50
$T_RSLEEP,1
$T_MISSION,80
$T_ABORT,200
$D_ABORT,175
$SM_CC,400
$PITCH_GAIN,27 # change from 29
$QUIT

cmdfile.2.8
$RESUME # send on dive

cmdfile.3.1
$T_RSLEEP,5 # slow call rate to think
$QUIT

Looking at track of the glider and wondering what/how navigation is being controlled
cmdfile.3.3
$T_RSLEEP,10 # slow even more
$QUIT

Looking at VBD, appears to be out by 20 cc (diveplot), so require a potential change of 20*4 = 80 and 80/2 = 40 units. Decided to change conservatively to 20.
Since didn't seem to be problems, turned capupload off
cmdfile.3.7
$D_TGT,150
$T_DIVE,50
$T_MISSION,80
$T_ABORT,200
$D_ABORT,175
$C_VBD,2871 # change VBD by 20
$T_RSLEEP,2 # increase frequency of call for dive instruction
$CAPUPLOAD,0 # turn capupload off
$QUIT

cmdfile.3.8
$RESUME

Dive looks okay, so going for deeper 300m dive
cmdfile.4.2
$D_TGT,300
$T_DIVE,100
$T_MISSION,180
$T_ABORT,220
$D_ABORT,350
$T_RSLEEP,2

$QUIT

cmdfile.4.3
$RESUME

To make more energy efficient reduce SM_CC to 350
cmdfile.5
$SM_CC,350
$GO

Command 4.2. didn't load so dive 5 was only 150 m, resending and then send RESUME
cmdfile.6.4
$D_TGT,300
$T_DIVE,100
$T_MISSION,180
$T_ABORT,220
$D_ABORT,350
$QUIT

Dive came back okay - looked like C_PITCH was out by a little. Made small change
cmdfile.7.8
$C_PITCH,2465 # small change
$RESUME

Dives 8, 9, 10 were all the same on "GO" for over night. Noticably dive 10 failed to communicate with the rudics basestation. So next dive (11) was made to the UEA base station (again with a go command).

Dives 10 and 11 didn't process on the UEA basestation (due to incompatible settings)

After Dive 11 the glider called into rudics - and a quit command was given whilst a decision was made whether to recover. In the end it was decided not to, since the glider was flying okay, and the concern (flat glider slope) was identified to be probably software related. Pitch angle (from the eng files) showed the glider was flying at 20 degrees. Didn't notice SM_CC set to max
The glider was given the resume command to start diving. It came to the surface with SM_CC pumped to 563 (max), forgot to reset for the next dive.

cmdfile.13
$SM_CC,400 # Bastien suggestion to keep this in here in case of SM_CC resets
$GO

Noticed that the glider gps fixes appear quite poor. Emailed kongsberg help who noted that
$N_GPS
should be set to 100840. This now sent to improve GPS location
cmdfile.14
$N_GPS,100840

$GO

cmdfile.15
$GO

cmdfile.16
SM_CC,350
ES_PROFILE,0 # concerned about battery levels so checking to see if eS853 significantly draining battery
$GO
Check profile 16 and there were no increases in ES_START post dive 16 so this worked.

Dive 17 didn't call in. Seems SM_CC 350 is not enough, as tends to switch to the other basestation

Dive 18 called into PSTN line. Battery looks a little more plateauing. Discussion with Kongsberg says that the battery measurement is the lowest voltage seen on the battery bus board during a dive. probably during pumping.

Dive 19 VBD retries seem to have stopped so sending glider 100m deeper.
Noted C_VBD seemed a bit off from last dive, and SM_CCmin increased. Not changed on this dive though
cmdfile.19
$D_ABORT,425
$D_TGT,400
$T_DIVE,135
$T_MISSION,205
$T_ABORT,720
$SM_CC,400
$GO

Email from Kongsberg. After a SM_CC force to max, the $PROTOCOL value is reset to 1
However this should be set to 9 for the modem flow control. Rich Patterson suggested to keep
this in the cmdfile.
Conversation with Bastien suggests to set compass,4 to do post dive compass calibration
cmdfile.20
$PROTOCOL,9
$COMPASS_USE,4
$SM_CC,400

Kongsberg email also noted that C_VBD was a little light and could be increased.
Looks like 30-40 cc change required. Added 60 a/d to C_VBD
cmdfile.21
$C_VBD,2931
$PROTOCOL,9
$SM_CC,400

$GO

Kongsberg also suggested dropping the SM_CC to 270, however, I have noted that whenever
I dropped SM_CC to 350 the glider doesn't achieve comms with the RUDICS line and changes to PSTN
as well as pumping to SM_CC max. Consider dropping to 375 to see if that works.
Also change to deeper dive.
cmdfile.22
$D_ABORT,475
$D_TGT,450
$T_DIVE,150
$T_MISSION,230
$T_ABORT,720
$PROTOCOL,9
$SM_CC,375
$GO

Glider left with no changes whilst fishing and recovering a mooring
cmdfile.23 - cmdfile.27
$PROTOCOL,9
$SM_CC,375
$GO

Changed SM_CC to lower value to reduce energy, increase dive depth to 500m and change C_PITCH by 5 Also restart echosounder, this time on down dive only to reduce energy consumption.

cmdfile.28
$SM_CC,350
$C_PITCH,2460
$D_ABORT,525
$D_TGT,500
$T_DIVE,170
$T_MISSION,255
$ES_PROFILE,1
$PROTOCOL,9
$SM_CC,375
$GO

Science file also changed so that science sensors (oxygen and chlorophyll) only sampling on the way down with the acoustics
science.28
// Science for JR17002, SG565, 30/12/2017
/for std glider w/ CT, oxy, Wet labs
/depth time sample gcint profile
50 5 111 60 311

200	5	122	120	311
300	5	126	120	311
1000	10	130	120	311

Back to standard settings
cmdfile.29
$SM_CC,350
$PROTOCOL,9
$GO

After some discussion with Kongsberg, implementing some changes to the sensitivity of the transponder, to reduce the number of random pings (raising XPDR_VALID). Which apparently are caused by the transponder thinking it is being interrogated.
Also changed D_BOOST to 5 on recommendation regarding using boost pump in shallow water
Reduced PITCH_GAIN by one more
cmdfile.30
$XPDR_VALID,3
$D_BOOST,5
$PITCH_GAIN,26
$SM_CC,350
$PROTOCOL,9
$GO

cmdfile.31
$XPDR_VALID,3
$D_BOOST,5
$PITCH_GAIN,26
$SM_CC,350
$PROTOCOL,9
$GO

Sleep time so file not changed
cmdfile.32 - 33
$SM_CC,350
$PROTOCOL,9
$GO

SM_CC reset to max? Reason? so raising SM_CC again a little to prevent it from happening
cmdfile not changing as calibrating the ships echosounders and the WBAT
cmdfile.34 - 46
$SM_CC,375
$PROTOCOL,9
$GO

Want to reduce SM_CC again as will influence battery consumption - go back to SM_CC = 350

Fishing on the WCB now - less attention on glider
cmdfile.47 - 56
$SM_CC,350
$PROTOCOL,9
$GO

Glider has coped with SM_CC of 350 for a while now, so reducing it
cmdfile.57
$SM_CC,325
$PROTOCOL,9
$GO

Looks like C_VBD needs changing again. Change by 60AD counts from 2931 to 2991
cmdfile.58
$SM_CC,325
$PROTOCOL,9
$GO

Prepping glider for recovery, set dive to 150 m
cmdfile.89
$SM_CC,400
$D_TGT,150
$T_DIVE,50
$T_MISSION,80
$T_ABORT,720
$D_ABORT,175
$PROTOCOL,9
$GO

Dive 99 send quit to recover glider

6 MOCNESS NET CATCH AND RESPIRATION EXPERIMENT

Vicky Fowler et al.

An 8m^2 MOCNESS net equipped with 333um mesh was deployed at several locations for the purpose of obtaining depth-stratified catches of the zooplankton community to a maximum depth of 1000 m. The water column was divided into approximately 200 m depth intervals in the deeper water column, reducing to 100 m and then 50 m intervals closer to the surface. The MOCNESS was deployed with Net 1 open, with the trawl wire paid out at a speed of 30 m/min and the ship travelling at between 2 and 2.5 knots. Net 1 was closed at the maximum sampling depth of 1000 m. The trawl wire was hauled in a 20 m/min and the subsequent 8 nets (Net 2 to 9) closed in sequence as the net reascended. The MOCNESS was deployed between 0 and 1000 m at the P2 and P3 stations. Set depths (m) were: 0-1000, 1000-875, 875-750, 750-625, 625-500, 500-375, 375-250, 250-125, 125-0. At the WCB station, the MOCNESS was deployed between 0 and 100m with the nets being opened at the following depths (m): 50-100, 100-85, 85-70, 70-55, 55-40, 40-25, 25-10, 10-5. The daytime MOCNESS net 1 was opened early and sampled from 20-100m. MOCNESS deployments were successful at all stations following an initial problem with the communications at P3.

6.1 Sample processing

The samples were processed as follows:

1. The sample was divided into two, with one half filtered onto 200um mesh within an interlocking mesh holder, the mesh removed and frozen at -80oC as soon as possible after the net arrived on deck.
2. Copepod specimens from the remaining half of the sample were further removed, these specimens were *Metridia gerlachei, Metridia lucens* and *Plueromamma spp*. A number of these specimens were placed in tin capsules for CHN analysis and frozen at -80°C. A further 20 copepods were placed in a 24 well respiration plate.
3. The remainder of the sample was preserved in 4% formaldehyde.

6.2 Respiration experiment

A presens loligo micro respirometer was used to measure the oxygen consumption rates of copepods caught in the MOCNESS. This system uses a 24 well plate fitted with optode sensors at the base of each 500 µl well. The plate sits on a specialised plate reader connected to a laptop and was automatically set up to read the oxygen levels in each well at set time frequencies. The wells were filled prior to the arrival of the MOCNESS using 0.2µm filtered underway sea water. In order to maintain a constant temperature the well plate and reader were placed within an incubator set to 4°C during and prior to any measurements. Respiration measurements were carried out for a maximum of 24 hours or until the MOCNESS was next deployed, this was a minimum of 4 hours. Four out of six sets of respiration measurements were successful; however, measurements at the WCB station were unsuccessful due to the copepods not surviving after being placed in the well plate. This was possibly due to the water used to fill the plate.

Fig 6. Sample being filtered through a 200µm mesh before being frozen at -80°C (left); catch being sorted for preservation (right).

Table 12 Mocness deployments during JR17002

Time (GMT)	Event No	Net No	Latitude	Longitude	Water depth	Net depth	Action	Comment
17/01/2018 04:00	117		-55.1693	-41.3033	3256.76	0	Mocness recovered	
17/01/2018 03:54	117	9	-55.1712	-41.301	3256.93	10.8	Net 9 closed	1/2 frozen at -80oC, 1/2 preserved in formalin
17/01/2018 03:44	117	9	-55.1758	-41.2956	3258.31	126	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
17/01/2018 03:33	117	8	-55.181	-41.2901	3255.95	246.4	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
17/01/2018 03:18	117	7	-55.1878	-41.2833	3249.9	375.2	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
17/01/2018 03:09	117	6	-55.1924	-41.2785	3247.73	501.8	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
17/01/2018 03:00	117	5	-55.1967	-41.2742	3249.5	624.6	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
17/01/2018 02:45	117	4	-55.2031	-41.2683	3257.83	750.7	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
17/01/2018 02:33	117	3	-55.2086	-41.2626	3274.36	875.5	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
17/01/2018 02:24	117	2	-55.213	-41.2581	3282.27	999.7	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin

17/01/2018 01:17	117		-55.2452	-41.2292	3296.24	0.3	Mocness deployed	P2
16/01/2018 15:24	110		-55.2556	-41.3996	3576.67	0	Mocness recovered	
16/01/2018 15:15	110	9	-55.2551	-41.3932	3571	10.2	Net 9 closed	1/2 frozen at -80oC, 1/2 preserved in formalin
16/01/2018 15:07	110	9	-55.2545	-41.3869	3569.59	124.2	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
16/01/2018 14:55	110	8	-55.2536	-41.378	3567.3	250.1	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
16/01/2018 14:44	110	7	-55.2529	-41.3696	3567.28	375.5	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
16/01/2018 14:34	110	6	-55.2525	-41.3613	3562.58	501.5	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
16/01/2018 14:23	110	5	-55.2519	-41.3532	3556.49	625.1	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
16/01/2018 14:13	110	4	-55.2517	-41.3454	3549.47	752.6	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
16/01/2018 14:04	110	3	-55.2515	-41.3386	3540.99	851.4	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
16/01/2018 13:50	110	2	-55.251	-41.3287	3522.75	1000.7	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
16/01/2018 12:51	110		-55.2501	-41.2734	3377.36	0.3	Mocness deployed	P2

12/01/2018 17:32	95		-53.7918	-37.9977	292.03	0	Mocness recovered	
12/01/2018 17:24	95	9	-53.793	-37.9878	316.91	5.4	Net 9 closed	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 17:18	95	9	-53.7939	-37.9805	321.05	10.5	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 17:11	95	8	-53.7946	-37.9738	319.19	25.5	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 17:05	95	7	-53.7953	-37.9669	320.13	40.6	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 16:59	95	6	-53.7959	-37.9608	319.47	55.1	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 16:52	95	5	-53.7965	-37.9537	317.88	70.2	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 16:43	95	4	-53.7975	-37.9431	318.53	87.1	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 16:37	95	3	-53.798	-37.9366	304.12	105.1	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 16:23	95	2	-53.7994	-37.9213	250.95	21	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 16:21	95		-53.7997	-37.918	248.82	0.6	Mocness deployed	WCB
12/01/2018 02:03	90		-53.7961	-38.0028	298.2	0	Mocness recovered	

12/01/2018 01:58	90	9	-53.7962	-37.9977	300.4	7	Net 9 closed	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 01:52	90	9	-53.7964	-37.991	304.74	9.4	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 01:46	90	8	-53.7966	-37.9857	308.35	26.4	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 01:40	90	7	-53.7967	-37.9798	317.59	39.8	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 01:34	90	6	-53.7968	-37.974	318.63	55.1	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 01:28	90	5	-53.7971	-37.9675	323.03	73.9	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 01:21	90	4	-53.7974	-37.9609	320.16	85.2	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 01:16	90	3	-53.7976	-37.955	320.73	100.8	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 01:10	90	2	-53.7979	-37.9485	322.16	50	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
12/01/2018 01:04	90		-53.7981	-37.9416	322.13	0.3	Mocness deployed	WCB
05/01/2018 04:21	30		-52.7348	-40.0013	3782.4	0	Mocness recovered	
05/01/2018 04:12	30	9	-52.7388	-40.0072	3782.12	10.2	Net 9 closed	1/2 frozen at -80oC, 1/2

								preserved in formalin
05/01/2018 04:01	30	9	-52.7436	-40.0146	3790.43	125.2	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
05/01/2018 03:48	30	8	-52.7489	-40.0229	3782.84	250.7	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
05/01/2018 03:38	30	7	-52.7535	-40.03	3780.86	375.5	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
05/01/2018 03:24	30	6	-52.7593	-40.0389	3785.45	500.5	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
05/01/2018 03:15	30	5	-52.7633	-40.0453	3779.18	625.4	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
05/01/2018 03:02	30	4	-52.768	-40.053	3789.16	750.7	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
05/01/2018 02:52	30	3	-52.7721	-40.0597	3789.31	875.5	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
05/01/2018 02:40	30	2	-52.7769	-40.068	3789.04	1000.5	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
05/01/2018 01:31	30		-52.7952	-40.1225	3781.79	0.6	Mocness deployed	P3
04/01/2018 21:17	26		-52.7426	-40.0956	3781.07	14.8	Mocness recovered	
04/01/2018 21:10	26	9	-52.746	-40.0965	3788.21	10.8	Net 9 closed	1/2 frozen at -80oC, 1/2 preserved in formalin

04/01/2018 21:00	26	9	-52.7507	-40.098	3788.37	125.5	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
04/01/2018 20:49	26	8	-52.7567	-40.0997	3779.19	236.7	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
04/01/2018 20:37	26	7	-52.7624	-40.1014	3787.65	376.3	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
04/01/2018 20:25	26	6	-52.7681	-40.1026	3784.61	501	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
04/01/2018 20:15	26	5	-52.7735	-40.1034	3787.63	627.2	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
04/01/2018 20:04	26	4	-52.7786	-40.1042	3787.08	750.5	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
04/01/2018 19:54	26	3	-52.7837	-40.1052	3780.86	876.9	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
04/01/2018 19:43	26	2	-52.7888	-40.1064	3784.7	998.3	Net opened	1/2 frozen at -80oC, 1/2 preserved in formalin
04/01/2018 18:42	26		-52.8223	-40.1095	3797.89	0	Mocness deployed	P3
04/01/2018 02:36	21		-52.8125	-40.1645	3796.4	0.6	Mocness motion sensor on deck	Mocness motion sensor TEST
04/01/2018 01:41	21		-52.8125	-40.1644	3793.28	1076.4	Mocness motion sensor at depth	Mocness motion sensor TEST
04/01/2018 00:49	21		-52.8125	-40.1644	3793.84	12.1	Mocness motion sensor in water	Mocness motion sensor TEST

03/01/2018 16:35	14		-52.7675	-40.3399	3002.02	0.6	Mocness recovered	P3 station, Net opening/closing failed.
03/01/2018 13:59	14		-52.8079	-40.1933	3001.65	0.6	Mocness deployed	P3 station, Net opening/closing failed.
01/01/2018 14:29	5		-52.3652	-49.1306	3188.44	0.6	Mocness recovered	TEST
01/01/2018 14:21	5	9	-52.3639	-49.1218	3200.55	35.5	Net 9 closed	TEST
01/01/2018 14:20	5	9	-52.3639	-49.1208	3200.52	35	Net opened	TEST
01/01/2018 14:19	5	8	-52.3638	-49.1198	3200.67	36	Net opened	TEST
01/01/2018 14:18	5	7	-52.3637	-49.1189	3199.67	35.2	Net opened	TEST
01/01/2018 14:17	5	6	-52.3636	-49.118	3199.38	34.7	Net opened	TEST
01/01/2018 14:16	5	5	-52.3634	-49.117	3198.58	32.3	Net opened	TEST
01/01/2018 14:15	5	4	-52.3633	-49.1162	3198.44	30.9	Net opened	TEST
01/01/2018 14:14	5	3	-52.3632	-49.1154	0	30.9	Net opened	TEST
01/01/2018 14:13	5	2	-52.3631	-49.1138	3196.63	35	Net opened	TEST
01/01/2018 14:10	5		-52.3627	-49.1108	3196.71	0	Mocness deployed	TEST

7 Motion-compensated Upward Downward Looking (MUDL) net

Vicky Fowler et al.

The MUDL was deployed during the cruise to examine foray behaviour in zooplankton (the movement of organisms in and out of the mixed layer). The idea behind this net is that by deploying it to a set depth for a period of time zooplankton were able to swim into either the upward or downward looking cod-end. The net was deployed to a depth of 100 m and a depth that sat 10 m below the chlorophyll maximum.

The deployment of the net was carried out by lowering the net to depth with the cod ends in a closed position. After a preset time interval, the cod ends rotated to an open position and remained open for a further 20 minutes, after which they rotated to a closed position once again. The net was then recovered. On recovery, the net mesh from the downward looking net was removed from the ring and the rotating mechanism was triggered manually while holding a bucket up to the cod end. Consequently, the contents of the cod ends poured into the upheld bucket. For the upward looking net, the cod end contents were retrieved through opening a tap at the bottom of the cod end.

The time intervals for the opening-closing mechanisms were uploaded to the motor via a modem cable from a laptop with customised Hydrobios software. Once the motor was programmed, the laptop was disconnected and the device set to an off position until the point of deployment. Prior to deployment, it was also necessary to fill the cod ends with water from the same depth as the resting depth of the net during deployment. This, along with the position of the chlorophyll maximum, was obtained from a CTD carried out prior to deployment and poured into the net via a funnel in the case of the downward looking net, or simply poured into the disconnected cod-end in the case of the upward looking net. At the point of deployment, the rotating device was turned on and a stop watch started to keep track of time during deployment. On recovery, the device was immediately turned to the off position and connected to the laptop to manually trigger a rotation to collect the water from the downward looking cod end.

After retrieval of the samples, they were filtered through 100 µm mesh in an interlocking sieve, the mesh was immediately extracted from the sieve and placed in a plastic bag and frozen at -80oC. Samples are to be taxonomically identified once back in Cambridge.

In total, 20 deployments of the MUDL were made, with 3 failures and 2 test deployments included. Deployments were mainly made at dawn and dusk. The deployments were made at P3, the WCB mooring and P2. At each station the net was deployed to 100 m, which was generally just below the bottom of the mixed layer and 10 m below the chl-a maximum each dawn and dusk. In almost all instances, the opening period at the resting depth was 20 mins. 10 minutes was allowed for the net to be deployed, arrive at the resting depth of 100 m, and allow thorough flushing before the cod ends opened. This time was reduced to 5 minutes for shallow deployments.

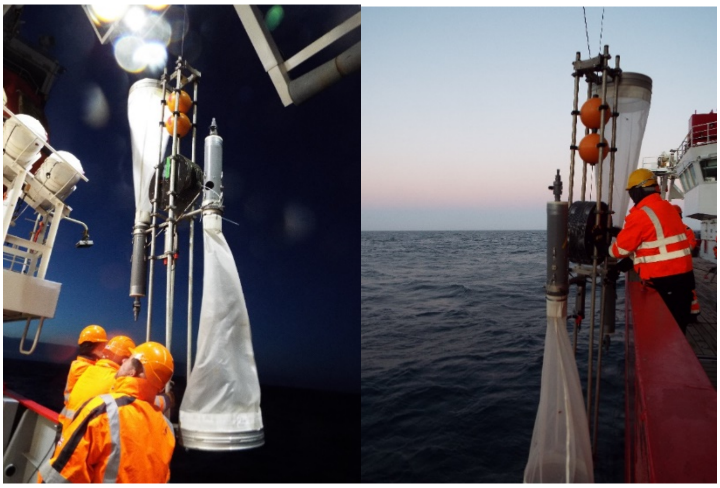


Fig 7 MUDL being deployed at dawn and dusk

Time	Ev. N	Latitude	Longitude	Water depth	Sea Surface T	Sea Surface Salinity	Sea Surface Transmittance	Chl	Sample depth (m)	Action	Comment
17/01/2018 06:21	119	-55.24825	-41.22443	3292.84	4.04	33.75	0.797	7.25		MUDL on deck	
17/01/2018 06:16	119	-55.24827	-41.22442	3292.93	4.04	33.76	0.796	6.7	60	Net closed	Sample frozen at -80°C
17/01/2018 05:54	119	-55.24826	-41.22441	3292.93	4.04	33.75	0.798	6.62	60	Net opened	
17/01/2018 05:51	119	-55.24827	-41.22439	3292.83	4.04	33.75	0.797	6.62		MUDL in water	
17/01/2018 05:42	118	-55.24827	-41.22438	3293.03	4.04	33.75	0.799	6.24		MUDL on deck	
17/01/2018 05:36	118	-55.24827	-41.22437	3293.1	4.04	33.76	0.796	6.44	100	Net closed	Sample frozen at -80°C
17/01/2018 05:09	118	-55.24828	-41.22442	3292.42	4.04	33.75	0.799	6.45	100	Net opened	
17/01/2018 05:00	118	-55.24829	-41.22437	3292.35	4.03	33.76	0.796	7.03		MUDL in water	
17/01/2018 00:21	115	-55.24846	-41.22507	3294.27	4.02	33.76	0.757	7.62		MUDL on deck	
17/01/2018 00:16	115	-55.24847	-41.22506	3294.38	4.0	33.76	0.763	7.28	60	Net closed	Sample frozen at -80°C
16/01/2018 23:55	115	-55.24845	-41.22502	3294.59	4.02	33.77	0.761	6.94	60	Net opened	
16/01/2018 23:51	115	-55.24846	-41.22503	3294.47	4.01	33.77	0.761	7.32		MUDL in water	
16/01/2018 23:42	114	-55.24848	-41.22506	3294.6	4.02	33.76	0.761	7.25		MUDL on deck	
16/01/2018 23:35	114	-55.24848	-41.22506	3294.37	4.01	33.76	0.762	7.08	100	Net closed	Sample frozen at -80°C
16/01/2018 23:10	114	-55.24846	-41.22508	3294.57	3.98	33.76	0.766	7.06	100	Net opened	
16/01/2018 23:05	114	-55.24845	-41.22506	3294.31	4.02	33.76	0.763	7.08		MUDL in water	
14/01/2018 00:25	105	-52.80614	-40.1271	3783.86	5.34	33.79	0.695	3.38		MUDL on deck	

14/01/2018 00:23	105	-52.80615	-40.12713	3783.83	5.3	33.79	0.695	3.28	52	Net closed	Sample frozen at -80°C
13/01/2018 23:58	105	-52.80614	-40.12715	3792.33	5.39	33.75	0.695	3.30	52	Net opened	
13/01/2018 23:56	105	-52.80612	-40.12715	3794.6	5.34	33.79	0.695	3.33		MUDL in water	
13/01/2018 23:42	104	-52.80615	-40.12715	3784.7	5.33	33.79	0.694	3.24		MUDL on deck	
13/01/2018 23:36	104	-52.80616	-40.12713	3793.89	5.34	33.79	0.696	3.26	100	Net closed	Sample frozen at -80°C
13/01/2018 23:16	104	-52.80613	-40.12711	3793.61	5.33	33.79	0.696	3.29	100	Net opened	
13/01/2018 23:12	104	-52.80611	-40.12712	3794.39	5.33	33.79	0.696	3.09		MUDL in water	
12/01/2018 06:35	94	-53.79828	-37.93307	289.25	3.80	33.75	0.586	15.23		MUDL on deck	
12/01/2018 06:32	94	-53.79829	-37.93308	287.9	3.78	33.75	0.588	14.8	20	Net closed	
12/01/2018 06:08	94	-53.79829	-37.93309	288.92	3.81	33.75	0.587	14.79	20	Net opened	
12/01/2018 06:06	94	-53.79831	-37.93311	290.24	3.81	33.75	0.587	15.51		MUDL in water	
12/01/2018 05:58	93	-53.7983	-37.93309	289.5	3.82	33.75	0.588	15.10		MUDL on deck	
12/01/2018 05:52	93	-53.7983	-37.93308	289.18	3.82	33.75	0.588	14.94	100	Net closed	
12/01/2018 05:24	93	-53.79831	-37.93315	291.04	3.81	33.75	0.589	14.89	100	Net opened	
12/01/2018 05:21	93	-53.79828	-37.93309	291.85	3.81	33.75	0.589	14.89		MUDL in water	Sample frozen at -80°C
12/01/2018 04:20	92	-53.79832	-37.93309	287.87	4.12	33.75	0.587	14.80		MUDL on deck	
12/01/2018 04:17	92	-53.7983	-37.93309	287.18	3.92	33.75	0.588	15.0	20	Net closed	
12/01/2018 03:52	92	-53.7983	-37.93309	287.46	3.85	33.76	0.587	14.78	20	Net opened	
12/01/2018 03:50	92	-53.79831	-37.93311	289.96	3.89	33.75	0.584	15.12		MUDL in water	Sample frozen at -80°C

12/01/2018 03:42	91	-53.79831	-37.93314	287.44	3.81	33.75	0.583	15.81		MUDL on deck	
12/01/2018 03:36	91	-53.79832	-37.93311	292.88	3.86	33.76	0.583	15.43	100	Net closed	
12/01/2018 03:10	91	-53.79829	-37.93311	289.83	3.83	33.75	0.584	15.73	100	Net opened	
12/01/2018 03:06	91	-53.79831	-37.93309	288.19	3.81	33.75	0.585	15.09		MUDL in water	Sample frozen at -80°C
12/01/2018 00:37	89	-53.79834	-37.93331	285.94	3.99	33.75	0.5786	16.56		MUDL on deck	
12/01/2018 00:35	89	-53.79834	-37.9333	284.34	3.97	33.76	0.578	16.73	20	Net closed	
12/01/2018 00:10	89	-53.79832	-37.93332	284.94	3.89	33.75	0.573	16.93	20	Net opened	
12/01/2018 00:08	89	-53.79832	-37.93333	287.01	3.86	33.75	0.575	16.69		MUDL in water	Sample frozen at -80°C
11/01/2018 23:57	88	-53.79835	-37.93333	283.86	3.82	33.75	0.585	14.946		MUDL on deck	
11/01/2018 23:52	88	-53.79833	-37.93333	287.13	3.74	33.75	0.595	14.094	100	Net closed	
11/01/2018 23:26	88	-53.79829	-37.93328	286.17	3.79	33.75	0.587	15.473	100	Net opened	
11/01/2018 23:20	88	-53.79829	-37.9333	289.42	3.86	33.75	0.583	15.96		MUDL in water	Sample frozen at -80°C
06/01/2018 15:09	41	-53.79867	-37.94481	319.59	3.57	33.78	0.734	12.42		MUDL on deck	
06/01/2018 15:03	41	-53.79868	-37.94477	319.2	3.55	33.78	0.735	11.50	100	Net closing failed	
06/01/2018 14:40	41	-53.79871	-37.94482	321.77	3.56	33.79	0.733	13.12	100	Net opened	
06/01/2018 14:34	41	-53.7987	-37.94485	318.49	3.56	33.78	0.738	11.52		MUDL in water	Sample frozen at -80°C
05/01/2018 06:45	32	-52.79038	-40.12243	3791.29	5.31	33.84	0.856	3.96		MUDL on deck	
05/01/2018 06:36	32	-52.79086	-40.12222	3780.86	5.32	33.84	0.856	3.76	45	Net closed	

05/01/2018 06:12	32	-52.79199	-40.12173	3781.06	5.34	33.84	0.856	3.76	45	Net opened	
05/01/2018 06:09	32	-52.792	-40.12172	3781.57	5.35	33.84	0.854	3.56		MUDL in water	
05/01/2018 06:01	31	-52.79199	-40.12172	3781.18	5.36	33.84	0.85	3.53		MUDL on deck	
05/01/2018 05:53	31	-52.79244	-40.12185	3781.4	5.37	33.84	0.857	3.67	100	Net closed	
05/01/2018 05:23	31	-52.79329	-40.12221	3792.29	5.34	33.84	0.851	3.29	100	Net opened	
05/01/2018 05:17	31	-52.79345	-40.12227	3791.14	5.19	33.83	0.848	3.31		MUDL in water	Sample frozen at -80°C
05/01/2018 00:43	29	-52.8129	-40.16323	3783.75	5.73	33.83	0.862	3.16		MUDL on deck	
05/01/2018 00:39	29	-52.81292	-40.16322	3784.59	5.73	33.83	0.858	2.79	45	Net closed	
05/01/2018 00:16	29	-52.81295	-40.1632	3784.43	5.73	33.83	0.860	3.98	45	Net opened	
05/01/2018 00:12	29	-52.81292	-40.1632	3784.49	5.73	33.83	0.862	3.10		MUDL in water	Sample frozen at -80°C
05/01/2018 00:05	28	-52.81293	-40.16321	3784.43	5.76	33.83	0.860	3.43		MUDL on deck	
05/01/2018 00:00	28	-52.81293	-40.16319	3784.46	5.78	33.83	0.860	2.90	100	Net closed	
04/01/2018 23:21	28	-52.81293	-40.16322	3784.77	5.91	33.83	0.865	3.18	100	Net opened	
04/01/2018 23:14	28	-52.81293	-40.16322	3784.81	5.87	33.83	0.863	3.19		MUDL in water	Sample frozen at -80°C
04/01/2018 22:52	27	-52.81293	-40.16323	3784.87	5.77	33.83	0.864	3.06		MUDL on deck	
04/01/2018 22:45	27	-52.81293	-40.16321	3784.56	5.89	33.83	0.863	2.81	50	Net closed	
04/01/2018 22:35	27	-52.81294	-40.16321	3784.47	5.90	33.83	0.864	2.90	50	Net opened	
04/01/2018 22:30	27	-52.81294	-40.16321	3784.56	5.91	33.89	0.864	2.64		MUDL in water	Sample frozen at -80°C
04/01/2018 00:06	20	-52.81261	-40.16428	3796.74	5.25	33.83	0.84	4.017		MUDL on deck	

03/01/2018 23:21	20	-52.81262	-40.1643	3794.22	5.27	33.83	0.84	3.92	100	MUDL at depth, deployment failed	
03/01/2018 23:14	20	-52.81263	-40.16429	3794.08	5.25	33.83	0.850	3.7		MUDL in water	
02/01/2018 17:02	11	-52.56236	-43.85231	3418.12	7.13	34.01	0.875	1.99		TEST, MUDL recovered to deck	Sample frozen at -80°C
02/01/2018 16:58	11	-52.5626	-43.85347	3418.14	7.12	34.01	0.87	2.07	50	TEST, Net closing failed	
02/01/2018 16:48	11	-52.5631	-43.85596	3418.48	7.13	34.01	0.87	2.65	50	TEST, Net opened	
02/01/2018 16:38	11	-52.56236	-43.85231	3418.12	7.13	34.01	0.87	1.99		TEST, MUDL in the Water	

8 RMT net and Macrozooplankton

Gabriele Stowasser et al.

8.1Gear

The RMT8 was used to characterise the macrozooplankton community in the Western Corebox in 200m oblique trawls and target trawls (Table – RMT net events). Target trawls were undertaken on krill swarms identified from the EK60. In oblique trawls net 1 was opened near the surface (10-20m) and the net deployed to 200m (where water depth was sufficient) before closing and net 2 opened at 200m depth and closed near the surface (10-20m). The choice of deployment type depended on the task. Target hauls were made to supply the WCB team with *Euphausia superba* (Antarctic krill) for length frequency measurements and Franki Perry (PhD student at Plymouth University) with krill for reproductive studies and other macrozooplankton for lipid studies. Krill and other zooplankton were furthermore sampled for micro- and nano-plastic incubation experiments (PhD students Kirstie Jones-Williams, University of Cambridge and Elisa Bergami, University of Siena, Italy respectively) as well as for a feeding study on Southern Right Whales in South Georgia waters (Gabi Stowasser and Jennifer Jackson, BAS). Oblique trawls were only undertaken at the Western Core Box CTD positions.

8.2 Catch sorting and processing

Oblique hauls

For the oblique hauls the total catch of net 2 (200m – surface) was sorted and quantified. Numbers caught and total weight were obtained for each species. For some groups specific identification was not possible and identification will be verified through re-examination in the laboratory. All material collected in net 1 (surface – 200m) was preserved in 4% formalin. All data were recorded in an Excel database.

Targeted hauls

The catch of targeted hauls was sorted and quantified. Where live *E. superba* were caught samples were taken for incubation experiments. In hauls, where sufficient numbers of *E. superba* were caught, length-frequency data was collected (see chapter on krill length frequency, Sophie Fielding, BAS). Krill total length was measured on 100 fresh krill, using the standard BAS measurement from the anterior edge of the eye to the tip of the telson, with measurements rounded down to the nearest mm (Morris et al. 1988). Maturity stage was assessed using the scale of Makarov and Denys with the nomenclature described my Morris et al. (1988).

Table 14: RMT8 hauls carried out on cruise JR17002.

Event No	Time and Date (GMT)	Latitude	Longitude	Net depth (m)	Action	Haul type
35	05/01/2018 23:29	53° 48.96'S	38° 44.72'W	39.8	Net 1 opened	Target
35	05/01/2018 23:35	53° 49.05'S	38° 44.43'W	32.3	Net 1 closed	Target
35	05/01/2018 23:37	53° 49.08'S	38° 44.33'W	19.9	Net 2 opened	Target
35	05/01/2018 23:38	53° 49.09'S	38° 44.28'W	22.6	Net 2 closed	Target
36	06/01/2018 01:38	53° 50.00'S	39° 08.12'W	17.2	Net 1 opened	W1.2S
36	06/01/2018 02:08	53° 50.93'S	39° 08.76'W	191	Net 1 closed	W1.2S
36	06/01/2018 02:09	53° 50.97'S	39° 08.78'W	200.4	Net 2 opened	W1.2S
36	06/01/2018 02:35	53° 51.77'S	39° 09.35'W	27.2	Net 2 closed	W1.2S
37	06/01/2018 04:58	53° 29.90'S	39° 15.59'W	11	Net 1 opened	W1.2N, net 2 accidentally closed at 200m
37	06/01/2018 05:30	53° 28.97'S	39° 14.06'W	196.7	Net 1 closed	
37	06/01/2018 05:31	53° 28.94'S	39° 14.02'W	195.3	Net 2 opened	
37	06/01/2018 05:58	53° 28.19'S	39° 12.83'W	200	Net 2 closed	
47	08/01/2018 01:42	53° 54.95'S	37° 19.58'W	40.6	Net 1 opened	Target
47	08/01/2018 01:45	53° 55.02'S	37° 19.67'W	30.4	Net 1 closed	Target
47	08/01/2018 01:46	53° 55.05'S	37° 19.70'W	31.5	Net 2 opened	Target
47	08/01/2018 01:47	53° 55.08'S	37° 19.74'W	27.2	Net 2 closed	Target
48	08/01/2018 02:16	53° 54.84'S	37° 19.59'W	35.8	Net 1 opened	Target
48	08/01/2018 02:21	53° 54.97'S	37° 19.73'W	35.5	Net 1 closed	Target
48	08/01/2018 02:21	53° 54.99'S	37° 19.77'W	35	Net 2 opened	Target
48	08/01/2018 02:27	53° 55.12'S	37° 19.99'W	35.2	Net 2 closed	Target
54	08/01/2018 23:37	53° 46.57'S	38° 34.14'W	20.7	Net 1 opened	Oblique, net 2 failed
54	09/01/2018 00:02	53° 47.12'S	38° 35.09'W	163.1	Net 1 closed	
54	09/01/2018 00:02	53° 47.14'S	38° 35.13'W	161.5	Net 2 opened	
54	09/01/2018 00:21	53° 47.58'S	38° 35.91'W	46	Net 2 closed	
62	09/01/2018 22:17	53° 26.69'S	38° 42.13'W	25.8	Net 1 opened	W2.2N
62	09/01/2018 22:51	53° 25.25'S	38° 41.33'W	192.9	Net 1 closed	W2.2.N
62	09/01/2018 22:51	53° 25.21'S	38° 41.31'W	198.8	Net 2 opened	W2.2N
62	09/01/2018 23:20	53° 24.07'S	38° 40.60'W	29.8	Net 2 closed	W2.2N
63	10/01/2018 05:21	53° 48.10'S	38° 36.88'W	20.4	Net 1 opened	W2.2S
63	10/01/2018 05:47	53° 47.29'S	38° 35.39'W	156.1	Net 1 closed	W2.2S
63	10/01/2018 05:48	53° 47.29'S	38° 35.39'W	156.1	Net 2 opened	W2.2S
63	10/01/2018 06:13	53° 46.50'S	38° 33.91'W	20.7	Net 2 closed	W2.2S
71	10/01/2018 21:26	53° 42.55'S	37° 56.56'W	21.2	Net 1 opened	W3.2S
71	10/01/2018 21:39	53° 42.76'S	37° 57.49'W	102.1	Net 1 closed	W3.2S
71	10/01/2018 21:40	53° 42.77'S	37° 57.55'W	106.2	Net 2 opened	W3.2S

71	10/01/2018 21:53	53° 42.97'S	37° 58.44'W	19.9	Net 2 closed	W3.2S
72	11/01/2018 01:04	53° 46.45'S	37° 31.07'W	24.5	Net 1 opened	Target
72	11/01/2018 01:14	53° 46.47'S	37° 31.78'W	32.8	Net 1 closed	Target
72	11/01/2018 01:14	53° 46.47'S	37° 31.81'W	34.4	Net 2 opened	Target
72	11/01/2018 01:19	53° 46.48'S	37° 32.21'W	23.7	Net 2 closed	Target
73	11/01/2018 01:54	53° 46.45'S	37° 31.15'W	30.7	Net 1 opened	Target
73	11/01/2018 02:04	53° 46.46'S	37° 31.83'W	29.3	Net 1 closed	Target
73	11/01/2018 02:05	53° 46.46'S	37° 31.92'W	30.4	Net 2 opened	Target
73	11/01/2018 02:15	53° 46.46'S	37° 32.67'W	25.5	Net 2 closed	Target
74	11/01/2018 03:09	53° 46.60'S	37° 31.62'W	30.7	Net 1 opened	Target
74	11/01/2018 03:19	53° 46.75'S	37° 32.28'W	26.4	Net 1 closed	Target
74	11/01/2018 03:20	53° 46.78'S	37° 32.38'W	22.3	Net 2 opened	Target
74	11/01/2018 03:30	53° 47.00'S	37° 33.09'W	28.5	Net 2 closed	Target
75	11/01/2018 04:45	53° 46.55'S	37° 31.50'W	37.6	Net 1 opened	Target
75	11/01/2018 04:55	53° 46.79'S	37° 32.24'W	34.1	Net 1 closed	Target
75	11/01/2018 04:56	53° 46.79'S	37° 32.26'W	33.3	Net 2 opened	Target
75	11/01/2018 05:06	53° 47.01'S	37° 32.99'W	34.7	Net 2 closed	Target
86	11/01/2018 20:04	53° 48.02'S	37° 34.61'W	112.1	Net 1 opened	Target
86	11/01/2018 20:14	53° 47.99'S	37° 35.35'W	94.9	Net 1 closed	Target
86	11/01/2018 20:14	53° 47.99'S	37° 35.41'W	92.7	Net 2 opened	Target
86	11/01/2018 20:24	53° 47.94'S	37° 36.15'W	95.4	Net 2 closed	Target
100	13/01/2018 00:35	53° 21.69'S	38° 04.94'W	19.9	Net 1 opened	W3.2N
100	13/01/2018 01:09	53° 20.47'S	38° 06.66'W	199.1	Net 1 closed	W3.2N
100	13/01/2018 01:10	53° 20.44'S	38° 06.71'W	197.8	Net 2 opened	W3.2N
100	13/01/2018 01:39	53° 19.43'S	38° 08.17'W	21	Net 2 closed	W3.2N

Table 15: Invertebrate and fish species sampled and preserved from RMT8 hauls in the Western Core Box area during cruise JR17002

Project	**Species**	**Event-Net**	**Number sampled**	**Storage**
Krill reproduction and zooplankton lipids (Franki Perry)	*Themisto gaudichaudii*	71-2	45	-80°C
	Euphausia frigida	71-2	16	-80°C
	Euphausia superba	36-2	1	Incubation experiments
	Euphausia superba	47-1	1	
	Euphausia superba	47-2	5	
	Euphausia superba	48-1	4	
	Euphausia superba	48-2	1	
	Euphausia superba	54-1	1	
	Euphausia superba	72-1	11	
	Euphausia superba	73-2	14	
	Euphausia superba	74-1	5	
	Euphausia superba	86-1	6	
	Euphausia superba	86-2	10	
Micro- and Nanoplastics	*Themisto gaudichaudii*	55-2	100	Incubation experiments
	Euphausia triacantha	54-1	12	
	Euphausia superba	72-1	11	
	Euphausia superba	72-2	22	

(Kirstie Jones-Williams and Elisa Bergami)	*Euphausia superba*	73-1	30	
	Euphausia superba	73-2	75	
	Euphausia superba	74-1	30	
	Euphausia superba	74-2	30	
	Euphausia superba	75-1	42	
	Euphausia superba	86-1	63	
	Euphausia superba	86-2	12	

9 The impact of Microplastics and Nanoplastics on Antarctic Zooplankton

Elisa Bergami, Kirstie Jones-Williams, Clara Manno

The presence of microscopic polymeric fragments has been recently documented in Antarctic surface waters and sediments. However, the impact of these anthropogenic stressors on Antarctic zooplankton is still poorly explored.

Antarctic krill (*Euphausia superba*) is a key species of the Antarctic marine food webs, widespread in the Southern Ocean and any stress affecting its presence and abundance, such as marine debris, could have dramatic consequences on the Antarctic marine ecosystems.

During this cruise, the individual impacts of micro- (MPs) and nano-sized plastics (NPs) on *E. superba* have been investigated using micro- and nano-sized polystyrene (PS) spheres in laboratory experiments. Bare PS microspheres (average size of 10 µm) as well as carboxylated (PS-COOH, nominal size of 60 nm) and amino-modified (PS-NH_2, nominal size of 50 nm) PS NPs were used. Moreover, yellow-green fluorescently labelled PS MPs and PS-COOH NPs were used to evaluate the biodisposition within the organisms.

On board JCR vessel, actively swimming adults of *E. superba* were collected by RMT8 (Events from 72 to 75) and immediately moved to the cold room (at +4°C) in buckets filled with 0.22 µm filtered seawater. After 18 – 24 h acclimation period, krill adults of similar size were selected for incubation experiments with MPs and NPs.

9.1 Short-term Antarctic Krill experiment

Short-term exposure (48 hours) experiments were carried out in 1 L polymeric bottles containing MP or NP suspensions prepared in 0.22 µm filtered seawater. Control (organisms in filtered seawater only) and experimental groups were run in six replicates, each containing 2 animals. The experiments were carried out in the cold room under controlled conditions (temperature of 4°C and photoperiod of 16:8 h light:dark).

For PS MPs experiments, in addition to the control, a low and high dose of microplastic was tested, differing

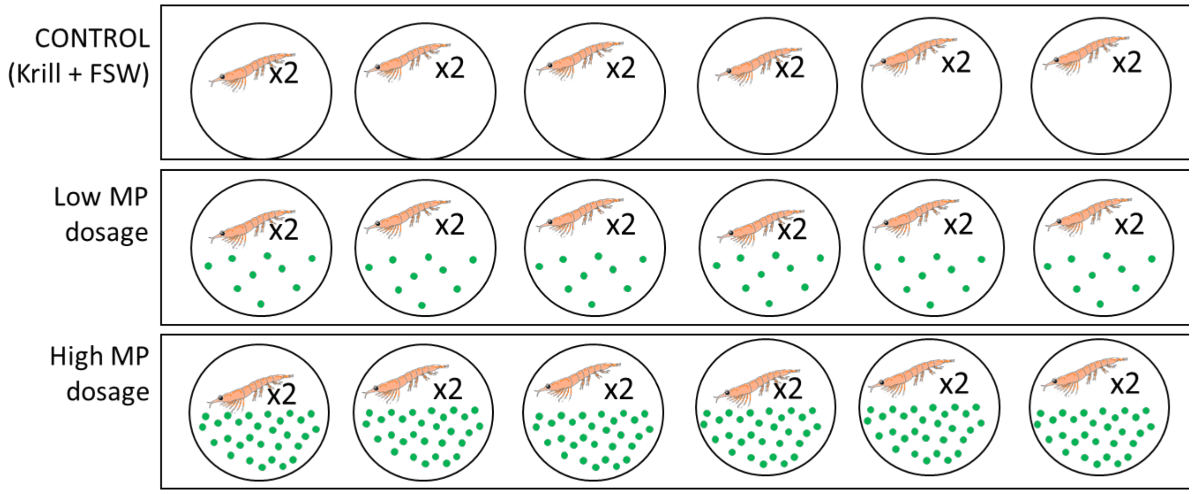


Fig. 8 Schematic of short term microplastic experiment (High Dose: 10,000particles mL-1; Low Dose: 100 particles mL-1, FSW: 0.22 µm filtered seawater.

by two orders of magnitude (100 particles mL-1 and 10 000 particles mL-1 respectively). These concentrations were based on work by Cole et al., 2015 which ascertained which looked to ascertain a toxicity curve for microplastic dosage on the copepod *Calanus helgolandicus* based on testing a logarithmic range of polystyrene concentrations (fig. 8)

For PS NPs experiments, 2.5 µg/mL PS-COOH and 2.5 µg/mL PS-NH_2 were tested in line with the previous experiments performed with *E. superba* juveniles during the past cruise JR16003. One additional bottle containing only 0.22 µm filtered seawater without organisms was considered as reference for microbiology analysis in short-term experiments with NPs. Animal behaviour, moulting and mortality rate were monitored at 1 and 2 d. At the end of the exposure (at 2 d), specimens were immediately stored at -80°C for lipid content and genetic analysis, for MP and NP experiments respectively. Dead organisms were kept frozen as well. Moreover, any moults and faecal pellets (FPs) produced by krill adults during the incubation were collected and preserved in ethanol at room temperature for further analysis. After NP experiments, the seawater from each experimental group was filtered at 0.22 µm using a vacuum pump filtration system and filters (in duplicate) stored at +4°C and -20°C to characterise the bacteria associated to NP exposure. Similarly, following the MP experiment, the remaining seawater from each sample (n=18) were filtered using the same protocol, but containerised and have been taken back to Cambridge for analysis.

9.2 Long-term Antarctic Krill experiment

Long-term exposure (5 d) experiments were carried out in 5 or 6 L buckets containing MP or NP suspensions in 0.22 µm filtered seawater. Control (organisms in filtered seawater only) and experimental groups were run in triplicate, each containing 5 animals. The experiments were carried out in the cold room under controlled conditions (temperature of 4°C and photoperiod of 16:8 h light:dark). Instant microalgae cultures (TP1800, ISO1800 and Pavlova 1800, Reed Mariculture U.S.) were supplied as feeding at the final concentration of 10^5 cells/mL at the start of the experiments and after 3 d. After the first 2 d of exposure, 0.22 µm filtered seawater was aerated, although the O_2 supply was intermittent owing to equipment limitations. Following the same motivation for the short term PS MP incubation, low and high MP dosages (100 and 10000particles mL-1 respectively) were tested.

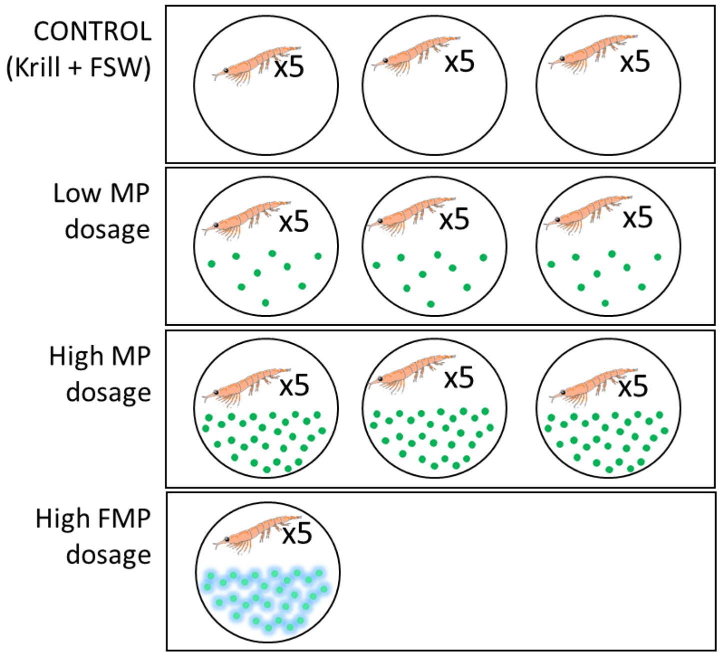


Fig. 9 Schematic of the experimental design of the Antarctic krill experiments performed using micro- and nano-sized polystyrene

For PS NPs experiments, PS-COOH and PS-NH_2 were tested at 0.5 µg/mL, which was chosen according to our previous findings on the brine shrimp *Artemia franciscana* exposed to PS NPs.

Animal behaviour, moulting and mortality rate were monitored each day. At 5 d of exposure the experiments were stopped, when krill started to die in the buckets. Specimens were immediately stored at -80°C for lipid content and genetic analysis, for MP and NP experiments respectively. Dead organisms were kept frozen as well. Moreover, any moults and faecal pellets (FPs) produced by krill adults during the incubation were collected and preserved in ethanol at room temperature for further analysis.

Table 14 Details of the experiments performed using Micro- (MPs), Nanoplastics (NPs) and Ocean Acidification (OA) treatments during the cruise with different model organisms: and amphipod *T. gaudichaudii*, Antarctic krill *E. superba* and pteropod *Limacina retroversa.*

Experiment	Species	Ev.	Latitude Longitude	Ev. Date	Treatment	Duration	n individual / replicate	n replicate
amp-exp	*T. gaudichaudii*	54	-53.46.57 -38.3414	08/01/ 2018	MPs	4 d	5	3
krill-ST-exp	*E. superba* adults	72–75	-53.4645 -37°.3107	10/01/ 2018	MPs, NPs	2 d	2	6
krill-LT-exp	*E. superba* adults	72–75	-53.4701 -37.3299	10/01/ 2018	MPs, NPs	5 d	5	3
pt-exp	*L. retroversa* juveniles	106	-52.7851 -40.151	14/01/ 2018	MPs + OA	2	10	3

9.3 Antarctic Amphipod Incubation

A recent study by Dawson et al., 2018 evidences the ability of Antarctic krill to fragment virgin polyethylene microbeads into nano sized particles. To date, there have been no investigations of whether the same capabilities exists for Themisto in spite of its ubiquitous nature in planktonic ecosystems.

One incubation experiment was set-up to investigate whether *Themisto* can cause the fragmentation of pristine polystyrene microspheres through the physical interaction. 30 healthy *Themisto* of similar size were taken after a 48 hour acclimation period. Five actively swimming *Themisto* with all appendages intact were placed into each incubation jar (1 L glass mason jars, hermetically sealed with orange synthetic rubber o-rings). Three jars were used for each treatment (Fig. 10), with those containing microplastics using a high dosage (10,000 particles/mL). All jars were filled with 1000Ml of FSW.

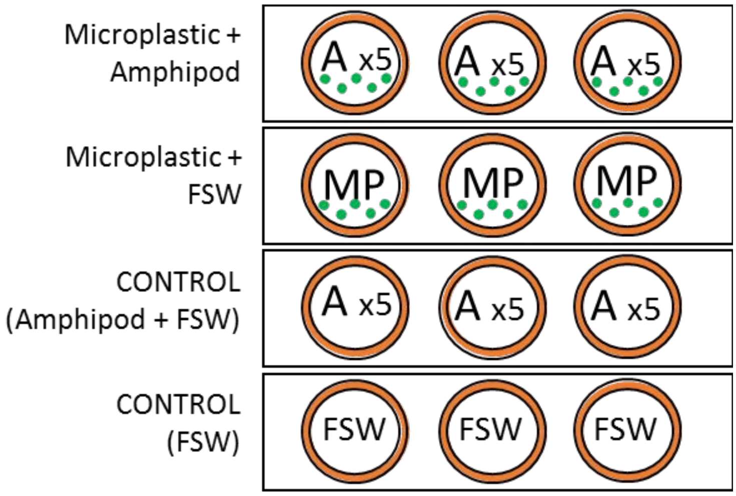


Fig. 10 Schematic of Themisto incubation set-up with 2 main treatments and 2 controls.

The incubation was kept in a temperature controlled environment (4°C) with a photoperiod of 12:12h light:dark hours. For each change of photoperiod, observational notes were made on behaviour, any mortalities or moults were removed from the sample and frozen at -80°C. Each jar was inverted gently three times to promote redistribution of plastics in the jars and prevent permanent settling.

On the fourth and final day, Themisto were removed and frozen at -80°C. The remaining solute was filtered through 0.2 µm micropore filter disks and subsequently air dried for 12 hours before being sealed and taken back to Cambridge for analysis. Moults and both dead and live animals were preserved in the -80°C freezer, with faecal pellets preserved in buffered ethanol in 5ml eppdendorf tubes.

9.4 Synergistic effects of ocean acidification and microplastics on pteropods

Many laboratory studies on marine zooplankton show physical effects such as increased immune response, reduced food consumption, reduced fecundity, and negative impacts on next generations and depletion of energy reserves after ingestion of microplastics. There have been no publications to date, which look to measure these effects on Antarctic Krill. Similarly, there have been no publications investigating microplastics effects on pteropod survivability. However the survivability of pteropods to ocean acidification has been an area of extensive research owing to their production of an aragonite shell, a more soluble form of calcium carbonate, which is particularly vulnerable to ocean acidification. When considering the real impact of a stressor such as increased acidification on pteropods, the literature is increasingly noting the need to test within a realistic suite of environmental parameters. To this end, there have been a number of multi-stressor experiments on pteropods, looking at the interplay of acidification, warming temperatures and/or sea water freshening. As a key zooplankton in the Southern Ocean, it is necessary to include them in our investigations of the impact of plastics on zooplankton in this region. To investigate whether pteropods ingest microplastics, it is therefore necessary to assess the combined effects of these with acidified waters.

Figure 11- 50 ml falcon tube with event 106 zooplankton sample fixed in 4% formalin. Main biomass consisting of *Limacina retroversa* pteropods.

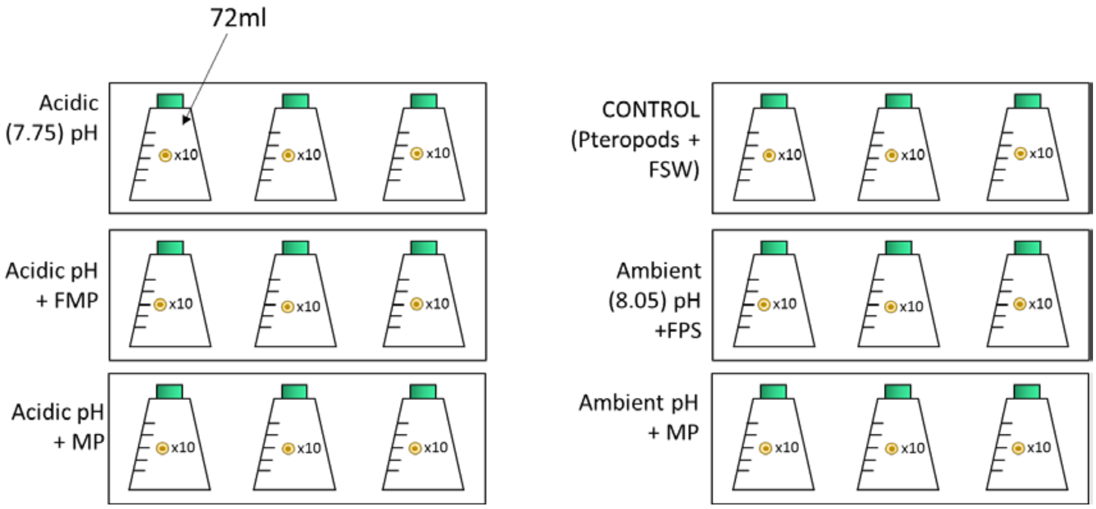
MUDL as BONGO Net

The upward facing BONGO component of the MUDL net was deployed 13 times (table 15). The main purpose of these nets was to capture healthy pteropods for incubation. These de0ployments used a 200µm mesh net, deployed opportunistically at 50 and 100m. Of these deployments, only the sample from Event 106 was used. This sample largely contained *Limacina retroversa*. A subsample was taken (n>200) and kept in 250 ml beakers containing 0.22 µm filtered sea water in the cold lab (4ºC) to acclimate for 20 hours. These were then incubated in a range of treatments (fig. 12). The remaining sample was preserved in a 50 mL falcon tube in 4% formalin (fig 11).

48 Hour Incubation

The survivability of pteropods to ocean acidification has been an area of extensive research owing to their production of an aragonite shell, a more soluble form of calcium carbonate, which is particularly vulnerable to ocean acidification. When considering the real impact of a stressor such as increased acidification on pteropods, the literature is increasingly noting the need to test within a realistic suite of environmental parameters. To this end, there have been a number of multi-stressor experiments on pteropods, looking at the interplay of acidification, warming temperatures and/or sea water freshening. As a key zooplankton in the Southern Ocean, it is necessary to include them in our investigations of the impact of plastics on zooplankton in this region. To investigate whether pteropods ingest microplastics, it is therefore necessary to assess the combined effects of these with acidified waters.

Solutions of filtered seawater (0.2um) were made up with five different treatments and a control, all in triplicate (Fig. 12). 70 ml flasks were filled to the top (72mL) and 10 healthy pteropods were collected by pipette and dispensed in each flask. The samples were then floated in a temperature controlled incubation tank (4.2ºC) and mortality was checked at 24, 36 and 48 hour intervals. pCO2 (partial pressure of CO2) and Ω ar (aragonite saturation state) were obtained using CO2SYS to provide acidified conditions (pH 7.75), based upon conservative estimates of pCO2 projections for 2100.



Figue 12 Schematic of incubation set-up. (FMP: fluorescent 10 µm polystyrene microsphere, MP: Bare 10µm polystyrene microspheres).

After 48 hours, pteropods were removed from their flasks and placed under the stereomicroscope into glass wells. At this stage, photographs were taken using a mounted camera and video footage was captured indicating physical interaction between MP spheres and the pteropod, showing the animal actively taking up the plastic and subsequently forcibly ejecting it. The 10 individuals from each treatment were washed three times in distilled water and air dried on geological slides before being packaged and returned to Cambridge. The remaining specimens were preserved in 70% ethanol in 5 ml Eppendorf tubes.

Table 15 BONGO deployment data.

Time	Latitude	Longitude	Event No	Water depth	SST	Surface Salinity	Transmittance Surface	Chlorophyll	PAR	Sample depth	Comment
17/01/2018 00:30	-55.2484	-41.2251	116	3293.87	4.0324	33.7659	0.761989	7.11828	1	100	BONGO at depth
16/01/2018 16:42	-55.2483	-41.2249	112	3292.94	3.7063	33.7689	0.761322	5.17764	1239	100	BONGO at depth
16/01/2018 16:34	-55.2483	-41.2249	111	3292.8	3.8235	33.7756	0.762053	4.51464	1779	50	BONGO at depth
14/01/2018 01:07	-52.7851	-40.151	106	3779.34	5.3421	33.798	0.699096	3.04356	1	50	BONGO at depth
12/01/2018 19:59	-53.7983	-37.9332	98	289.44	3.845	33.7581	0.588313	11.99484	234.4	50	BONGO at depth
12/01/2018 19:47	-53.7983	-37.9331	97	290.48	4.0234	33.7567	0.567585	13.02444	445.6	50	BONGO at depth
06/01/2018 14:11	-53.7987	-37.9448	40	321.29	3.5613	33.7907	0.742833	11.2554	904.4	50	BONGO at depth
06/01/2018 14:04	-53.7987	-37.9448	39	319.46	3.5601	33.7899	0.740185	11.19144	431	50	BONGO at depth
04/01/2018 16:05	-52.8288	-40.1634	24	3796.44	5.7668	33.8357	0.857533	0.76752	1762	100	BONGO at depth
04/01/2018 15:55	-52.8288	-40.1634	23	3795.46	5.7176	33.8212	0.85226	1.61304	1813	50	BONGO at depth
03/01/2018 21:00	-52.8126	-40.1643	18	3796.23	5.2917	33.8344	0.848579	2.16684	475.6	200	BONGO at depth
03/01/2018 20:47	-52.8126	-40.1643	17	3793.15	5.1715	33.83	0.846879	2.12628	571.4	50	BONGO at depth
03/01/2018 20:38	-52.8126	-40.1643	16	3790.39	5.2886	33.842	0.848321	2.145	588	50	BONGO at depth

9.5 Microplastic Surface Sampling – NEMO

Microplastic samples were collected from two transects in the Southern Ocean. The first begun at the nearest opportunity outside of the Falkland Islands, transiting due west, sampling sample either side of the polar front (data to be analysed later to identify the approximate location of the front during this summer season (2017/2018)). Deployments aimed to be every 12 hours, but were weather dependent and often opportunistic (table 3).The second transect provides unique insight along the northern most tip of the Western Antarctic Peninsula, collecting in open water and in colder ice influenced waters moving southward. Both transects used the same sampling protocol outlined below, with a concentrated effort around Deception Island (Fig. 13).

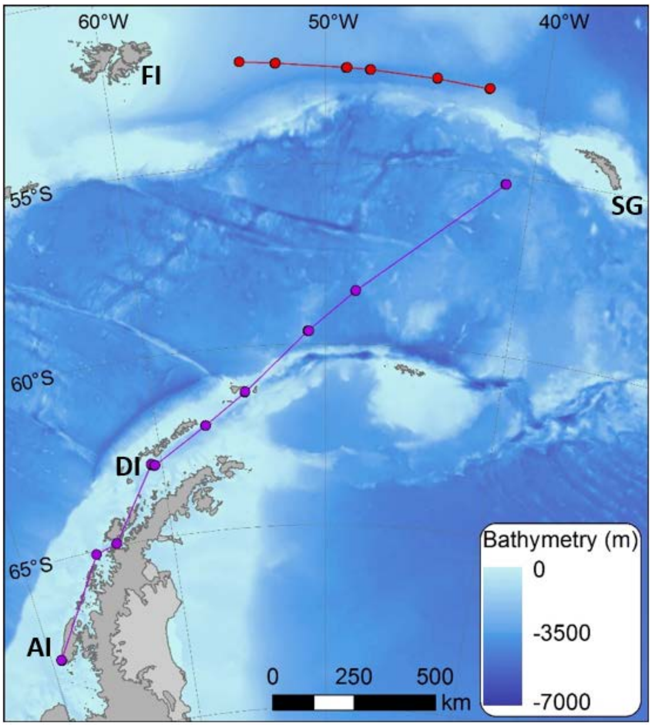


Fig. 13 Map of the microplastic sampling transects. Transect 1 (Red) from the Falkland Islands (FI) to a mooring located west of South Georgie (SG). Transect 2 (Purple) from a second mooring located SW of SG to Rothera on Adelaide Island (AI) via Deception Island (DI). Markers indicate net deployments. Lines represent sampling with underway pump.

9.6 Surface Sample Collecting

The NEMO (NEuston Modified) net was built in the field by mounting a HydroBios microplastics sampling net inside the larger Neuston sledge, enabling sampling to be carried out in maximum sea state of Beaufort 5 (Fig. 14). A flowmeter was attached to the cross bar at the entrance of the net opening to record flow rate. Ship speed and the net's aperture of $0.6m^2$ has been used to additionally calculate volumetric flow rate. The NEMO was deployed successfully 16 times off the starboard bow. On average, deployments were carried out in Beaufort 4 with moderate conditions (average wind speed= 11.56 knots).

During each sampling period of approximately 30 minutes, the ship transited at a speed of 2-3 knots. In order to limit ship based contamination, the net was lowered into the water approximately 5m off the ship out of the wake. In addition, scrapings of various plastic and paint based sources were taken from the sledge and the surrounding deck (details in sup. material, part I), where the net was stored and deployed from. Spectral analysis using Fourier Transform Infrared technology (FT-IR) will enable identification of these, signalling any possible contamination from the ship

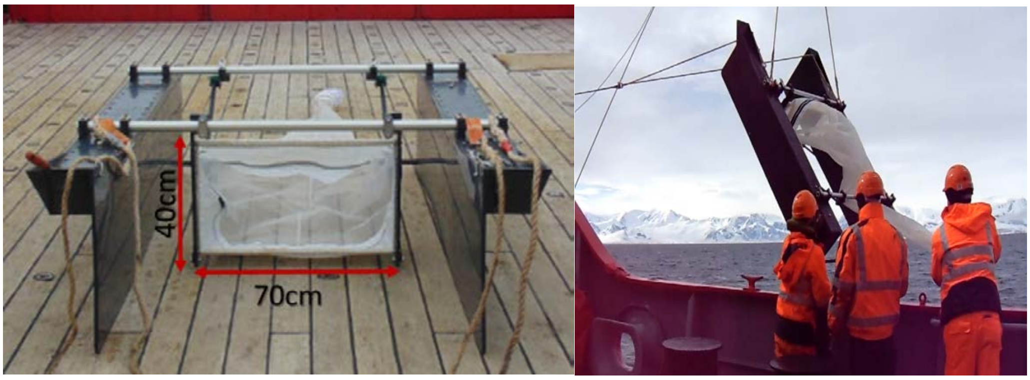


Fig. 14 (Left) Mounting of HydroBios microplastic sampling net into neuston sledge. (Right) Deployment of NEMO net from ship starboard bow

Before being brought back to deck, the net was rinsed using an uncontaminated seawater supply jetting water and feeding any additional detritus into the cod end. The cod end was then taken to the dry laboratory for concentration and storage of sample. The cod end was emptied into a bucket,

Table 16 NEMO net deployment and retrieval times

Time	Latitude	Longitude	Event No	Net No	Wind Speed	Ship Speed	Water Depth	Action
02/01/2018 23:43	-52.6958	-42.546	12	5	9.447082	2.8	2755.24	Net retrieved on deck
02/01/2018 23:10	-52.681	-42.5199	12	5	10.65227	2.4	2810.65	Net in the water
02/01/2018 11:47	-52.5534	-44.9414	10	4	15.31749	2	3001.98	Net retrieved on deck
02/01/2018 11:12	-52.5334	-44.9407	10	4	11.91576	2.3	-*	Net in the water
01/01/2018 23:46	-52.3936	-47.9946	9	3	10.88553	2	3779.52	Net retrieved on deck
01/01/2018 23:10	-52.3936	-47.957	9	3	10.88553	1.9	3803.77	Net in the water
01/01/2018 11:48	-52.3598	-49.0759	3	2	19.49676	1.9	3201.26	Net retrieved on deck
01/01/2018 11:12	-52.3524	-49.0386	3	2	20.02159	2.3	3110.24	Net in the water
31/12/2017 23:45	-52.221	-52.2779	2	1	23.05399	3.3	2459.68	Net retrieved on deck
31/12/2017 23:10	-52.212	-52.2446	2	1	21.73218	2.3	2454.73	Net in the water
31/12/2017 17:26	-52.1378	-53.8669	1	TEST	24.00647	2.5	2009.58	Net retrieved on deck
31/12/2017 17:13	-52.1364	-53.8555	1	TEST	24.86176	2.6	2005.58	Net in the water

- Not recorded

flushing with 0.22 µm filtered seawater (herein, FSW). This was then sieved through a 300 µm steel sieve. Samples were stored in high density polyethylene Nalgene bottles and fixed in a 75% ethanol solution and will remain on the RSS JCR until its return (due approximately June, 2018).

Table 16 NEMO net deployment and retrieval times

Time	Latitude	Longitude	Event No	Net No	Wind Speed	Ship Speed	Water Depth	Actio
22/01/2018 13:22	-67.6807	-69.3119	128	15	1.574514	2.3	175.14	Net retrie on de
22/01/2018 12:59	-67.6674	-69.3205	128	15	2.254859	2.4	179.88	Net ii the wate
21/01/2018 14:25	-64.9311	-63.6641	127	14	19.18574	2.2	559.48	Net retrie on de
21/01/2018 14:01	-65.1012	-65.1204	127	14	7.775376	2.1	257.78	Net ii the wate
20/01/2018 13:25	-62.9392	-60.6456	126	13	1.632829	0.3	156.47	Net retrie on de
20/01/2018 13:00	-62.9531	-60.6443	126	13	3.887688	2.1	160.91	Net ii the wate
20/01/2018 12:43	-62.981	-60.6094	125	12	7.328292	4.6	111.98	Net retrie on de
20/01/2018 12:20	-62.9485	-60.6423	125	12	16.36717	2.3	159.23	Net ii the wate
20/01/2018 11:36	-62.9965	-60.4673	124	11	1.768898	2.1	248.56	Net retrie on de
20/01/2018 11:00	-62.9946	-60.4202	124	11	0.194384	1.8	480.21	Net ii the wate
19/01/2018 22:27	-62.0856	-57.1146	123	10	13.64578	1.8	1657.95	Net retrie on de
19/01/2018 21:55	-62.0898	-57.083	123	10	14.92872	1.7	1593.5	Net ii the wate
19/01/2018 13:36	-61.264	-54.6574	122	9	11.87689	2.1	349.23	Net retrie on de
19/01/2018 13:03	-61.25	-54.6296	122	9	4.257018	2.2	413.37	Net ii the

9.7 Microplastic Sub-Surface Sampling – Underway Pump

An ad hoc sub-surface sampling system was attached to the underway pump outlet located in the dry laboratory. The underway pump takes in seawater from 6 m below sea level at a variable rate. A range of flow rates were measured to provide an upper and lower limit of the intake for any given sampling event. PVC tubing was connected to the radio laboratory pump outlet and secured into a HDPE 1 L Nalgene bottle. The lid was hollowed out and a replaceable piece of 300 µm mesh secured into the opening. This was fastened into a net which had a second smaller mesh (200 µm) temporarily fastened at the opening (Fig. 15). In doing so, the underway pump could be run during the sampling period for each NEMO net and additionally between each location (table 18).

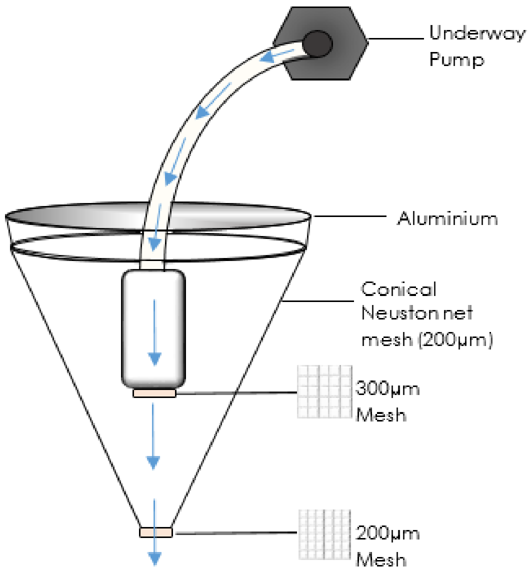


Fig. 15 Microplastic subsurface sampler attached to the underway pump outlet.

Sampling events varied in time but in each case, three petri dishes were opened in the vicinity of the sink area to collect procedural blanks. Once a sampling event had finished, determined either by the commencement or end of a NEMO net deployment, the outlet was switched off and each mesh carefully removed from their fastening.

Samples were placed in aluminium foil "cups" in a foil covered tray to prevent airborne contamination. These samples were folded in half twice and sealed in aluminium foil packaging and stored in the laboratory in a fastened polypropylene plastic container at room temperature. These samples currently reside at Cambridge ready for analysis.

Tale 18 Time and location of underway pump sampling periods.

Date	Time	Latitude	Longitude	Sample_No	Action
31.12.17	10:15	-52.0537455	-54.479462	UP_1Ao	Open pump
31.12.17	10.15	-52.0537455	-54.479462	UP_1Bo	
31.12.17	19:40	-52.22101	-52.27793	UP-1Ac	Close pump
31.12.17	19:40	-52.22101	-52.27793	UP-1Bc	
31.12.17	19:53	-52.1233825	-52.160514	UP_2Ao	Open pump
31.12.17	19:53	-52.1233825	-52.160514	UP_2Bo	
31.12.17	20:31	-52.22101	-52.27793	UP_2Ac	Close pump
31.12.17	20:31	-52.22101	-52.27793	UP_2Bc	
31.12.17	21:28	-52.22855	-52.14904	UP_3Ao	Open pump
31.12.17	21:28	-52.22855	-52.14904	UP_3Bo	
01.01.18	07:30	-52.34066	-49.17128	UP_3Ac	Close pump
01.01.18	07:30	-52.34066	-49.17128	UP_3Bc	
01.01.18	07:55	-52.35237	-49.03861	UP_4Ao	Open pump
01.01.18	07:55	-52.35237	-49.03861	UP_4Bo	
01.01.18	08:44	-52.35984	-49.0757	UP_4Ac	Close pump
01.01.18	08:44	-52.35984	-49.0757	UP_4Bc	
01.01.18	19:52	-52.3902	-47.98615	UP_5Ao	Open pump
01.01.18	19:52	-52.3902	-47.98615	UP_5Bo	
01.01.18	20:44	-52.39363	-47.99458	UP_5Ac	Close pump
01.01.18	20:44	-52.39363	-47.99458	UP_5Bc	
01.01.18	21:40	-52.3991	-47.80501	UP_6Ao	Open pump
01.01.18	21:40	-52.3991	-47.80501	UP_6Bo	
02.01.18	07:43	-52.51751	-45.02734	UP_6Ac	Close pump
02.01.18	07:43	-52.51751	-45.02734	UP_6Bc	
02.01.18	07:56	-52.311729	-44.591157	UP_7Ao	Open pump
02.01.18	07:56	-52.311729	-44.591157	UP_7Bo	
02.01.18	08:45	-52.33147	-44.56977	UP_7Ac	Close pump
02.01.18	08:45	-52.33147	-44.56977	UP_7Bc	
02.01.18	09:42	-52.33637	-44.43005	UP_7Ao	Open pump
02.01.18	09:42	-52.33637	-44.43005	UP_7Bo	
02.01.18	19:57	-52.67354	-42.52573	UP_7Ac	Close pump
02.01.18	19:57	-52.67354	-42.52573	UP_7Bc	
02.01.18	20:01	-52.67621	-42.51309	UP_8Ao	Open pump
02.01.18	20:01	-52.67621	-42.51309	UP_8Bo	
02.01.18	20:44	-52.69625	-42.54684	UP_8Ac	Close pump
02.01.18	20:44	-52.69625	-42.54684	UP_8Bc	
16.01.18	08:50	-55.24931	-41.23291	UP_9Ao	Open pump
16.01.18	08:50	-55.24931	-41.23291	UP_9Bo	
16.01.18	09:25	-55.25013	-41.26527	UP_9Ac	Close pump
16.01.18	09:25	-55.25013	-41.26527	UP_9Bc	
18.01.18	09:56	-58.50813	-48.39979	UP_10Ao	Open pump
18.01.18	09:56	-58.50813	-48.39979	UP_10Bo	
18.01.18	10:35	-58.51915	-48.4172	UP_10Ac	Close pump
18.01.18	10:35	-58.51915	-48.4172	UP_10Bc	

18.01.18	10:50	-58.51915	-48.4172	UP_11Ao	Open pump
18.01.18	10:50	-58.51915	-48.4172	UP_11Bo	
18.01.18	20:00	-59.64092	-50.9165	UP_11Ac	Close pump
18.01.18	20:00	-59.64092	-50.9165	UP_11Bc	
18.01.18	21:00	-59.63838	-50.96195	UP_12Ao	Open pump
18.01.18	21:00	-59.63838	-50.96195	UP_12Bo	
19.01.18	18:50	-61.25001	-54.62956	UP_12Ac	Close pump
19.01.18	18:50	-61.25001	-54.62956	UP_12Bc	
19.01.18	10:00	-61.25001	-54.62956	UP_13Ao	Open pump
19.01.18	10:00	-61.25001	-54.62956	UP_13Bo	
19.01.18	10:35	-61.26238	-54.65435	UP_13Ac	Close pump
19.01.18	10:35	-61.26238	-54.65435	UP_13Bc	
19.01.18	10:42	-61.26675	-54.66166	UP_14Ao	Open pump
19.01.18	10:42	-61.26675	-54.66166	UP_14Bo	
19.01.18	18:50	-62.0898	-57.08295	UP_14Ac	Close pump
19.01.18	18:50	-62.0898	-57.08295	UP_14Bc	
19.01.18	18:55	-62.0898	-57.08295	UP_15Ao	Open pump
19.01.18	18:55	-62.0898	-57.08295	UP_15Bo	
19.01.18	19:25	-62.08607	-57.11143	UP_15Ac	Close pump
19.01.18	19:25	-62.08607	-57.11143	UP_15Bc	
19.01.18	19:48	-62.08559	-57.11461	UP_16Ao	Open pump
19.01.18	19:48	-62.08559	-57.11461	UP_16Bo	
20.01.18	07:50	-62.9946	-60.42017	UP_16Ac	Close pump
20.01.18	07:50	-62.9946	-60.42017	UP_16Bc	
20.01.18	07:55	-62.9946	-60.42017	UP_17Ao	Open pump
20.01.18	07:55	-62.9946	-60.42017	UP_17Bo	
20.01.18	08:25	-62.99654	-60.46728	UP_17Ac	Close pump
20.01.18	08:25	-62.99654	-60.46728	UP_17Bc	
20.01.18	09:10	-62.99074	-60.58087	UP_18Ao	Open pump
20.01.18	09:10	-62.99074	-60.58087	UP_18Bo	
20.01.18	09:44	-62.98246	-60.60524	UP_18Ac	Close pump
20.01.18	09:44	-62.98246	-60.60524	UP_18Bc	
20.01.18	09:55	-62.95309	-60.64428	UP_19Ao	Open pump
20.01.18	09:55	-62.95309	-60.64428	UP_19Bo	
20.01.18	10:25	-62.94078	-60.64559	UP_19Ac	Close pump
20.01.18	10:25	-62.94078	-60.64559	UP_19Bc	
21.01.18	18:45	-64.93797	-63.69269	UP_20Ao	Open pump
21.01.18	18:45	-64.93797	-63.69269	UP_20Bo	
21.01.18	10:50	-65.1012	-65.12038	UP_20Ac	Close pump
21.01.18	10:50	-65.1012	-65.12038	UP_20Bc	
21.01.18	11:00	-65.1012	-65.12038	UP_21Ao	Open pump
21.01.18	11:00	-65.1012	-65.12038	UP_21Bo	
21.01.18	11:25	-64.93109	-63.66408	UP_21Ac	Close pump
21.01.18	11:25	-64.93109	-63.66408	UP_21Bc	
22.01.18	09:40	-67.66737	-69.32052	UP_22Ao	Open pump
22.01.18	09:40	-67.66737	-69.32052	UP_22Bo	

22.01.18	09:50	-67.68068	-69.3119	UP_22Ac	Close pump
22.01.18	09:50	-67.68068	-69.3119	UP_22Bc	

10 KRILL egg production experiment

Frances Perry

Antarctic krill, *Euphausia superba* (hereafter krill) are pivotal to the ecosystem function in the Southern Ocean. Within the Southern Ocean their population centre is found in the south West Atlantic sector (Atkinson *et al.* 2008). This sector is currently the only area in which the krill fishery has been active for the past two decades (Grant *et al.* 2013) and is also the area undergoing the most rapid changes due to climate change (Maksym *et al.* 2012). To better understand Antarctic krill population dynamics and what impact a changing environment may have on them, in addition to how competition between the fishery and other krill predators may function over small scales we must better understand krill reproductive output. Specifically how egg output varies between individual females and the rates of embryonic development success. Furthermore understanding why eggs may fail to hatch and what environmental factors influence will be able to help us predict successful spawning. This knowledge can be used in models to predict reproductive output on larger scales and how the output may fluctuate on multiyear time scales.

The location of the western core box cruise give me the chance to collect krill from an area known for its high density of large reproductively active adults (Tarling *et al.* 2007). And the cold room aboard the JCR was an ideal location to incubate female krill for experimental purposes.

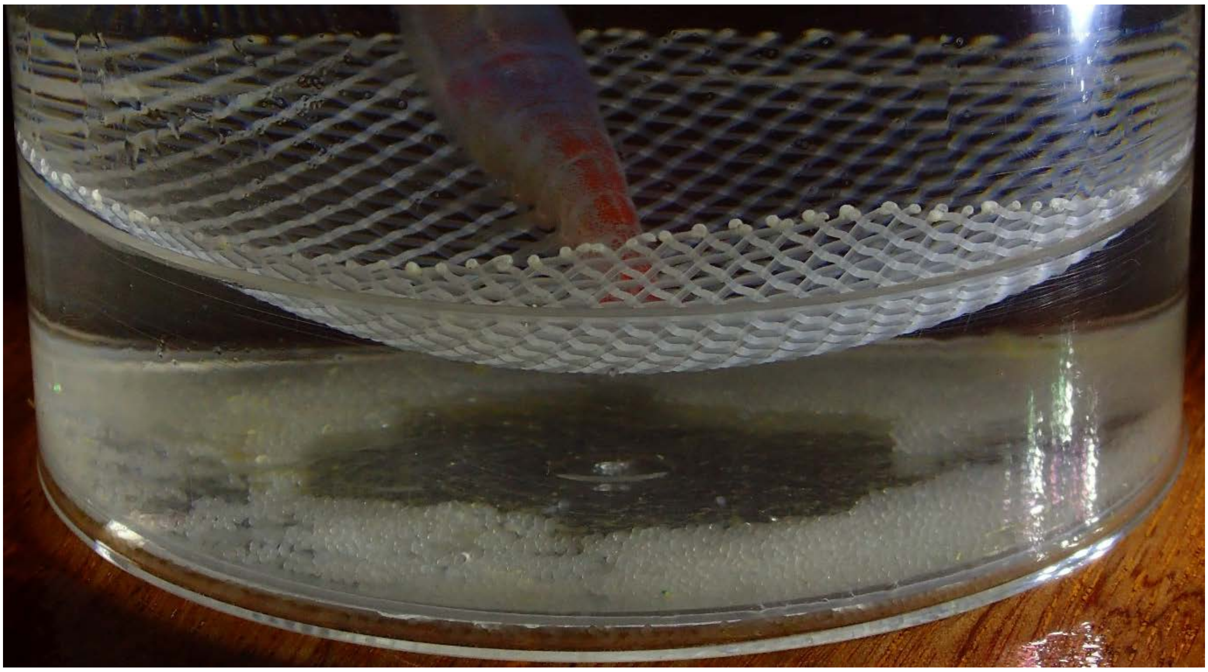
Whilst aboard the JCR my objective was to capture Antarctic krill adults, and to incubate any gravid females until they released eggs. Importantly all the females were incubated separately so that variability in eggs produced from individual females could be analysed. If eggs were released I had two aims; firstly, I wanted to investigate rates of successful embryonic development and the lipid content at different stages of this development. For this experiment I wanted to incubate eggs and subsample them at different stages of development. On return to UK these eggs I would then analyse each of these different stages for both lipid content and rates of successful development, and see how much they varied between females. The second objective was to collect eggs produced from females so they could be frozen immediately and assessed later for lipid content. However, having stated these aims the main challenge with this was to actually catch some gravid females.

10.1 Materials and methods

During the cruise I collected krill from either targeted or non-target trawls using the RMT8 net. Once the krill had been removed from the nets and transferred to white sample buckets in the wet lab I used a small sieve to gently check the gender of the adult krill as well as attempt to determine if the female had any spermatophores attached.

Any krill that fitted the criteria were transferred directly to a 500ml Nalgene pot. These Nalgene containers were then transferred to the krill hotel (aka The Krilton). The Krilton was a large 120l tub, within which there were a number of pieces of plastic downpipe cut to length and all placed vertically. These pipes were just larger than the diameter of the Nalgene pots, and were tall enough to allow six Nalgene tubs to be stacked on top of each other. To stop the Nalgene pots from floating up in the pipes, pots of gravel were used to weigh them down. The Krilton had an inlet and an outlet point to allow water flow through, the inlet being roughly 5cm higher that the outlet. The inlet was connected to the underway sea water supply that comes into the cold stow through a tap in the right hand corner of the sink. The underway sea water was unfiltered and was collected from underneath the ship at a depth of 5m. The outflow from the Krilton was directed straight into the scuppers. The water flowed out of the scuppers fast enough to not flood the cold stow. However, when The Krilton was first set up the filters on the exit of the scuppers were clogged so we had a small flood. This problem was easily solved by clearing the filters, and the problem didn't reoccur for the length of the cruise. All of the Nalgene pots, and guttering contained a large number of holes to ensure good water flow to the krill, without allowing them to escape.

Fig. 16: Krill eggs



The negative buoyancy of the krill eggs means that in natural conditions they sink away from the females. Previous experiments incubating gravid female krill have employed methods of keeping the eggs separate from the females once they've been released to stop cannibalistic consumption of the eggs (Ross & Quetin, 1983; Harrington & Ikeda, 1986; Yoshida et al. 2011). Therefore in this experiment a combination of transparent acrylic discs and 1mm mesh circles were employed to create a false bottom in the Nalgenes so that the eggs could sink out of the reach of the females. When designing a way of keeping the females separate from the eggs in Cambridge we initially used a strip of 1mm mesh to encircle the inside walls of the Nalgene in addition to the acrylic disc and mesh circle. When I was actually incubating krill in the Nalgenes I observed that the krill were getting their antennae caught in this mesh around the sides of the Nalgene. This consequently restricted their movement, and I was worried that it would reduce their health. For this reason I removed the mesh from the sides of all the jars. The reason for this mesh was to create pressure on the acrylic circle to stop it from moving up and down in the jar and crushing the eggs. The mesh circle actually had enough friction on the side of the jar to stop this from happening so the mesh I removed was somewhat redundant any way

Whilst the experiment was running it became clear that the egg separator methodology was flawed in another way. The eggs were checked every 12 hours, but if the females had released eggs they were returned to The Krilton for a further two hours to allow them to finish spawning. However, when the Nalgenes were removed from The Krilton they would naturally empty of water to the level of the aeration holes. When the pots were returned to the water to allow the females to finish spawning the water flow back into the pot was re-suspending the eggs that already been released. The proof that this was definitely occurring was when eggs began appearing in pots that had no krill in. The entire experiment was kept in the cold stow on board the ship, a room that was maintained at 4 °C. The top of the aquaria was covered first with a foam baffle and then with a wooden lid, both of which were tied down. This meant the krill were kept in darkness, except for when they were being checked. The krill in the hotel were then be monitored at midday and midnight for the length of the experiment. During these checks every krill was checked to see if she had produced eggs, moulted or died. Dead krill were removed, as were moults and frozen in the -80°C fridge. If a female had produced eggs then she was left for a further two hours so that she could finish spawning. After this time period the female was removed from the Nalgene, weighed and measured and placed in the -80°C fridge. The eggs were then gently transferred from the Nalgene to an egg counting dish using; a 2l jug, a wash bottle, 45um filtered seawater, a small pipette, small glass watch glass, 200um mesh sieve and an egg counting dish. Once the eggs had been transferred to the egg counting dish they were photographed using Sophie Fieldings Nikon camera and flash gun set up. The photographs were taken so that they could be counted and an average diameter could be determined in post-processing. Once the eggs had been photographed they were either; all transferred to 2ml ependorfs and stored in the -80°C fridge, or, they were divided up and used in an embryonic development experiment. Although the female krill were kept in unfiltered sea water, once the eggs had been removed from the bottom of the Nalgene pots only filtered sea water (45um) was used to transfer them between containers. This was a preventative measure to reduced bacterial contamination. In addition to checking the females in the hotel, a plankton sample was obtained on 65 um mesh attached at the point of ingress on the large aquaria. Each sample was collected for an hour at both midday and midnight. This sample was then moved to the -20°C fridge. From these samples it should be possible to see what plankton were present during the time period of the experiment, and be able to compare the samples collected during the day and during the night.

My egg hatch success experiment was carried out on the bench in the cold room. This meant that the temperature of the cold room 4 °C was the temperature at which the experiment was carried out. The eggs were kept in 15ml falcon tubes that were held in test tube racks partially submerged in water. This partial submersion was an attempt to maintain temperature better. However, this measure would not have stop the temperature fluctuating in the cold room with people opening and closing the door. In total eggs from four females were used for this experiment. The aim was to sample the eggs in triplicate at four different stages of embryonic development (Zhongnan et al. 2011);

Multicellular (12 hours), x3
Gastrula (24-36 hours), x3
Limb bud (72-84 hours), x3
Nauplii (156 hours). X3

} x 2 one for fixing at -80 °C and the other in 2% acid lugols(making 24 falcon tubes in total per egg batch).

As well as each life stage being replicated in triplicate, everything was repeated twice. This was so that each stage could be preserved at -80 °C for lipid analysis as well as in 2% acid lugols for later analysis of embryonic development. It is at this point where I will have to admit a mistake on my part. When preparing for the cruise I had thought that the cold room was being maintained at 0.5 °C. Therefore I had planned on incubating the eggs in the cold room for seven days. This was one more day than was predicted for the eggs to hatch according to Yoshida et al. (2004). However, the true temperature of the cold stow being 4 °C. In George & Strömberg (1985) it was stated that during one of their experiments when one of the aquaria was accidently set to 4.5 °C all embryonic development was inhibited. From the evidence provided from this paper and the fact that I didn't observe any eggs hatching. I must assume that the conditions under which I did my experiment were too warm. When

I analyse the samples later this year I will be able to see if there was any development in the eggs and at what point all development stopped.

Tab 19 Event number of krill female caught

Between the three of us working in the cold stow two incubation experiments were done with Antarctic krill eggs. In total eggs from six different females were incubated. And from all of these experiments none of the eggs hatched. Even those eggs maintained at 0.5 °C and 2.5 °C in temperature controlled aquaria. This is in contrast to other experiments that have been done in the cold room on the JCR where eggs have hatched to nauplii before. Table 19 show the event number from which each adult female was caught. The row numbers denote the number given to each of the different pieces of guttering. Within each of the pieces of guttering there were six Nalgenes each given a letter. These are represented by the letters above each column.

	a	b	c	d	e	f
1	73	74	74	73	73	73
2	74	74	74	74	74	74
3	74	74	48	48	73	48
4	72	72	72	72	72	72
5	72	72	72	72	72	72
6	72	72	72	72	72	72
7	72	72	72	72	72	72
8	72	72	72	72	72	72
9	72	72	72	72	72	72
10	73	73	73	73	72	72
11	73	73	73	73	73	73
12	73	73	73	73	73	73
13	73	73	73	73	73	73
14	73	73	73	73	73	73
15	73	73	73	73	73	73
16	73	73	73	73	73	73

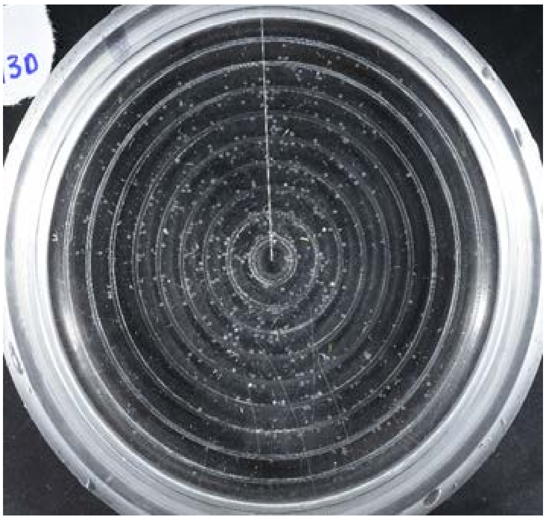


FIG 17 krill egg counting dish

Fortunately in addition to the four females from which I used eggs for this failed experiment another 22 females produced eggs. All of which were successfully photographed and put in the -80 °C freezer so I should still be able to carry out lipid analysis on the egg and the females. In addition to the 26 females who produced eggs I froze another 58 females who had been incubated in The Krilton, as well as a number of other adult female krill caught during other events but would not fit in The Krilton. Another possible way of using the samples collected during the cruise would be to investigate the spermatophores attached to the females. It was clear that a number of the females were carrying spermatophores and some of them were carrying more than one. There is surprisingly little in the literature on spermatophores and their content. From the preserved females and the moults it would be possible to remove some spermatophores for further analysis. This could be an area for further research but I would need to do some more reading before I could determine if it was an avenue worth investigating.

10.2 Improvements

With the aid of hindsight I would make the following changes to the my experiment if I were to repeat it; Alter the procedure for returning the females that had started spawning to The Krilton for a further two hours to allow them to complete spawning. This would stop eggs being re-suspended and lost through the aeration holes when they are returned to The Krilton. However, the aeration holes in the sides of the pots allow a continuous flow of fresh seawater to the krill. To be able to create a method of incubation that allows the females access to fresh sea water at the same time as not allowing the eggs to escape from the pots and giving the females long enough to complete their spawning could be a challenge.

The embryonic development of krill is extremely time sensitive. Checking for eggs every 12 hours means that if the eggs were spawned an hour after the last check the eggs could have progressed through the first multicellular stage before any experiment has even started. This oversight should be reduced considerably before any further experiments are carried out.

The method of removing the eggs from the Nalgene pots is complicated because of the aeration holes in the sides. It involves a lot of handling of eggs. The more handling of the eggs the greater the failure rate of the eggs in species such as *Euphausia pacifica* (Ross, 1981). Harrington & Ikeda (1986) suggested the at *Euphausia superba* eggs are less sensitive to handling than *E. pacifica.* However, in further experiments I would want to create a protocol where eggs could be handled less. This would probably require changing the set of the pots so the eggs couldn't be lost out of the aeration holes. Needs further consideration.

The negative buoyancy of both eggs and faecal pellets meant that they both fell to the bottom of the Nalgene containers. When removing the eggs from the containers it was impossible to be selective between the faecal pellets and eggs. Therefore all the samples contain some faecal pellets that will need removing before any analysis is done. Before repeating this experiment I would want more advice on how to reduce this contamination.

The failure to incubate eggs any eggs in the cold room during this cruise is a bit mysterious. However, I believe the reason I didn't manage to successfully incubate any eggs to the nauplii stage is because the temperature in the cold room was too high. For this reason I would use temperature controlled aquaria for any repeats of this experiment. I would also want to change the method of incubating the eggs. In the falcon tubes even the small numbers of eggs that I was trying to incubate ended up piling up on each other. In the future it may be better to keep all of the eggs in one large kilner jar and then sub-sample from that one jar. This would cut down the amount of egg handling and would allow all of the eggs more space during the incubation period.

Since The Krilton was last used it had been stored outside. This exposure to the elements had made the material brittle. This became apparent when we were securing it in the cold room. The extra pressure on the side of the tank exerted by the ratchet straps caused two large cracks to appear; one by a water intake, and one along one of the longer outer sides. Thanks to the help of the engineers we managed to fix both of these cracks well enough to stop them leaking for the duration of the experiment. However, when the tank was being moved out of the cold stow at the end of the cruise some cracks appeared that will now mean The Krilton is now unusable for another experiment. There is a second Krilton at BAS, which is possibly 100l compared to 120l which could be used as a replacement. However, before this is used it should be thoroughly checked for cracks.

A short poem presented at the science presentations given to the crew, engineers and scientists before the start of science.

New Years Day

It's New Year's Day aboard the JCR,

And I've been asked to tell you what I achieved so far
So I'd like to inform you why I'm here
Apparently it's not suitable to just drink beer.

As a young beaker I've already learned quite a lot
It's a ship not a boat, and the Falklands can be hot!
But don't be alarmed for I have not been lazy
My purpose is not lost and my aims aren't all hazy.

My equipment has been shifting
Through some strenuous lifting
To a place called the cold stow
The ideal place for some krill to grow.

My experiment could be successful
If we catch a net full
Of the key stone species *Euphausia superba*
A small crustacean species that I'm afraid I aim to murder.

Elisa Bergami design

I will be acting hotelier for female krill
From which I'm hoping some eggs will spill
Now you will have to forgive me for a small digression
The next bit is tricky in rhyming expression.

11 eDNA sampling

Vicky Fowler, Sophie Fielding

eDNA samples were collected for a project with Will Goodall-Copestake, with a primary purpose to investigate whether there is a DNA technique to make quantitative estimates of krill density. Samples were collected along the Western Core Box acoustic transects so that bulk water filtration can be compared with acoustic estimates of krill density.

For each sample a 0.6µm filter cartridge (LP200-18-60) was used to filter water for an hour through the Balston-Parker filtration unit. The pump rate was set to 0.7 and a test identified that the pump filtered 5 litres of seawater in 2 minutes and 48 seconds. This same setting was used throughout the cruise, therefore the volume of water filtered per sample is estimated to be 107 litres. Fresh water was passed through the pipe and filtration rig between samples. Nitrile gloves were worn throughout the procedure, and the filter was bagged and placed in the -80C freezer immediately after filtration ceased.

In total 7 samples were collected (Table samples)

Table 20 eDna samples

Time (GMT)	Latitude °	Longitude °	Flow rate	Sampling time (mins)	Location
11/01/2018 17:17	-53.6416	-37.6661	5 litres/168 seconds	60	WCB 4.2 On-Shelf

11/01/2018 14:34	-53.2116	-37.8111	5 litres/168 seconds	60	WCB 4.2 Off-shelf
10/01/2018 18:07	-53.7286	-37.9607	5 litres/168 seconds	60	WCB 3.2 On-shelf
10/01/2018 15:18	-53.2677	-38.1134	5 litres/168 seconds	60	WCB 3.2 Off-shelf
09/01/2018 18:11	-53.4499	-38.6893	5 litres/168 seconds	60	WCB 2.2. off-shelf
09/01/2018 15:55	-53.7707	-38.5888	5 litres/168 seconds	60	WCB 2.2 on-shelf
08/01/2018 18:44	-53.8837	-39.1322	5 litres/168 seconds	60	WCB 1.2 off-shelf

12 Where are they now? Right whales in the South Georgia marine ecosystem

Gabi Stowasser and Jennifer Jackson

Great whales have been subject to centuries of global hunting, first from small boats close to shore, and more recently by offshore factory ships which hunted and processed whales out in the ocean and were responsible for the most intense phase of exploitation of the world's whale stocks. While 20th century whaling rapidly decimated most of the lunge-feeding whales particularly humpback, blue, fin and sei whales, the destruction wrought by a similarly intense fishery for right whales up until the 1850s is not so well known. Right whales were one of the first large whales to be hunted because they are slow moving, calve in sheltered bays and have high fidelity to these calving areas. What catch records exist, suggest this fishery was incredibly intense on their calving grounds and their more accessible offshore aggregations.

In the Southwest Atlantic, right whales were exploited on their coastal calving grounds in Argentina and Brazil; whaling off Brazil began in 1602 and continued until commercial whaling became illegal in 1986. After nearly 400 years of hunting, southern right whales are now calving in these waters again, and for the first time in more than two centuries, they are regularly sighted on their associated high latitude feeding grounds off South Georgia, where they feed on Antarctic krill. Their principal calving ground off Península Valdés is one of the best-studied whale calving grounds in the world, with 40 years of data collection providing estimates of annual abundance and reproductive rates of known individuals through time. Consequently this is the only right whale population for which a direct relationship between high latitude environmental variability and calving ground reproductive success has been uncovered, indicating that climate and food availability off South Georgia influences right whale reproductive rates.

At present almost nothing is known about southern right whale ecology and habitat use on their South Georgia feeding ground, although this area is (i) a significant Southern Ocean krill and biodiversity hotspot, (ii) an area which has experienced significant climate fluctuation, influencing the population dynamics of other well studied krill predators, and (iii) one of the four principal areas where the Antarctic krill fishery operates. No baseline studies of any whale populations foraging in this important ecosystem have been conducted to date, although sightings data and observations from tourist vessels show increasing numbers of whales feeding in this ecosystem. For right whales, such surveys are long overdue and necessary in order to conduct an assessment of whale recovery from four centuries of exploitation (i.e. number and distribution of whales using this feeding ground), and to understand how regional South Georgia climate and habitat influence lower latitude population trends for this population (i.e. linking high latitude sightings, feeding, health status and foraging tracks with life history data available from the calving grounds).

We propose to conduct the first baseline survey of right whales feeding in South Georgia waters spanning 8 weeks of surveys during the austral summer. This survey will commence a crucial program of population monitoring for this species, to understand the population identity, dynamics, abundance and habitat use of right whales feeding in these waters, and link their foraging ecology, health and reproductive status with the low latitude calving grounds off Argentina and Brazil.

As part of this project the aim on the Western Core Box Cruise was the sampling of potential prey species for stable isotope analysis. Invertebrate species collected from RMT8 hauls are listed in Table.

Table 21: Invertebrate species sampled from RMT8, MOCNESS and BONGO catches for stable isotope analysis during JR17002

Species	**Event**	**Net**	**Numbers sampled**
Calanoides acutus	90	3+4 MOCNESS	20
	97	BONGO	20
Euphausia frigida	36	2*	23
	54	1	10
	71	2	10
	72	2	20
Euphausia superba	54	1	3
	72	2	10
	73	1	20
	73	2	20
	74	1	20
	75	2	10
	86	1	20
Euphausia triacantha	36	2	30
	54	1	20
	73	2	1
	75	1	4
	100	2	8
Euphausia vallentini	72	2	3
	73	1	3
	73	2	2
	74	2	4
Euphausiid furcilia	54	1	20
Paraeuchaeta spp.	35	1+2	22
	54	1	10
Rhincalanus gigas	71	2	20
	97	BONGO	20
Salpa thompsoni	100	1	5
	100	2	3

Themisto gaudichaudii	35 54	1+2 1	15 20

* all samples where no specific net type is indicated derive from RMT8 catches

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

In order to establish an isotopic baseline for the depth horizons where zooplankton samples originated from corresponding particulate organic matter (POM) was collected. POM samples were obtained through filtering waters collected by Niskin bottles deployed via a CTD rosette. Water was taken from various depths at each station (Table). All water samples collected from Niskin bottles were processed on-board. Depending on the density of particles varying volumes of seawater per depth were filtered onto 47mm GF/F filters and the filters stored frozen at -80°C.

Table 22: POM samples collected for stable isotope analysis on JR17002

Station	Event	sample depths	latitude	longitude
W2.2N	61	5m, 25m Chlmax (43m), 75m, 125m, 200m, 450m, 750m	53° 25.91'S	38° 41.58'W
WCB Mooring	96	5m, 25m, Chlmax (14m), 75m, 125m, 200m	53° 47.90'S	37° 55.99'W

13 GEAR AND MOORINGS

Bjørg Helen Apeland, Peter Enderlein, Carwyn Davies et al.

General

During JR17002 the WCB and P3 moorings where successfully recovered and redeployed. In addition, the P2 mooring was recovered.

13.1 Mooring at P3

Recovery

The recovery took place on 03/01/2017 at 11.06 using release **2060** to release the mooring**.** The mooring was hooked mid ships and the mooring winch rope attached. The whole rig was recovered by using the mooring winch and a stopper rope on a cleat. The recovery took approx. 2 ½ hours to recover with no problems to report.

Performance

Three CTD's and one ADCP were recovered, the data downloaded and checked.
Seaguard current meter with O2 sensor (shallow and deep): The instrument was successfully recovered and it collected data during the all period of deployment. No sign of corrosion and/or damage was detected. After the download of data, we redeployed both instruments.
Sediment trap (shallow and deep): All the bottles were successfully recovered in both sediment traps. Bottles were packed into vermiculate boxes for storage at +4°C for analysis in Cambridge. The pH of the solution in each bottles was measured and was ranging between 8.00-8.01. This pH values confirmed that the buffer solution was working well and the samples will be suitable for further Ocean Acidification study. We redeployed the sediment traps by suing the original McLane plastic bottles. Bottles in the Deep sediment trap were programmed to rotate each 15-30 days as for the previous year. Shallow sediment trap was deployed to a deeper position (just above the deep sediment trap). Bottle in the shallow sediment trap were programmed to rotate between 3-6days in order to investigate the short time high pulse of carbon flux.
Pro-Oceanus-CO2 sensor was successfully recovered and no sign of corrosion or damage were observed. Data acquisition stopped in April because a mistake in the setting of the instrument. The sensor with the new setting was redeployed as for the previous year.

SAMI-PH was successfully deployed.

PPS was not deployed because during the deploying operation the instrument accidently fall on the deck and several filter support got broken. We learnt from this experience that the PPS does not have an adequate frame to protect the main unit. For the next cruise we are planning to design a system to provide extra protection/support to the delicate part of the instrument (such as the filter platform)

Aquamonitor was not deployed last year because need refurbishment and repair form previous deployment damage. This Aquamonitor was successfully deployed. The 48 plastic bags were filled with 3 different preservative according to the analysis to achieve. Pat of the bags were filled with ethanol 96%, part with formalin 4% and part with mercuric chloride.

Redeployment

The mooring was redeployed on 13/01/18 at 18.47 GMT, with a few adjustments to the previous set-up. The deployment started at 18.47 GMT, buoy first. The weight was finally released at 21.47 GMT at -52.48.18 S, -40.09.54 W, and corrected water depth 3748 m.

Work Carried Out

Acoustic Releases: 93 + 2060

- ✓ New batteries
- ✓ Tested
- ✓ New Linking Bar

Irmarsat Iridium Beacon 13901110, IMEI: 3002340605535030

- ✓ New Batteries
- ✓ Tested

Argos Beacon: SN 280, ID: 60210

- ✓ New Batteries
- ✓ Tested

NOVATECH Combo beacon: R090-020,Ch B, 159.480 MHz

- ✓ New Batteries
- ✓ Tested

CTD 37 SMP 43742: 2426 on main buoy. SN 37-11807

- ✓ Downloaded data, file: L:\cruise_science_work\Mooring P3\CTD 2462
- ✓ New Batteries
- ✓ Set Up Instrument for redeployment → **Instrument redeployed on WCB Mooring**
- ✓ Set real time clock to PC clock (p. 28)
- ✓ Check instruments is ok and clock is set properly by using "DS" command (p. 27)
- ✓ Set up instrument for "Autonomous Sampling" following instructions on page 24. Started at 01/17/18 00.00.01
- ✓ Sample num = 0 automatically makes entire memory available for recording
- ✓ Sample interval: 900 sec

CTD 37 SMP 43742: 4584 below water sampler

- ✓ Download data, file: L:\cruise_science_work\Mooring P3\CTD 4584
- ✓ New Batteries
- ✓ Set up instrument for redeployment

ADCP WHS300-I-UG26: 2967

- ✓ Download data, file: L:\cruise_science_work\Mooring P3\ADCP 2967\P3_16000.000
- ✓ New Batteries
- ✓ Set up instrument for redeployment:
    - Erase data (p.16 WinSC)
    - Start WinSC for set up instrument
    - Set up instrument
        - Number of bins: 30 (1-128)
        - Bin size (m): 8 (0.2-16)
        - Pings per ensamble: 10
        - Interval: 15 min
        - Duration: 550 days
        - Transducer depth: 200 m
    - Save deployment settings
    - Start time: 17/01/18, 00.00.01
    - Set up ADCP real time clock to PC clock
    - Don't verify the compass (needless on a ship)
    - Run pre-deployment test to check instrument

Sediment Trap Shallow: Parflux No: 11966-01 Top

- ✓ New Batteries (14 x C-Cells + 1x 9V Battery)
- ✓ Do NOT remove both batteries at the same time!
- ✓ Always disconnect the cable on the sediment trap first, before unplugging the computer end.
- ✓ Set up sediment trap with sample tubes
- ✓ Downloaded data, file
- ✓ Event 1 of 22 = 01-15-17
- ✓ Event 2 of 22 = 02-01-17
- ✓ Event 3 of 22 = 02-15-17
- ✓ Event 4 of 22 = 03-01-17

- ✓ Event 5 of 22 = 04-01-17
- ✓ Event 6 of 22 = 05-01-17
- ✓ Event 7 of 22 = 06-01-17
- ✓ Event 8 of 22 = 07-01-17
- ✓ Event 9 of 22 = 08-01-17
- ✓ Event 10 of 22 = 09-01-17
- ✓ Event 11 of 22 =10-01-17
- ✓ Event 12 of 22 = 11-01-17
- ✓ Event 13 of 22 = 12-01-17
- ✓ Event 14 of 22 = 12-15-17
- ✓ Event 15 of 22 = 01-01-18
- ✓ Event 16 of 22 = 01-15-18
- ✓ Event 17 of 22 = 02-01-18
- ✓ Event 18 of 22 = 02-15-18
- ✓ Event 19 of 22 = 03-01-18
- ✓ Event 20 of 22 = 04-01-18
- ✓ Event 21 of 22 = 05-01-18
- ✓ Event 22 of 22 = 06-01-18
- ✓ Tested

Sediment Trap Deep: Parflux No: 13176-01 Bottom

- ✓ New batteries
- ✓ Do NOT remove both batteries at the same time!
- ✓ Always disconnect the cable on the sediment trap first, before unplugging the computer end.
- ✓ Set up sediment trap with sample tubes
- ✓ Downloaded data, file
- ✓ Event 1 of 22 = 01-15-17
- ✓ Event 2 of 22 = 02-01-17
- ✓ Event 3 of 22 = 02-15-17
- ✓ Event 4 of 22 = 03-01-17
- ✓ Event 5 of 22 = 04-01-17
- ✓ Event 6 of 22 = 05-01-17
- ✓ Event 7 of 22 = 06-01-17
- ✓ Event 8 of 22 = 07-01-17
- ✓ Event 9 of 22 = 08-01-17
- ✓ Event 10 of 22 = 09-01-17
- ✓ Event 11 of 22 =10-01-17
- ✓ Event 12 of 22 = 11-01-17
- ✓ Event 13 of 22 = 12-01-17
- ✓ Event 14 of 22 = 12-15-17
- ✓ Event 15 of 22 = 01-01-18
- ✓ Event 16 of 22 = 01-15-18
- ✓ Event 17 of 22 = 02-01-18
- ✓ Event 18 of 22 = 02-15-18
- ✓ Event 19 of 22 = 03-01-18
- ✓ Event 20 of 22 = 04-01-18
- ✓ Event 21 of 22 = 05-01-18
- ✓ Event 22 of 22 = 06-01-18

- ✓ Tested

SeaGuard current meter w. O_2 sensor: 1307 Shallow

- ✓ Number of records: 4462, session ended 21.10.01
- ✓ SN: 1307
- ✓ Current meter sensor: 851
- ✓ Optode: 1561
- ✓ The seaguard current meter with O_2 sensor does not output a setup file
- ✓ Deployment settings:
  - o The sampling interval was set to 2 hrs, as this resulted in a deployment time of 560 days. All other settings were left at the manufactures settings. It was checked that the current meter was set in burst mode (optimal for long term battery use). It is assumed a deployment file will be logged on the memory card for download on retrieval.
    - ▪ Data Downloaded, file: L:\cruise_science_work\Mooring P3\SeaGuard 1307
  - o New Batteries.
  - o Started recording 17.01.18, 00.00.01

Seaguard Current meter with O_2 sensor: 1309, Deep

- ✓ SN: 1309
- ✓ Number of records: 4462
- ✓ Session ended 21.59.10
- ✓ Current meter sensor: 851
- ✓ Optode: 1561
- ✓ The Seaguard current meter with O_2 sensor does not output a setup file.
- ✓ Deployment settings:
  - o The sampling interval was set to 2 hrs, as this resulted in a deployment time of 560 days. All other settings were left at the manufactures settings. It was checked that the current meter was set in burst mode (optimal for long term battery use). It is assumed a deployment file will be logged on the memory card for download on retrieval.
  - o Data downloaded, file: L:\cruise_science_work\Mooring P3\SeaGuard 1309
  - o New batteries
  - o Started recording 17.01.18, 00.00.01

SAMI PH

- ✓ Setup
- ✓ Calibration
- ✓ New Battery
- ✓ New Chemicals
- ✓ Downloaded files
- ✓ Remove D.W Bag

PPS

- ✓ New Batteries
- ✓ Set up instrument
- ✓ Filters changed
- ✓ Removed protection cable
- ✓ Mzk plug

AQUA MONITOR

- ✓ Test on the bench
- ✓ Set up instrument
- ✓ Filling new bags with preservatives

PCO_2

- ✓ Testing on the bench
- ✓ Calibration
- ✓ Erase data! (Very important as there is only 2Gig storage)
- ✓ Cleaning membrane and pump
- ✓ Set up instrument
- ✓ Downloaded data file
- ✓ Charge battery clock
- ✓ Change battery units
    - o Need to include foam in housing.

13.2 WCB Mooring

Recovery

The recovery took place on 06/01/2018 at 15.44 GMT using release **2006** to release the mooring**.** The recovery took approx. 2 ½ hours to recover with no problems to report.

Performance

One CTD, and one ADCP were recovered, the data downloaded and checked.
Sediment trap was successfully recovered and no bottles went missed.
Sono.Vault was successfully recovered and redeployed (see 13.4)

Redeployment

The mooring was redeployed on 12/01/18 at 20.39 GMT, the sediment trap was not redeployed. A WBAT with 120 kHz transducer was mounted on the orange buoy. The mooring was deployed buoy first as per drawing below. The weight was finally released at 21.15 GMT at – 53.79801 S, -37.93390 W.

Work done:

Acoustic Releases

- New Batteries
- Tested
- New linking bar
    - o Mooring was recovered with heavy corrosion on both linking bars as well as fixings.
        - ▪ New spares needed x 2:
            - Top linking bar
            - Bottom linking bar
            - Large washer bottom
            - Large washer top
            - Screws top/bottom
            - Bolt with washer + nut

Argos Beacon SM251 ID: 35520

- New Batteries
- Tested

Iridum Beacon

- SN: MOI5U5, IME: 300434060651120
- New batteries
- Tested

NOVATECH Combo beacon:

- New batteries
- Tested

CTD 37 SMP 29579 – 2462

- Download data: L:\cruise_science_work\Mooring_WCB\CTD_1807
- New batteries

- Set up instrument for redeployment
    - Set real time clock to PC clock (p. 28)
    - Check instrument is ok and clock is set properly by using "DS" command (p. 27)
    - Set up instrument for "Autonomous Sampling" following the instructions on page 24. Started at 01/01/18 00.00.01
    - Samplenum=0 automatically makes entire memory available for recording
    - Sample interval = 900.

ADCP WHS300-I-UG161 Serial number: 17273

- Download data file: L:\cruise_science_work\Mooring_WCB\ADCP_17273
- New batteries
- Set up instrument for redeployment
    - Erase Data – NOT DONE!
    - Start WinSC for set up of instrument
    - Set up instrument:
        - Number of bins: 30 (1-128)
        - Bin size (m) : 8 (0.2 – 16)
        - Pings per ensamble: 10
        - Interval: 15 min
        - Duration: 550 days
        - Transducer depth: 200m
        - Save deployment settings.
        - Start time: 01/01/18. 00.00.01 – Start after deployment
        - Set up ADCP real time clock to PC clock
        - Don't verify the compass
        - Run pre-deployment test to check instrument.

Simrad WBT Serial number: 240826 and 120 kHz transducer Serial Number:127

- Download data file from USB drive (not done this time as no previous deployment)
- New Batteries (note battery used was from JR15004 and had previous use on JR15004. Expectation is that ~120 amphours remained in the battery (total life of 128 amphours)
- Setup instrument for redeployment:
    - New batteries
    - Erase USB data stick
    - Start mission planner
    - Send new mission to WBT to include
        - Start time/ End time (to not ping in water) (13/1/2018 03:00 – 26/12/2018 00:00)
        - Ping ensembles including CW/FM pings (15 of each)
        - Event start interval (1 hour)
        - Range 250 m
        - Battery usage = (29.918 remaining out of 128 amphours)
        - Note firmware was upgraded prior to deployment and WBAT is operating using Storage controller FW v2.4.0-130, Storage controller driver v0.6.92, mission controller FW v2.2.5.0, mission controller FPGA v10. These files can only be viewed in EK80 software verion 1.11

Sediment trap:

- ✓ Downloaded data, file
- ✓ Event 1 of 22 = 01-15-17
- ✓ Event 2 of 22 = 02-01-17
- ✓ Event 3 of 22 = 02-15-17
- ✓ Event 4 of 22 = 03-01-17
- ✓ Event 5 of 22 = 04-01-17
- ✓ Event 6 of 22 = 05-01-17
- ✓ Event 7 of 22 = 06-01-17
- ✓ Event 8 of 22 = 07-01-17
- ✓ Event 9 of 22 = 08-01-17
- ✓ Event 10 of 22 = 09-01-17
- ✓ Event 11 of 22 =10-01-17
- ✓ Event 12 of 22 = 11-01-17
- ✓ Event 13 of 22 = 12-01-17
- ✓ Event 14 of 22 = 12-15-17
- ✓ Event 15 of 22 = 01-01-18
- ✓ Event 16 of 22 = 01-15-18
- ✓ Event 17 of 22 = 02-01-18
- ✓ Event 18 of 22 = 02-15-18
- ✓ Event 19 of 22 = 03-01-18
- ✓ Event 20 of 22 = 04-01-18
- ✓ Event 21 of 22 = 05-01-18
- ✓ Event 22 of 22 = 06-01-18

13.3 P2 Mooring at P2 (Not redeployed)

Recovery

The recovery took place on 16/01/2018 at 09.17 GMT using release **1219** to release the mooring**.** The acoustic releases responded straight away and after ranging the mooring successfully a few time, the mooring was released and was within 5min at the surface. The mooring was hooked mid ships and the mooring winch rope attached. The recovery took approx. 2 ½ hours to recover with no problems to report.

Performance

Two CTD's, one ADCP and Aquadoop current meter were recovered, the data downloaded and checked. Sediment traps were successfully recovered and no bottles went missed.

Redeployment

Mooring was not redeployed.

Work Done

ADCP

- Downloaded data, file: L:\cruise_science_work\Mooring_P2\ADCP
- Removed batteries

CTD 4852

- Downloaded data, file: L:\cruise_science_work\Mooring_P2\CTD_4852
- Removed batteries

CTD 4855

- Downloaded data, file: L:\cruise_science_work\Mooring_P2\CTD_4855
- Removed batteries

Current Meter 20222-1

- Downloaded data, file: L:\cruise_science_work\Mooring_P2\Current_Meter_20222-1
- Removed batteries

Sediment traps (shallow and deep)

- ✓ Downloaded data, file
- ✓ Event 1 of 22 = 01-15-17
- ✓ Event 2 of 22 = 02-01-17
- ✓ Event 3 of 22 = 02-15-17
- ✓ Event 4 of 22 = 03-01-17
- ✓ Event 5 of 22 = 04-01-17
- ✓ Event 6 of 22 = 05-01-17
- ✓ Event 7 of 22 = 06-01-17
- ✓ Event 8 of 22 = 07-01-17
- ✓ Event 9 of 22 = 08-01-17
- ✓ Event 10 of 22 = 09-01-17
- ✓ Event 11 of 22 =10-01-17
- ✓ Event 12 of 22 = 11-01-17
- ✓ Event 13 of 22 = 12-01-17
- ✓ Event 14 of 22 = 12-15-17
- ✓ Event 15 of 22 = 01-01-18
- ✓ Event 16 of 22 = 01-15-18
- ✓ Event 17 of 22 = 02-01-18
- ✓ Event 18 of 22 = 02-15-18
- ✓ Event 19 of 22 = 03-01-18
- ✓ Event 20 of 22 = 04-01-18
- ✓ Event 21 of 22 = 05-01-18
- ✓ Event 22 of 22 = 06-01-18

P2 Sediment trap mooring (3200m water depth)

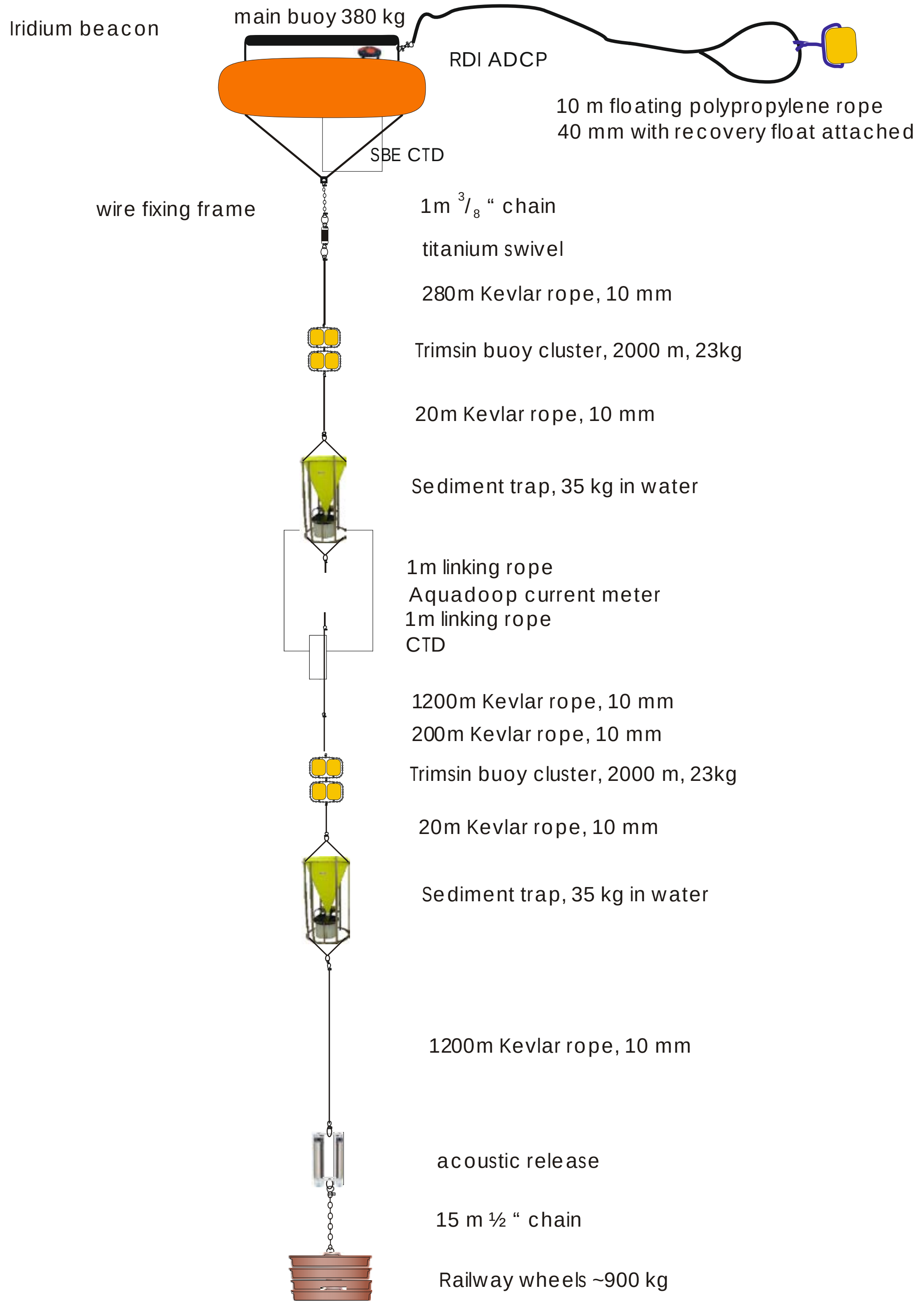


Fig 19: P2- Mooring rig recovered

P3 Sediment trap mooring (3700m water depth)

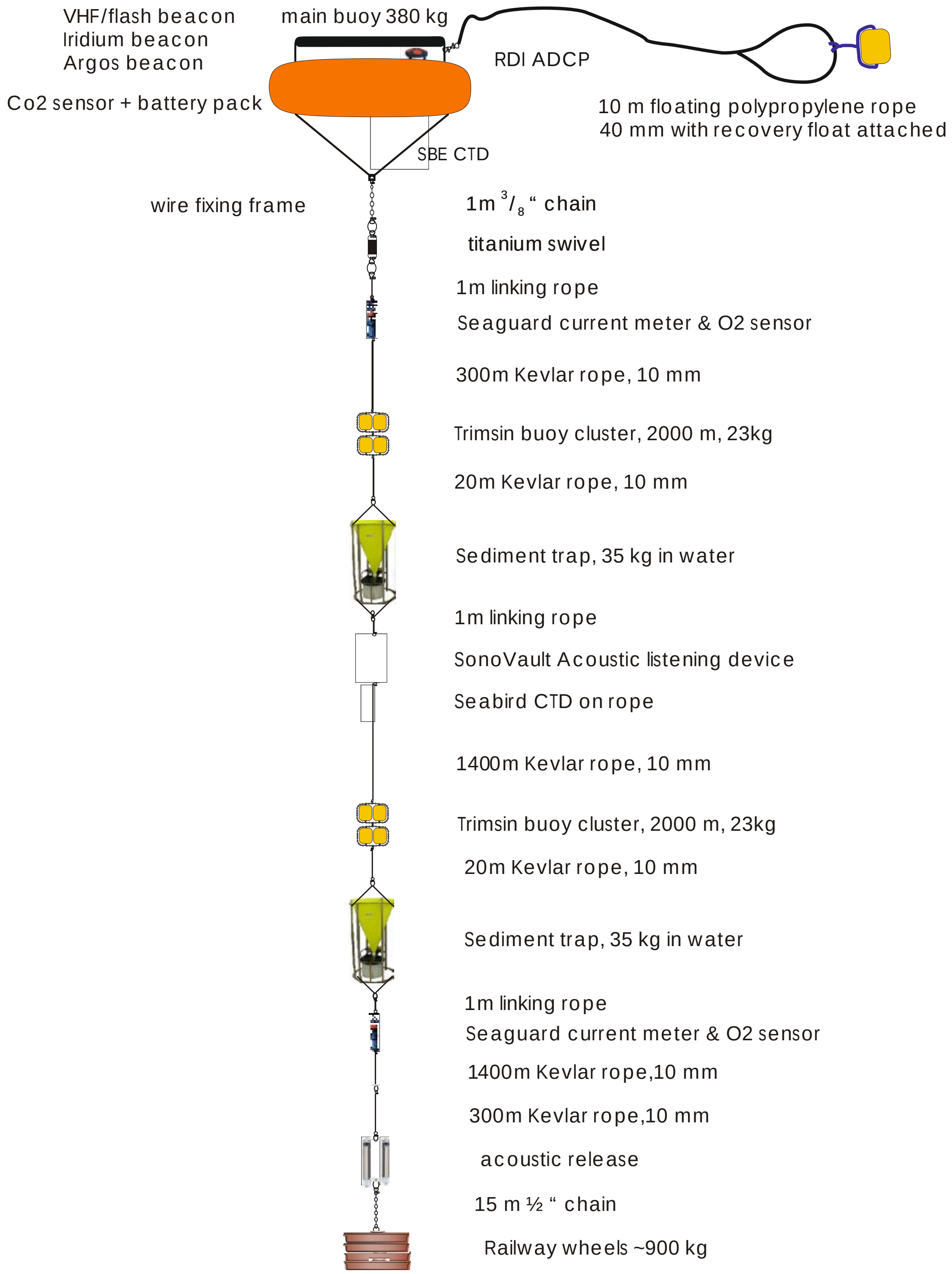


Fig. 20:P3- Mooring rig recovered

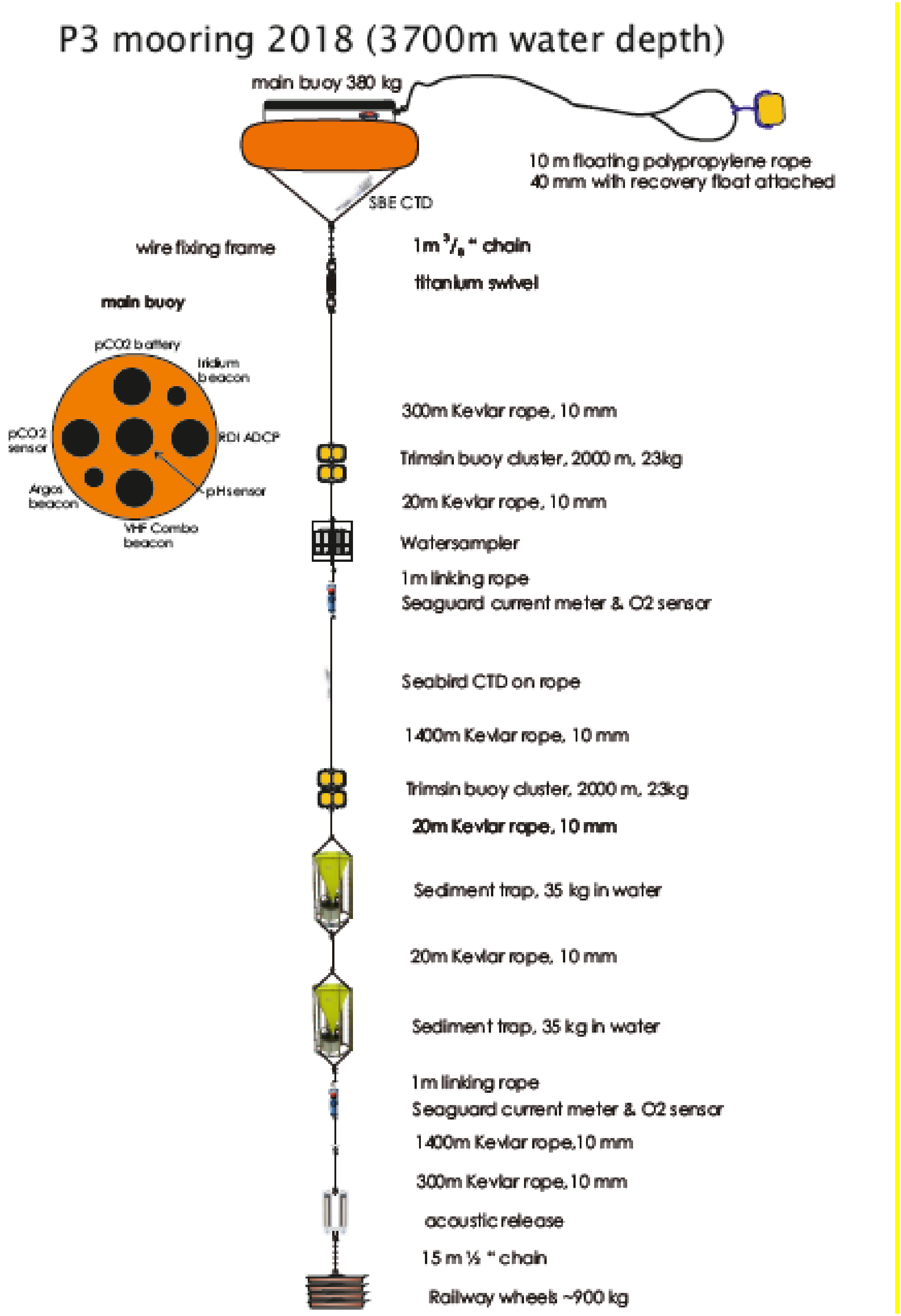


Fig 21: P3- Mooring rig Deployed

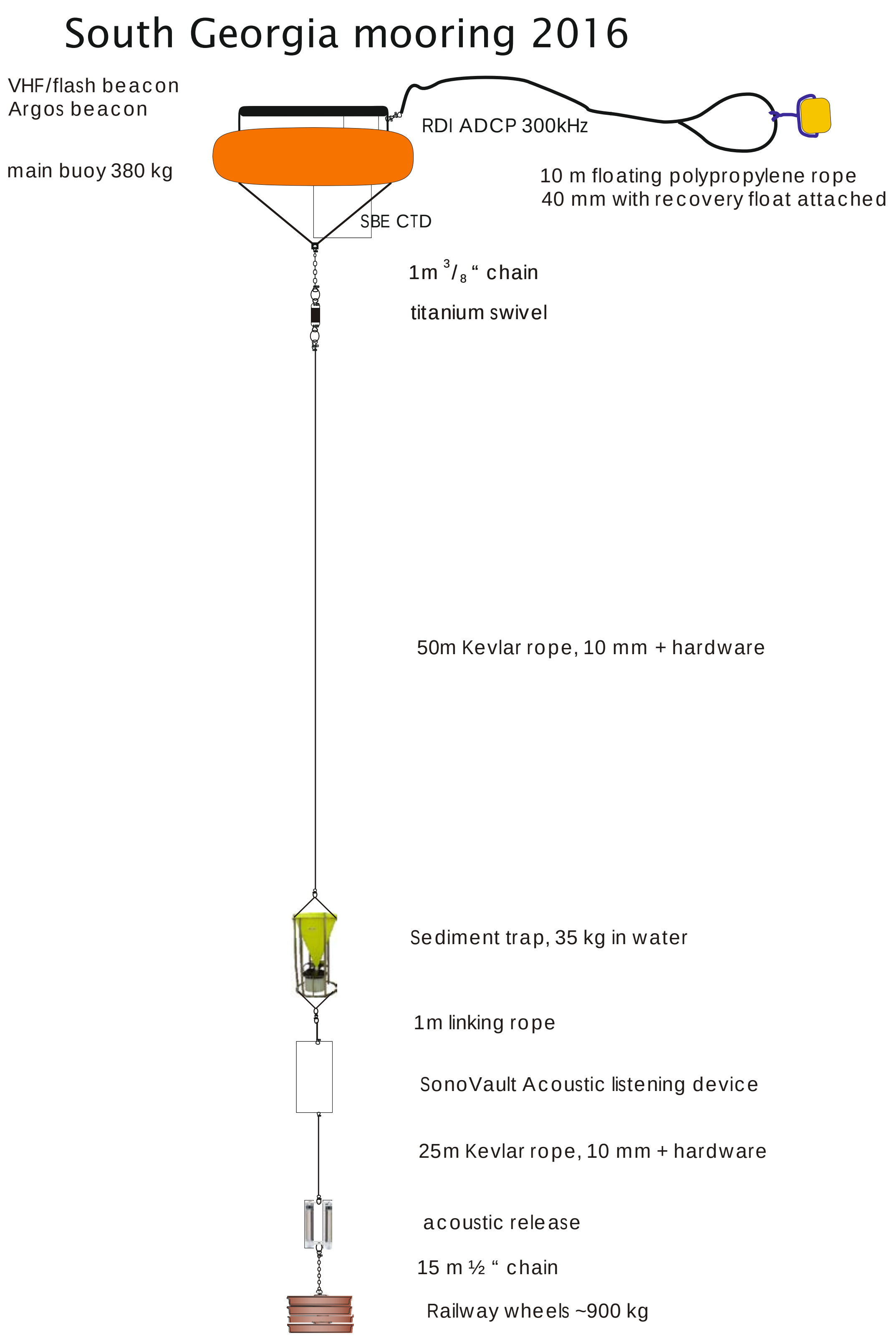


Fig 22: WCB- Mooring rid recovered

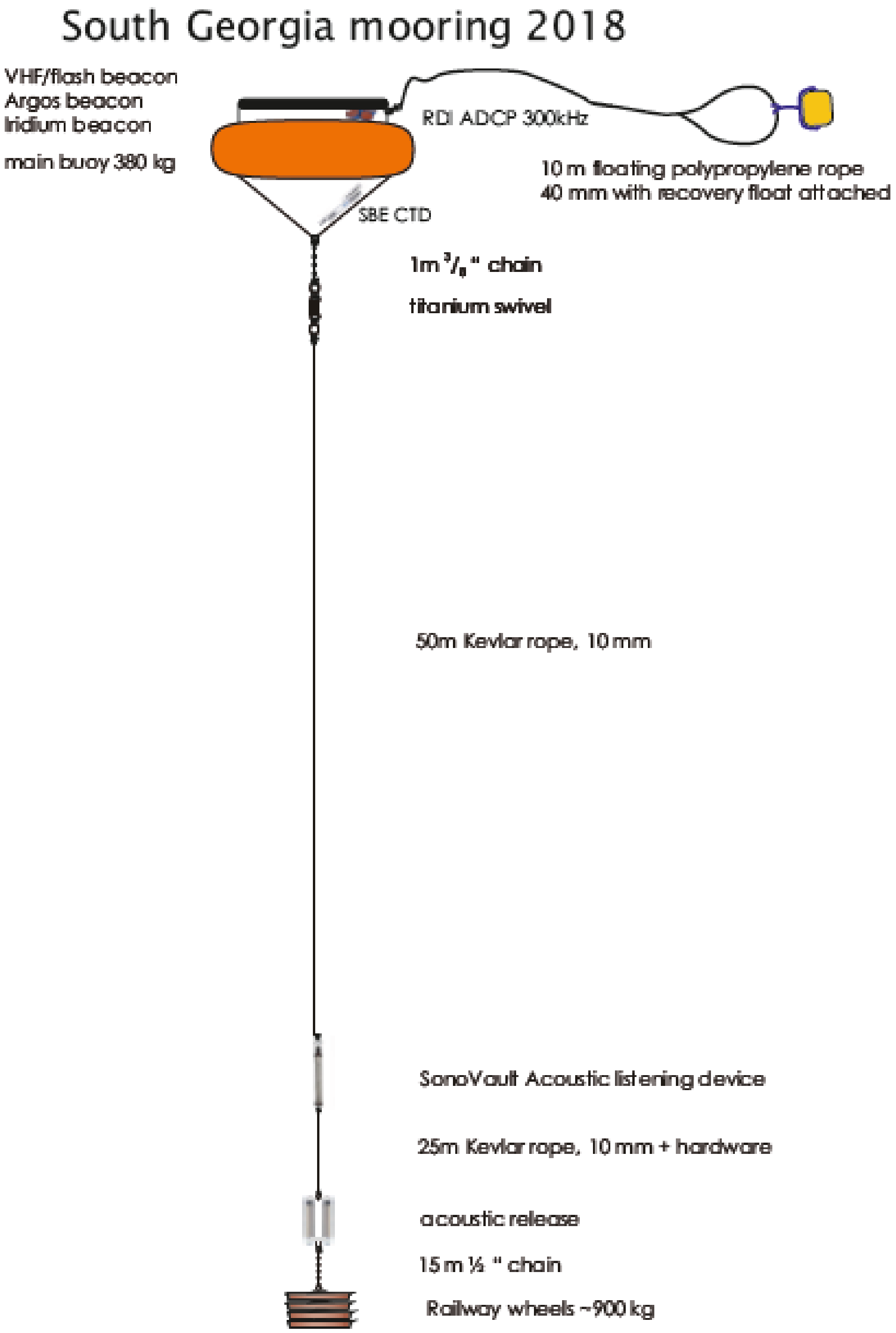


Fig 23: WCB- Mooring rig deployed

13.4 Sono.Vault update and deployment

Carson McAfee, David Goodger, Jeremy Robst, Gabi Stowasser

The Sono.Vault storage modules of both Sono.Vaults, deployed on the P3 and WCB moorings respectively, were updated following the instructions of the manufacturer (see below). The batteries were exchanged, the data downloaded and one instrument re-deployed on the shallow water WCB mooring. The remaining Sono.Vault will be deployed in Tristan da Cunha waters on JR17004. All data files recorded during deployment are stored on flash drives, which are kept by Dr. Ian Staniland (BAS), the owner of both instruments.

TESTING THE SONO.VAULT SD CARD AND SYSTEM

Configuration

The systems config should be stored on Card one, it is an XML file. The file is called SRV_CFG.XML and the working version used for JR17002 is below. The Sonovault has a serial connection which is configured by the file on the first SD card. (Currently baud rate=9600) it also used flow control CTS and RTS. The port (p1) can be accessed externally but is easiest to access via P1 on the PCB, details of the pin out are on pg7 of its manual.

Requests

The system can be communicated with using the commands listed on pages 25-30 of the manual but the most useful are

- "?{get Clock.Time}" Which gives you the current system time
- "?{sampling.storage}" Which Provides details of SD cards which are attached

Internal Storage

Internal storage is provided by a bank of SD cards, formatted with the FAT32 filesystem. It was found that putting all the cards once after another is the most reliable result. Running "?{sampling.storage}" over and over shows that SD card detecting is very unreliable. This method worked best, this time. The power should be disconnected before removing an SD card.

14 Data Management

Petra ten Hoopen, UK Polar Data Centre, BAS

__Data storage__

All data recorded by instrumentation linked to the ship's network were recorded directly to respective folders within /data/cruise/jcr/20171221/ and additional folders were created within /data/cruise/jcr/20171221/work/ to allow the cruise scientists to back-up their work. When the data are transferred to the Storage Area Network (SAN) at BAS, the pathname to the files is identical.

Site identifiers

Specific codes were given to work stations consistent with the previous Western Core Box surveys (W1.1, W1.2, W2.1, W2.2, W3.1, W3.2, W4.1 and W4.2) and mooring sites (WCB, P2 and P3).

Event logs

Event numbers were assigned to equipment deployments sequentially by the officers on watch when completing the bridge event log. 128 separate events were recorded. In addition to the bridge event log, a number of digital logs were maintained to record deployments and sampling.

Deployments were performed to support research of the following scientists:

- Elisa Bergami (University of Siena**,** Italy) – micro- and nono-plastics, exotoxic tests
- Sophie Fielding (BAS, UK) – glider, acoustics
- Vicky Fowler (BAS, UK) – zooplankton migration and respiration
- William Goodall-Copestake (BAS, UK) – eDNA analysis
  Kirstie Jones-Williams (BAS, UK) – zooplankton response to and carrier of microplastics
- Clara Manno (BAS, UK) – ocean acidification, micro- and nanoplastics in zooplankton
- Frances Perry (PML, UK) – Euphausia superba eggs lipids and hatching frequency analysis
- Gabriele Stowasser (BAS, UK) – stable isotope analysis

Datasets overview

Equipment / activity	**Number of deployments**	**Comments**
MUDL	**19**	**one frame used in either BONGO or MUDL configuration**
BONGO	13	
MOCNESS	08	
RMT8	16	
NEUSTON MICRONET	15	
eDNA samples	7	
Conductivity-Temperature-Depth (CTD)	19	
Acoustic Doppler Current Profiler (ADCP)	continuous recording	
EK60 echosounder	continuous recording	
EK80 echosounder	continuous recording	
EA600 single beam echosounder	continuous recording	
Underway data streams	continuous recording	
Expendable Bathythermograph (XBT)	25	
P3 deep mooring recovery & deployment	1	
WCB shallow mooring recovery & deployment	1	
P2 deep mooring recovery	1	
Glider deployment & recovery	1	

Data sets description

Dataset	**MUDL**	
Instruments	**Motion-compensated Upward and Downward Looking net, mesh size 0.1 mm**	
Description	MUDL deployments were vital for collection of zooplankton and analysis of zooplankton taxonomic composition.	
Metadata	Digital Log	JR17002_BONGO_MUDL /data/cruise/jcr/20171221/work/cruise_event_logs

Analogue data	None available at this stage.
Digital data	None available at this stage.
Physical samples	The primary repository for physical samples will be the BAS biological store. Post-cruise the samples will be examined, described and analysed. Tissue samples of key taxa were preserved at -80 degrees for future taxonomic analysis.
Long term data manageme nt	Event metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. There are ongoing efforts to hold net sample metadata and sample analysis data in the Low Trophic Level Database developed by the UK Polar Data Centre.
Users of the data	Vicky Fowler.

Dataset	**BONGO**	
Instruments	**BONGO net, mesh size 0.1 mm**	
Description	BONGO deployments were vital for study of Euphausia superba adults, larvae and juveniles in relation with nanoplastics (EB) and incubation experiments of pteropods in relation with microplastics (KJW).	
Metadata	Digital Logs	JR17002_BONGO_MUDL /data/cruise/jcr/20171221/work/cruise_event_logs
Analogue data	None available at this stage.	
Digital data	None available at this stage.	
Physical samples	The primary repository for physical samples will be the BAS biological store. Post-cruise the samples will be examined, described and analysed. Biological samples were preserved in 96% ethanol for morphological analysis, in RNA-later for gene expression analysis or in -80 degrees for lipid analysis.	
Long term data manageme nt	Event metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. There are ongoing efforts to hold net sample metadata and sample analysis data in the Low Trophic Level Database developed by the UK Polar Data Centre.	
Users of the data	Elisa Bergami, Kirstie Jones-Williams.	

Dataset	**MOCNESS**
Instruments	**Multiple Opening and Closing Net and Environmental Sampling System net, mesh size 0.3 mm**

Description	Mocness net deployments were vital for collection of zooplankton and study of zooplankton respiration during migration up and down the water column.	
Metadata	Digital Log	JR17002_MOCNESS /data/cruise/jcr/20171221/work/cruise_event_logs It would be possible to generate the Mocness log file automatically from the netmonitor log that is recorded to the scs data streams after each net deployment and contains the necessary details together with valuable contextual data of each net sample.
Analogue data	None available at this stage.	
Digital data	None available at this stage.	
Physical samples	The primary repository for physical samples will be the BAS biological store. Post-cruise the samples will be examined, described and analysed. Biological samples were examined and copepods selected for incubation experiments to study respiration of organisms in distinct layers of the water column. Mocness sample was split into two halves. One half was preserved in 4% formalin for ZooScan analysis and the second half was frozen in -80 degrees for CHN analysis.	
Long term data manageme nt	Event metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. There are ongoing efforts to hold net sample metadata and sample analysis data in the Low Trophic Level Database developed by the UK Polar Data Centre.	
Users of the data	Vicky Fowler	

Dataset	**RMT8**	
Instruments	**RMT8 net, mesh size 5mm**	
Description	RMT8 deployments were vital for a number of zooplankton studies. In particular, the RMT8 biological samples will be used for taxonomic composition and stable isotope analysis (GS), Euphausia superba biomass estimate (SF), incubation experiments of gravid Euphausia superba females (FP), nanoplastic incubation experiments with Antarctic krill, salps and other key zooplankton taxa (EB) and microplastic incubation experiments with pteropods and other key zooplankton species (KJW).	
Metadata	Digital Log	JR17002_RMT8 /data/cruise/jcr/20171221/work/cruise_event_logs It would be possible to generate the RMT8 log file automatically from the netmonitor log that is recorded to the scs data streams after each net deployment

		and contains the necessary details together with valuable contextual data of each net sample.
Analogue data	None available at this stage.	
Digital data	None available at this stage. A limited amount of taxa specific analysis was undertaken but was too preliminary to include as distinct datasets.	
Physical samples	The primary repository for physical samples will be the BAS biological store. Post-cruise the samples will be examined, described and analysed. Biological samples were sorted after RMT8 and a record was made of (rough) taxonomy, weight and number of individuals. Biological samples were preserved in 96% ethanol for morphological analysis, in RNA-later for gene expression analysis, in -80 degrees for lipid analysis, in 4% formaling for ZooScan analysis or Lugol's for further incubation.	
Long term data manageme nt	Event metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. There are ongoing efforts to hold net sample metadata and sample analysis data in the Low Trophic Level Database developed by the UK Polar Data Centre.	
Users of the data	Gabriele Stowasser, Sophie Fielding, Frances Perry, Kirstie Jones-Williams, Elisa Bergami.	

Dataset	**NEUSTON_MICRONET**	
Instruments	**Neuston net, mesh size 0.3mm**	
Description	Neuston deployments were vital for collection of microplastics and associated zooplankton. The samples will be used for microplastics-zooplankton interaction analysis.	
Metadata	Digital Log	JR17002_NEUSTON_MICRONET /data/cruise/jcr/20171221/work/cruise_event_logs
Analogue data	None available at this stage.	
Digital data	None available at this stage.	
Physical samples	The primary repository for physical samples will be the BAS biological store. The biological samples were preserved in 96% ethanol and will be post-cruise examined, described and analysed.	
Long term data manageme nt	Event metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS.	

Users of the data	Kirsty Jones-Williams

Dataset	**eDNA water samples**	
Instruments	**Underway water filtered with 0.6 µm filter cartridge**	
Description	Seven water samples from underway water stream were taken at four stations of the Western Core Box survey, W1.2, W2.2, W3.2 and W4.2, filtrated and preserved for molecular analysis.	
Metadata	Digital Log	JR17002_EDNA_krill /data/cruise/jcr/20171221/work/cruise_event_logs
Analogue data	None available at this stage.	
Digital data	None available at this stage.	
Physical samples	The primary repository for physical samples will be the BAS biological store. The biological samples were preserved in -80 degree Celsius for later examination.	
Long term data manageme nt	Event metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. Sequence data to be submitted to one of the International Nucleotide Sequence Database Collaboration Archives.	
Users of the data	Will Goodall-Copestake	

Dataset	**CTD data**		
Instruments	**Sensors on the CTD frame**		
Description	CTD were vital to hold accurate measurements of Conductivity, Temperature and Depth in the long-term monitoring sites of P2, P3 and Western Core Box area.		
Metadata	Paper Logs	BAS AME holds paper copies of the CTD sampling logs which need to be scanned at the end of the season.	
	Digital Log	JR17002_CTD /data/cruise/jcr/20171221/work/cruise_event_logs	
Digital data	Raw	.bl, .hdr, .hex, .000 (LADCP) /data/cruise/jcr/20171221/ctd	
	Processed	asc, .cnv, .ros,	/data/cruise/jcr/20171221/ctd/JR17002_Processed
Long term data manageme nt	Raw and processed data will be stored on the SAN at BAS and also available from the BODC.		

Users of the data	Cruise participants and collaborators in the first instance.

Dataset	**CTD bottle**	
Instrument	**CTD – Niskin bottles**	
Description	Seawater from Niskin bottles was collected for analysis of dissolved inorganic carbon (DIC), particulate organic matter (POM), dissolved organic matter (DOM) and nutrients or to prime the MUDL net prior to deployments.	
Metadata	Paper Logs	BAS AME holds paper copies of the CTD sampling logs which need to be scanned at the end of the season.
	Digital Logs	• JR17002_CTD_BOTTLES /data/cruise/jcr/20171221/work/cruise_event_logs The log can be produced by a script reading either from the raw .bt file or the .ros files and values averaged into a fewer data points. • JR17002_CTD_bottles_consignee.docx /data/cruise/jcr/20171221/work/cruise_event_logs The file provides an overview of Niskin bottle consignees at the time of CTD deployments.
Digital data	/data/cruise/jcr/20171221/ctd	
Long term data manageme nt	Event metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. Data will be stored on the SAN at BAS	
Users of the data	Gabriella Stowasser, Clara Manno, Sophie Fielding, COMICS.	

Dataset	**XBT data**	
Instruments	**Expendable Bathythermograph**	
Description	XBT were used for temperature profile measurements through the water column during the Western Core Box survey. 25 Lockheed Martin Sippican T5 probes were deployed on five WCB transects.	
Metadata	Digital Log	JR17002_XBT /data/cruise/jcr/20171221/work/cruise_event_logs
Digital data	/data/cruise/jcr/20171221/xbt	
Long term data manageme nt	Metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. Data will be stored on the SAN at BAS.	
Users of the data	Cruise participants and collaborators in the first instance.	

Dataset	**VMADCP data**
Instruments	**Vessel Mounted Ocean Surveyor Acoustic Doppler Current Profiler**
Description	VMADCP were vital to hold accurate measurements of water current velocities using the Doppler effect on sound waves scattered back from particles within the water column.
Digital data	/data/cruise/jcr/20171221/adcp
Long term data manageme nt	Metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. Data will be stored on the SAN at BAS.
Users of the data	Cruise participants and collaborators in the first instance.

Dataset	**EA600 data**
Instruments	**Kongsberg EA600 single-beam echosounder**
Description	The Kongsberg EA600 single beam echosounder has been used for water column depth reading as navigational aid and vital information for scientific equipment deployments.
Digital data	/data/cruise/jcr/20171221/ea600
Long term data manageme nt	Metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. Data will be stored on the SAN at BAS.
Users of the data	Cruise participants and collaborators in the first instance.

Dataset	**EK60 data**
Instruments	**EK60 echosounder**
Description	EK60 echosounder operated 3 frequencies (38 kHz, 70 kHz and 200 kHz) and generated data vital for location of Antarctic krill swarms. Furthermore, acoustic data from 8 Western Core Box transects were generated as part of the long-term WCB monitoring.
Digital data	/data/cruise/jcr/20171221/ek60
Calibration	/data/cruise/jcr/20171221/ek60/Calibration_20180107_JR17002
Long term data manageme nt	Metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. Data will be stored on the SAN at BAS.
Users of the data	Cruise participants and collaborators in the first instance.

Dataset	**EK80 data**
Instruments	**EK80 echosounder**
Description	EK80 echosounder operated the frequency 120 kHz and complemented the EK60 acoustic dataset.
Digital data	/data/cruise/jcr/20171221/ek80
Long term data manageme nt	Metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. Data will be stored on the SAN at BAS.
Users of the data	Cruise participants and collaborators in the first instance.

Dataset	**Underway data streams**
Instruments	Various – all logged by NOAA SCS software
Description	Underway data from a variety of oceanographic, meteorological, navigational and acoustic sources are logged by SCS software on a timescale dependent on the instrument.
Digital data	/data/cruise/jcr/20160223/scs
Long term data manageme nt	Metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. Data will be stored on the SAN at BAS.
Users of the data	Met Office, cruise participants and collaborators in the first instance.

Dataset	**P3 deep mooring data**
Instruments recovered	**CTD on main buoy, CTD below shallow sediment trap, ADCP, Seaguard current meter with O2 sensor shallow, Seaguard current meter with O2 sensor deep, sediment trap shallow and sediment trap deep, SonoVault acoustic listening, PCO_2**
Instruments deployed	CTD on main buoy, CTD below shallow sediment trap, ADCP, Seaguard current meter with O2 sensor shallow, Seaguard current meter with O2 sensor deep, sediment trap shallow and sediment trap deep, SAMI pH, Aqua monitor, PCO_2,
Description	The P3 deep mooring • deployed on 29/12/2016 during the JR16003 cruise • recovered in the event 13 on 03/01/2018 • redeployed in the event 103 on 13/01/2018.
Digital data	/data/cruise/jcr/20171221/work/cruise_science_work/Mooring P3
Long term data manageme nt	Metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. Data will be stored on the SAN at BAS.

Users of the data	Cruise participants and collaborators in the first instance.

Dataset	**P2 deep mooring data**
Instruments recovered	**CTD on main buoy, CTD below shallow sediment trap, ADCP, Aquadopp current meter, sediment trap shallow and sediment trap deep.**
Instruments deployed	None
Description	The P2 deep mooring • deployed on 31/12/2016 during the JR16003 cruise • recovered in the event 108 on 16/01/2018 • not redeployed.
Digital data	/data/cruise/jcr/20171221/work/cruise_science_work/Mooring P2
Long term data manageme nt	Metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. Data will be stored on the SAN at BAS.
Users of the data	Cruise participants and collaborators in the first instance.

Dataset	**WCB shallow mooring data**
Instruments recovered	**CTD on main buoy, ADCP, sediment trap shallow, SonoVault acoustic listening**
Instruments deployed	CTD, ADCP, shallow sediment trap, SonoVault acoustic listening, WBAT echosounder
Description	The WCB shallow mooring • deployed on 26/12/2016 during the JR16003 cruise • recovered in the event 42 on 06/01/2018 • redeployed in the event 99 on 12/01/2018.
Digital data	/data/cruise/jcr/20171221/work/cruise_science_work/Mooring WCB /data/cruise/jcr/20171221/work/cruise_science_work/WBAT
Long term data manageme nt	Metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. Data will be stored on the SAN at BAS.
Users of the data	Cruise participants and collaborators in the first instance.

Dataset	**Glider data**
Instruments	**Glider SG565**
Description	The autonomous underwater vehicle SeaGlider 565 has been used to collect oceanographic parameters in 99 dives. The glider was

	deployed in the event 22 on 04/01/2018 and recovered on 13/01/2018.
Digital data	/data/cruise/jcr/20171221/work/cruise_science_work/Glider
Long term data manageme nt	Metadata will be stored within the Marine Metadata Portal developed by the UK Polar Data Centre at BAS. Data will be stored on the SAN at BAS.
Users of the data	Cruise participants and collaborators in the first instance.

ANNEX A: ICT ENGINEER

Jeremy Robst

Data Logging / SCS

The SCS server and data logging systems worked well throughout the cruise, cruisewith few logging events occurring.

Time & Date (GMT)	Event
2017/12/21 12:57	ACQ restarted, newleg run (**Leg: 20171221**)
2018/01/01 18:27 – 18:29	ACQ restarted whilst adding Tcount stream to SCS – logging midships wireless sheave.
2018/01/02 11:04	EA600 not outputting depth overnight , rebooted
2018/01/03 11:00 – 18:30	EA600 left on passive mode after mooring
2018/01/04 11:00 – 15:00	EA600 intermittent – replaced with Brix PC to fit inside bridge cabinet
2018/01/20 20:32 – 11:01	Oceanlogger crashed, not outputting any data. Restarted.
2018/01/23	ACQ restarted, end of leg

Oceanlogger

On 10th January 2018 it was noticed that the Oceanlogger was not outputting any values for the sampletemp field. This was investigated on 22nd January with AME. The sampletemp field actually is the fluorometer sample temp, and the new fluorometer fitted in summer 2017 does not output this value. So the oceanlogger merely outputs a zero length string. This was changed on 22nd January to output “NaN” to make the missing field more obvious.

Other systems

The other systems on board – the JRLB unix fileserver, SABRIS systems and ESX server all worked without any serious issues. Occasionally the VEEAM backups (around once a month) will fail and the VEEAM server needed to be restarted.

ANNEX B Scientific Gear Report

Peter Enderlein, Carwyn Davies, Bjorg Apeland

The majority of deployments on the cruise were the routine night fishing operations required for the WCB, as well as sunrise and sunset MUDL stations at P2, P3 and WCB locations. Aditionally, the Neuston Sledge was deployed for the first time in several years, with a modified net to collect microplastics.

RMT8 (18 deployments, 2 failures)

The RMT8 was a mainstay of the WCB delivery, predominantly functioning correctly for both target fishing and stratified hauls on station. There were two failed deployments to note, both involving the entanglement of the first net closure bridle around the top spreader bar (ie. upon the second firing of the motor). The bridle was badly kinked and replaced, and the suspected reason for failure was a reduced towing speed relative to previous deployments (2kts compared to 3kts JR16003). Towing speed was therefore increased and no further issues occurred.

MOCNESS (9 deployments, 1 failure)

Despite the replacement of the biowire during refit 2016, the twisting problems experienced JR16003 recurred on this voyage. On one early MOCNESS deployment, 3 full turns were observed at the bridle upon recovery. This was suspected to be due to incorrect tension on the wire during initial spooling, thus a weighted test rig with roll sensor was towed with 2000m of cable out in an attempt to alleviate the problem. This appeared to be successful, with an occasional half-turn subsequently manifesting itself at the bridle, although this caused no deployment issues.

There was one failed deployment due to an electrical defect, with a new cable fabricated by the AME team. For subsequent seasons, an improved solution has been constructed (but not tested), with the motor driver moved from a mid-cable potted enclosure to within the pressure housing of the DWNM itself. This utilises previously blank pins on the DWNM connector.

MUDL (17 deployments, 3 failures, 1 pre-deployment failure)

The MUDL prototype developed last season was required heavily on this cruise. Unfortunately early in the cruise, there were several issues causing repeated failure both on deck and in the water. These were resolved sufficiently to facilitate the science program, however it is suggested the improvements upon the prototype are required to increase resilience for repeated deployment. When working well, however, the MUDL proved effective to depths of 100m, and the deployment process was fine-tuned over the course of the cruise. The failure modes experienced were:

- Leak between ball valve and seat, leading to inability to pre-fill cod end on deck and poor retention of samples. Two reasons suspected – incorrect construction of valve assembly leading to gap; and potentially out-of-round ball. Mounting holes for valve seat were ovaled to allow for adjustment of seat assembly, and retaining bolt holes in seat were helicoiled. Ball was replaced with spare.
- Under-rotation of ball valve due to poor performance of lubricant in cold water. Both silicone grease and Vaseline trialed, both with poor results. Frequent cleaning and re-lubrication required.

- Under-rotation of ball valve due to play in attachment of valve assembly to bracket. This was temporarily rectified with judicious use of cable ties, however a more rigid housing is required long term.
- Failure of motor to complete a correct 90/270 degree cycle. Despite a full strip down of the motor and extensive bench testing, a cause was not found. Suspected to be a function of excessive stiffness at the ball valve, thus exceeding torque available from the motor.
- Potential damage to cod end and ball valve assembly during stowage. Suggested that a storage cradle be constructed for subsequent seasons.

MUDL as Bongo (13 deployments)

By opening the ball valves, the upward-looking net of the MUDL could be used for half-bongo deployments, and was used in this configuration several times.

Mammoth (1 deployment, 1 failure)

A test deployment of the Mammoth net was attempted in Stromness Harbour, following reports from the Comics cruise on RRS Discovery of failures. Unfortunately an intermittent electrical failure prevented communication between the net and deck box, and due to time constraints this issue was not found or rectified, despite extensive testing.

NEMO (NEuston MOdified) (16 deployments)

The Neuston sledge was modified whilst mobilising for the cruise, to accommodate a 300 micron net for microplastic sampling. Fortunately the height of the new net mouth was identical to that of the original, and so only the fabrication of new spacers between the net and keels was required.

The sledge was test deployed early in the cruise, as there was limited experience of deployment amongst those on board. A preventer, led through the aftmost panama lead on the folk'sl, was used on the forward Amco crane, with the McArtney winch installed on the foredeck to provide lift, via a snatch block on a short strop on deck giving the correct lead to the levelwind. Once deployed, a 10mm dyneema line from the towing bridle was led forward to the panama ahead of that used for the preventer. Experimentation determined the length of line required to tow the sledge roughly level with the forward edge of the accommodation structure.

ANNEX C ANTARCTIC MARINE ENGINEERING REPORT

McAfee Carson and Goodger David

Engineering Technical Section
British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

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

Cruise Report Instructions

Neil French (nefren) is the first point of contact for marine scientific instrumentation – any questions email (nefren@bas.ac.uk) or phone him (01223 221398); or secondly Mike Rose (mcr@bas.ac.uk, 01223 221584) when Neil not available.
Before you leave HQ for cruise support obtain an up to date image of the JCR directories from the M: drive. The database for locating incidentals and spares is now maintained on the JCR by AME and a copy for reference should be sent back to the UK each year. Please contact nefren if you are unfamiliar with this database. A list of spares/stock required should be included at the end of this report. However critical items must be ordered immediately.
A brief cruise report checklist is required for every cruise AME are responsible for supporting. Include pertinent notes on fault history and diagnosis at the end of the report even if you have already discussed via email. This information will be added to the instrumentation database maintained in the UK.
Please log all problems or changes made to systems in use while the cruise is underway to your own log book.
At the end of the cruise, please fill in the simple checklist attached, briefly describing any problems or changes made to the instrumentation (including intermittent problems, repairs, expansion, changes to software, etc). Tick 'Used?' against all instruments which were used or logged. This is so we can follow up these issues and keep a good history of our instruments.

In order to help us with calibrations and repairs, please note the serial numbers of the instruments actually used (as listed on the checklist), and also serial numbers of any spares which you swapped or tested due to a fault or fault-finding. Enter any details on the checklist. We now have many spare sensors which are identical except for serial number.
Please leave a copy of the cruise report on the ship in the electronics workshop for the next support engineer and email a copy to nefren, robite & sfbr.

LAB Instruments

Instrument	**S/N Used**	**Comments**
AutoSal	No	
Scintillation counter	No	
Magnetometer STCM1	**No Longer on Ship**	
XBT	Used	One bad payload, See Notes

ACOUSTIC

Instrument	S/N Used	Comments
ADCP	Yes	
PES	**No Longer On Ship**	
EM122	Yes	
TOPAS	No	
EK60/80	Yes	Issues with the 120KHz transceiver See Notes
SSU	No	**SSU Removed and Superseded by Ksync**
USBL	Yes	Testing Only See Notes
10kHz IOS pinger	No	
Benthos 12kHz pinger S/N 1316 + bracket	No	
Benthos 12kHz pinger S/N 1317 + bracket	No	
MORS 10kHz transponder	No	

OCEANLOGGER

Instrument	S/N Used	Comments
Barometer1(UIC)	V145002	
Barometer1(UIC)	V145003	
Foremast Sensors		
Air humidity & temp1	60743897	See Notes
Air humidity & temp2	61698922	See Notes
TIR1 sensor (pyranometer)	172882	
TIR2 sensor (pyranometer)	172883	
PAR1 sensor	160959	
PAR2 sensor	160960	
prep lab		
Thermosalinograph SBE45	453893-0130	
Transmissometer C-Star	846DR	
Fluorometer Wetstar	1498	
Flow meter	05/811950	
Seawater temp 1 SBE38	3862856-0599	
Seawater temp 2 SBE38	3862856-0601	

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

Instrument	S/N Used	Comments

Deck unit 1 SBE11plus	11P15759-0458	
Underwater unit SBE9plus	09P30856-0707	
Temp1 sensor SBE3plus	032705	
Temp2 sensor SBE3plus	03P5042	
Cond1 sensor SBE 4C	042222	Installed on 01-01-2018
Cond1 sensor SBE 4C	043488	Removed on 01-01-2018
Cond2 sensor SBE 4C	042255	
Pump1 SBE5T	054488	
Pump2 SBE5T	052371	
Standards Thermometer SBE35	3527735-0024	
Transmissometer C-Star	396DR	Installed on 02-01-2018
Transmissometer C-Star	1399DR	Removed on 02-01-2018
Oxygen sensor SBE43	432291	
PAR sensor	70688	
Fluorometer Aquatracka	097324001	
Altimeter PA200	10127.27001	Installed on 01-01-2018
Altimeter PA200	27001	Removed on 01-01-2018
LADCP	14897	See Notes
CTD swivel linkage	961018	
Pylon SBE32	052371	
Notes on any other part of CTD e.g. faulty cables, wire drum slip ring, bottles, swivel, frame, tubing etc		Cable leading from the swivel to the 9 plus was replaced after a comms failure at 3000m on 03-01-2018 its resistance was 8Kohm on a standard mulitmeter. CTD has operated well since

AME UNSUPPORTED INSTRUMENTS BUT LOGGED

Instrument	**Working ?**	**Comments**
EA600	Yes	
Anemometer	Yes	Used main all cruise
Gyro	Yes	
DopplerLog	Yes	Disabled during Echo calibration
EMLog	Yes	

CHECK FANS ARE Running Daily

Instrument
Oceanlogger
EM122, TOPAS, NEPTUNE UPSs
Seatex Seapath
EM122 Tween Deck
TOPAS Tween Deck

End of Cruise Procedure

At the end of the cruise, please ensure that:

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

Please clean the intake fans on the following machines:

Instrument	Cleaned?
Oceanlogger	Yes
EM120, TOPAS, NEPTUNE UPSs	Yes
Seatex Seapath	Yes
EM120 Tween Deck	Yes
TOPAS Tween Deck	Yes

<u>Cruise Summary</u>

This cruise focused on krill related research around the South Georgia area. This involved a number of net deployments managed by the Mechanical AME team. Additionally there were a number of mooring deployments and recoveries. The CTD was used throughout the cruise to profile mooring sites and collect sample water for DIC and MUDL experiments.

The majority of the AME role during this cruise was spent assisting scientists in preparing instruments, repairing instruments and running CTD's. In addition to this significant effort has been made to revive the AME JCR Wiki. The wiki was started a number of years ago, but had fallen in to memory. Dave Goodger has invested his Halley experience to restructure the Wiki in order to make it more applicable to daily use, and therefore improve its convenience and value.

Note: It would be appreciated if all following AME engineers could continue using and improving the Wiki. Consistency is key.

This cruise was used to train David Goodger on the JCR ship systems and the role of the AME engineer. A full syllabus has been written on the Wiki to help guide future training, and ensure that new engineers are exposed to all aspects of the AME role on the ship.

Additional notes and recommendations for change / future work

Wiki

- As Requested by Mike Rose, the ship is now using the wiki in a similar style to the bases. This means what there are engineering logs for all instruments and pages with information for each instrument. Hopefully this will help progress towards aligning the ships and bases engineering operations. Some discussion with IT has been had about creating an offline copy similar to the bases. The wiki for the SDA has also been discussed along with the possibility of starting it before the SDA enters service so that it is in a better state for the first cruise.

EA600

- **Issue**: On previous cruise (JCR17001), the EA600 pc and display failed. This was replaced with a standard desktop PC strapped to the outside of the bridge console. Apart from being an untidy solution this was also considered to be unsafe.
  Resolution: Using parts we had on the ship already, ICT reinstalled an operating system and software on to a small form factor PC (Gigabyte Blox) so that it could be enclosed on the bridge. This has resolved the safety problems, and is a much neater solution.
  Continued Issue: The monitor being used does not look neat on the bridge consoles, and the display is a bit too bright for the bridge. Its angle fo view is also limited. We would like to resolve the monitor issue.

Ocean logger

- **Issue**: The Foremast systems were using only one TH head at the end of the previous cruise (JCR17001). This was trouble shot by the previous AME Eng's.
  Resolution: The system was fixed by replacing the Sensor and Head on 28/12/2017 while in Mare harbour.
- **Issue**: On the 20/01/2018 (20:32) the ocean logger VI stopped running. Just froze.
  Resolution: The VI was closed and restarted on 21/01/2018 (11:00).
- **Issue:** The Salinity Sample temperature is not being logged to the SCS.

USBL

- **Issue:** USBL fails at 2200m. It was noted that while testing USBL on the CTD that our beacons commonly fail to respond after going below 2200m.
  Investigation: The Db Calcs where carried out to determine the point at which the beacon didn't have enough return power with both the "Big" and "standard" Transducer heads. 2200m is what should be expected for the current setup. Full Report available on Wiki and upon request from DG.
  Ongoing: Check on the system being purchased for the new ship and ensure that the factors determined on this cruse are taken into account.

Seapath

- **Issue**: Spare Seapath Unit is not in rack and units are incorrectly labelled
  Resolution: Installed spare and relabelled all of Seapath units to ensure that no confusion is caused

Moorings

- **Issue:** Support for Aqua Tracker
  Result: Support was provided for both the Aqua Tracker (a water collection system). This involved Battery Packs and comms cable. The main issue was a lack of familiarity and serial comms experience by the Scientist setting up the system.
- **Issue:** Support for Sonovault
  Result: The Sonovault (a whale hydrophone) was supplied with incorrect batteries each of these required modifying to fit in the battery enclosure then metal disks adding to ensure that contact was made. It also required support to program and communicate with the system due to the system not being shipped with its comms cable.
  Ongoing: Instruments should arrive will all there parts and be checked better in Cambridge in order to negate the need to "bodge" at sea, this puts science results at risk.

Clam/winch monitor.

- **Issue:** The CLAM analogue video repeater cuts out. It was found that the video splitter behind the CLAM PC fails. This is commonly "fixed" when the operator hits it.
  Resolution: The splitter has now been replaced

CTD

- **Issue:** During a CTD test (ship event 004) issues where found with; Altimeter reading 1.6m, Conductivity Cell 1 giving bad data and unusual result from PAR.
  Resolution: Replaced Conductivity Cell 1 SN:043488 -> SN042222. Replaced Altimeter SN:27001 -> SN10127.244740. PAR appeared to be ok, it is assumed that the inconsistent data was due to a bank of cloud passing over half way through the test
- **Issue:** Transmissomiter Calibration. After the calibration, the percentage scale was not covering the full range as expected. In order to determine if this was an instrument issue the instrument was swapped
  Resolution: REMOVED CST-396DR installed CST-1399DR
- **Issue:** During Ship event 015 the incorrect bottles fired or didn't fire at all
  Investigation: It was concluded that this was most likely a communication issue. The sea cable was Mega tested in sections to the 9 plus. The mega testing di dnot reveal any problems. A resistance test was run on the cables, and It was found that the cable from the swivel to the 9plus was bad and the connections themselves had an 8KΩ resistance unlike the others with a negligibly small one.
  Resolution: The cable was replaced and has worked reliably since
- **Issue:**The crewe who receive and deploy the CTD do not know its current depth and thus its time to surface.
  Resolution: Using scientific wiring boxes K, a feed for the CLAM was sent

down to the bottle annex where a monitor was installed. The monitor was an old one previously used for the winch operator and replaced in refit. The monitor is now housed in a waterproof container above the shelf. While installing the feed cable it was found that there is a short on the 3rd 50Ω channel between the main lab and the bottle annex. Crew seem very happy with the improvement.

LADCP.

- **Issue:** Battey Connector Damage. The Battery Connector was damaged, as noted in the previous cruise report. The spare was hand carried down.
  Resolution: Connector was replaced and the battery enclosure was greased and checked.
- **Issue:** The "Master" Ladcp Cable (deck side link) has significant resistance over its battery charge lines. This results in a voltage drop, and is therefore not capable of charging the battery pack using the master cable.
  Resolution: The slave deck side cable was connected for charging purposes.

UIC Piccaro

- **Issue:** An e-mail was received by Neil Brough asking to check the Picarro in the UIC as he couldn't remotely gain access. It was found that the second PC was switched off. It also transpired that Neil and the Techs at UEA who carry out maintenance did not know the TeamViewer password.
  Resolution: The computer was booted and password changed
  Ongoing: This setup needs to be looked at, it is in an unsuitable location. It should be better contained rather than a PC ratchet strapped to the floor. David Goodger will meet with the PI once back in Cambridge.

UWIA

- The UWIA was started on behalf of the PI (Rob Mulvaney). The system has not caused any significant issues (standard maintenance). A full report (daily logs, and cruise track) will be included on the next cruise report as the system is still recording.

ANNEX D EVENT LOG

Date/Time	Ev	Lat	Lon	Comment
22/01/2018 12:48	128	-67.65831	-69.32413	Start slow down for Neuston deployment. Off passage
21/01/2018 14:25	127	-64.93109	-63.66408	Neuston on deck
21/01/2018 14:21	127	-64.93197	-63.66933	Neuston out of water
21/01/2018 14:20	127	-64.93221	-63.67064	Commence recovery of Neuston net
21/01/2018 14:01	127	-64.93797	-63.69269	Neuston net in water
21/01/2018 13:54	127	-64.93797	-63.69269	Commence deploy Neuston net
20/01/2018 13:25	126	-62.93917	-60.64557	Neuston on deck
20/01/2018 13:21	126	-62.94078	-60.64559	Neuston out of water
20/01/2018 13:20	126	-62.94132	-60.64556	Commence Neuston recovery
20/01/2018 13:00	126	-62.95309	-60.64428	Neuston in water
20/01/2018 12:58	126	-62.95422	-60.64418	Commence Neuston deployment
20/01/2018 12:43	125	-62.98096	-60.60935	Neuston on deck
20/01/2018 12:41	125	-62.98207	-60.6063	Neuston out of water
20/01/2018 12:40	125	-62.98246	-60.60524	Commence recovery of Neuston
20/01/2018 12:20	125	-62.99005	-60.58331	Neuston in water
20/01/2018 12:18	125	-62.99074	-60.58087	Commence deployment of Neuston
20/01/2018 11:36	124	-62.99654	-60.46728	Neuston on deck
20/01/2018 11:00	124	-62.9946	-60.42017	Newston net deployed
20/01/2018 10:48		-62.99046	-60.39555	Start slow down
19/01/2018 22:36	123	-62.09459	-57.14274	Vsl resumbe passage
19/01/2018 22:27	123	-62.08559	-57.11461	net on deck
19/01/2018 22:24	123	-62.08607	-57.11143	start recovery
19/01/2018 21:55	123	-62.0898	-57.08295	Vsl @ 2kts
19/01/2018 21:55	123	-62.0898	-57.08295	Newston net deployed
19/01/2018 21:53	123	-62.09	-57.08093	Start slow down
19/01/2018 13:42	122	-61.26675	-54.66166	Neuston secured
19/01/2018 13:36	122	-61.26401	-54.65744	Neuston on deck
19/01/2018 13:32	122	-61.26238	-54.65435	Start recover Neuston
19/01/2018 13:03	122	-61.25001	-54.62956	Neuston in water
19/01/2018 13:00	122	-61.24879	-54.62624	Vessel off passage at 2.5kts. Ready for deployment
19/01/2018 12:53	122	-61.24143	-54.60998	Start slow down for Neuston deployment
18/01/2018 23:48	121	-59.63941	-50.98043	Neuston net secured
18/01/2018 23:39	121	-59.6381	-50.96644	Neuston net on deck
18/01/2018 23:36	121	-59.63838	-50.96195	Commence recovery of Neuston net
18/01/2018 23:05	121	-59.64092	-50.9165	Neuston net in water
18/01/2018 23:00	121	-59.64146	-50.91085	Neuston net deployed
18/01/2018 22:50	121	-59.63466	-50.87934	Start slow down for Neuston net deployment
18/01/2018 13:42	120	-58.52395	-48.42605	Neuston secured
18/01/2018 13:33	120	-58.51915	-48.4172	Neuston on deck
18/01/2018 13:29	120	-58.51719	-48.41399	Commence recovery
18/01/2018 13:10	120	-58.50813	-48.39979	Neuston in water
18/01/2018 13:08	120	-58.50724	-48.3984	Start deploy Neuston
18/01/2018 13:00	120	-58.50338	-48.39202	Off passage. heading into wind
18/01/2018 12:55	120	-58.4968	-48.37796	start slow down for Neuston deployment
17/01/2018 06:48		-55.2555	-41.23794	On Passage
17/01/2018 06:42		-55.24835	-41.22556	VSL off DP
17/01/2018 06:21	119	-55.24825	-41.22443	MUDL Recovered to Deck
17/01/2018 06:16	119	-55.24827	-41.22444	Commence Recovering MUDL
17/01/2018 05:54	119	-55.24826	-41.22441	MUDL Stopped at 60m
17/01/2018 05:51	119	-55.24827	-41.2244	MUDL in the Water
17/01/2018 05:50	119	-55.24826	-41.2244	Commence Deploying MUDL
17/01/2018 05:42	118	-55.24827	-41.22438	MUDL Recovered to Deck
17/01/2018 05:36	118	-55.24827	-41.22438	Commence Hauling MUDL
17/01/2018 05:09	118	-55.24828	-41.22442	MUDL Stopped at 100m

17/01/2018 05:06	118	-55.24827	-41.22442	MUDL in the Water
17/01/2018 05:00	118	-55.24828	-41.22443	Commence Deploying MUDL
17/01/2018 04:54		-55.24825	-41.22431	VSL on DP
17/01/2018 04:42		-55.2463	-41.22964	Commence Slowing Down
17/01/2018 04:12		-55.17122	-41.30499	On Passage
17/01/2018 04:06		-55.16804	-41.3049	Commence Turning Off Station
17/01/2018 04:00	117	-55.16932	-41.30333	MOCNESS Recovered to Deck and Stern Bulwark Door Closed
17/01/2018 03:56	117	-55.17076	-41.30147	Stern Bulwark Door Open
17/01/2018 02:25	117	-55.21259	-41.25847	Stop lowering at 1933m. Commence recovery
17/01/2018 01:17	117	-55.24516	-41.22916	MOCNESS in water
17/01/2018 01:14	117	-55.24663	-41.22748	Commence deployment of MOCNESS
17/01/2018 01:12	117	-55.24771	-41.22604	Vessel at 2.0 kts
17/01/2018 01:06	117	-55.24848	-41.2251	Vessel off DP mode
17/01/2018 00:52	116	-55.24847	-41.22508	BONGO on deck
17/01/2018 00:51	116	-55.24847	-41.22507	BONGO out of water
17/01/2018 00:30	116	-55.24844	-41.22507	stopped at 100m
17/01/2018 00:25	116	-55.24847	-41.22507	Commemce deploy BONGO. In water
17/01/2018 00:21	115	-55.24846	-41.22507	MUDL on deck
17/01/2018 00:20	115	-55.24846	-41.22505	MUDL out of water
17/01/2018 00:16	115	-55.24847	-41.22506	Commence recovery of MUDL
16/01/2018 23:55	115	-55.24845	-41.22502	Stopped lowering at 60m
16/01/2018 23:51	115	-55.24846	-41.22503	MUDL in water
16/01/2018 23:50	115	-55.24845	-41.22507	Commence deployment of MUDL
16/01/2018 23:42	114	-55.24848	-41.22506	MUDL on deck
16/01/2018 23:40	114	-55.24848	-41.22505	MUDL out of water
16/01/2018 23:35	114	-55.24848	-41.22506	Commence recovery of MUDL
16/01/2018 23:10	114	-55.24846	-41.22508	Stop lowering at 100m
16/01/2018 23:05	114	-55.24845	-41.22506	MUDL in water
16/01/2018 23:04	114	-55.24845	-41.22506	Commence deployment of MUDL
16/01/2018 19:42	113	-55.24848	-41.2251	CTD recovered to deck
16/01/2018 19:40	113	-55.24849	-41.22511	CTD at surface
16/01/2018 18:17	113	-55.2485	-41.22512	CTD Stopped at 3248m
16/01/2018 17:20	113	-55.24848	-41.22511	CTD Veering to Approx 3200m
16/01/2018 17:14	113	-55.24851	-41.22513	CTD in the Water
16/01/2018 17:09	113	-55.2485	-41.22509	Commence Deploying CTD
16/01/2018 16:50	112	-55.24837	-41.22486	Bongo Net Recovered to Deck
16/01/2018 16:42	112	-55.24835	-41.2249	Bongo Net Stopped at 100m
16/01/2018 16:39	112	-55.24837	-41.22489	Bongo Net in the Water
16/01/2018 16:38	111	-55.24835	-41.22487	Bongo Net Recovered to Deck
16/01/2018 16:34	111	-55.24834	-41.22486	Bongo Net Stopped at 50m
16/01/2018 16:32	111	-55.24833	-41.22488	Bongo Net in the Water
16/01/2018 16:30	111	-55.24821	-41.22481	Commence Deploying Bongo Net
16/01/2018 16:24		-55.24867	-41.2238	VSL on DP
16/01/2018 16:18		-55.2532	-41.24064	Commence Slowing Down
16/01/2018 15:48		-55.2549	-41.39042	On Passage
16/01/2018 15:36		-55.25644	-41.40368	VSL off DP
16/01/2018 15:30		-55.25607	-41.40343	VSL on DP
16/01/2018 15:23	110	-55.25545	-41.39852	MOCNESS Recovered to Deck and Stern Bulwark Door Closed
16/01/2018 15:17	110	-55.25513	-41.39409	Stern Bulwark Door Open
16/01/2018 13:51	110	-55.25013	-41.27334	MOCNESS in water
16/01/2018 12:50	110	-55.25019	-41.27218	Start deploy MOCNESS
16/01/2018 12:46	110	-55.25023	-41.26815	Stern door open
16/01/2018 12:42	110	-55.25017	-41.26606	DP mode off
16/01/2018 12:27	109	-55.25013	-41.26527	Neuston sledge on deck
16/01/2018 12:26	109	-55.2501	-41.26453	DP mode on
16/01/2018 12:23	109	-55.25006	-41.26176	Commence recovery of Neuston sledge

16/01/2018 11:54	109	-55.24931	-41.23291	Neuston sledge in water
16/01/2018 11:51	110	-55.24921	-41.22988	MOCNESS at 1000m
16/01/2018 11:50	109	-55.24916	-41.22884	Vessel at 2.5 kts heading ready to deploy Neuston sledge
16/01/2018 11:48	109	-55.24906	-41.228	Vessel off DP mode
16/01/2018 10:55	108	-55.24906	-41.22804	releases recovered
16/01/2018 10:40	108	-55.24891	-41.22674	Sediment trap recovered
16/01/2018 10:30	108	-55.24884	-41.22576	2nd trimsby cliuster recovered
16/01/2018 10:10	108	-55.24865	-41.22384	CTD recovered
16/01/2018 10:05	108	-55.24862	-41.22339	Sediment trap and current meter recovered
16/01/2018 09:55	108	-55.24854	-41.22244	Trimsby cluster recovered
16/01/2018 09:41	108	-55.24841	-41.22077	top float recovered
16/01/2018 09:36	108	-55.24841	-41.21998	Mooring attached
16/01/2018 09:18	108	-55.24608	-41.21027	Sternd door down commence recovery
16/01/2018 09:18	108	-55.24608	-41.21027	Buoy sighted
16/01/2018 09:17	108	-55.24608	-41.21026	P2 mooring relesed
16/01/2018 04:37	107	-55.24357	-41.21227	CTD Recovered to Deck
16/01/2018 04:23	107	-55.24358	-41.21225	CTD Stopped at 100m
16/01/2018 04:17	107	-55.2436	-41.21224	CTD Veering to 100m
16/01/2018 04:16	107	-55.2436	-41.21225	CTD in the Water
16/01/2018 04:10	107	-55.2436	-41.21223	Commence Deploying CTD
16/01/2018 03:12		-55.24289	-41.21121	VSL on DP
16/01/2018 02:54		-55.23738	-41.19533	Commence Slowing Down
14/01/2018 03:06		-52.81059	-40.16443	VSL on DP
14/01/2018 01:17	106	-52.78508	-40.15103	BONGO on deck
14/01/2018 01:15	106	-52.78508	-40.15104	BONGO out of water
14/01/2018 01:07	106	-52.78505	-40.15102	commence recovery
14/01/2018 01:05	106	-52.78505	-40.15104	BONGO in water
14/01/2018 01:04	106	-52.78505	-40.15105	Start deploy BONGO
14/01/2018 00:55	103	-52.78507	-40.15102	Fixed mooring landed position 52 47.915S 040 09.595W
14/01/2018 00:54	103	-52.78508	-40.15103	3rd range water depth 3779m
14/01/2018 00:48	103	-52.78495	-40.14999	On DP for 3rd range
14/01/2018 00:30	105	-52.80609	-40.12712	OFF DP
14/01/2018 00:25	105	-52.80614	-40.1271	MUDL out of water
14/01/2018 00:23	105	-52.80615	-40.12713	Commence recovery of MUDL
13/01/2018 23:58	105	-52.80614	-40.12715	MUDL at 52m
13/01/2018 23:56	105	-52.80614	-40.12717	Start deploy MUDL in water
13/01/2018 23:42	104	-52.80615	-40.12715	Commence recovery of MUDL
13/01/2018 23:42	104	-52.80615	-40.12715	MUDL out of water
13/01/2018 23:16	104	-52.80613	-40.12711	MUDL at 100m
13/01/2018 23:12	104	-52.80611	-40.12712	MUDL in water
13/01/2018 22:52	103	-52.8061	-40.12713	2nd range water depth 3794m
13/01/2018 22:49	103	-52.80613	-40.12713	On DP for 2nd range
13/01/2018 22:09	103	-52.80967	-40.17884	Vsl on station for first range
13/01/2018 21:55	103	-52.8041	-40.15982	Vsl off DP
13/01/2018 21:49	103	-52.80368	-40.15943	Stern doors closed
13/01/2018 21:47	103	-52.80355	-40.15931	Weights released in psn 52 48.18S 040 09.54W
13/01/2018 21:30	103	-52.80242	-40.15867	Acoustic releases over the side
13/01/2018 20:39	103	-52.78516	-40.1483	sediment trap and Seaguard current meter deployed
13/01/2018 20:30	103	-52.79261	-40.15281	Sediment trap deployed
13/01/2018 20:26	103	-52.78415	-40.14773	Trimsin buoy cluster deployed
13/01/2018 19:41	103	-52.77485	-40.1421	Seabird CTD attached
13/01/2018 19:35	103	-52.77419	-40.14173	Water sampler and Seaguard current meter deployed
13/01/2018 19:21	103	-52.77346	-40.14127	Trimsin buoy cluster and deployed
13/01/2018 18:58	103	-52.77094	-40.13971	Top Float in the Water
13/01/2018 18:55	103	-52.77084	-40.13971	Stern Bulwark Door Open
13/01/2018 18:48	103	-52.77079	-40.13966	Stern Bulwark Door Closed

13/01/2018 18:47	103	-52.77075	-40.13965	Stern Bulwark Door Open
13/01/2018 18:12		-52.77263	-40.14137	VSL on DP
13/01/2018 17:48		-52.81259	-40.16464	VSL off DP (Relocating to P3 Deployment Positon) and Sonardyne Pole Recovered
13/01/2018 17:39	102	-52.81248	-40.16437	CTD Recovered to Deck
13/01/2018 15:45	102	-52.81252	-40.16434	CTD Stopped at 3736m
13/01/2018 14:40	102	-52.81207	-40.16411	USBL pole in extended. Lowering CTD to 3750m
13/01/2018 14:37	102	-52.81207	-40.1641	CTD in water
13/01/2018 14:35	102	-52.81209	-40.1641	start deploying CTD
13/01/2018 14:24	102	-52.81187	-40.16411	Switch to DP mode at position
13/01/2018 14:10	102	-52.80243	-40.16395	Start slow down
13/01/2018 13:42		-52.7407	-40.16787	Off DP mode
13/01/2018 13:31	22	-52.73933	-40.16842	Glider on deck
13/01/2018 13:30	22	-52.73926	-40.1684	Rope attached to glider begin retrieval
13/01/2018 12:28	22	-52.74379	-40.15865	Vessel on DP mode
13/01/2018 12:25	22	-52.7438	-40.1583	Glider spotted
13/01/2018 12:05	22	-52.74239	-40.11297	Start slow down for glider retrieval
13/01/2018 04:00		-53.35628	-38.10852	On Passage (To P3)
13/01/2018 03:48		-53.36103	-38.08308	VSL off DP
13/01/2018 03:33	101	-53.36104	-38.08276	CTD Recovered to Deck
13/01/2018 03:13	101	-53.36104	-38.08282	CTD Stopped at 1000m
13/01/2018 02:56	101	-53.36104	-38.08276	Start to lower to 1000m
13/01/2018 02:52	101	-53.36102	-38.08278	CTD in water
13/01/2018 02:50	101	-53.36103	-38.08273	Start Deploying CTD
13/01/2018 02:48	101	-53.36104	-38.08275	Vessel on station
13/01/2018 02:36	101	-53.36166	-38.08156	On DP
13/01/2018 02:10		-53.32317	-38.14242	Head back to CTD 3.2
13/01/2018 01:47	100	-53.31958	-38.1423	RMT on deck
13/01/2018 01:45	100	-53.32069	-38.14072	RMT out of water
13/01/2018 01:42	100	-53.36105	-38.08278	Stern door open
13/01/2018 01:22	100	-53.33398	-38.12129	Commence recovery
13/01/2018 00:34	100	-53.36216	-38.08149	Stern door closed
13/01/2018 00:31	100	-53.36106	-38.08278	RMT in water
13/01/2018 00:29	100	-53.36498	-38.07782	Stern door open
13/01/2018 00:20	100	-53.37052	-38.07015	In Posn heading into wind @ 2.5kts
12/01/2018 21:36		-53.79733	-37.93526	Vsl on passage
12/01/2018 21:30		-53.79739	-37.93512	Off DP transit to CTD 3.2N
12/01/2018 21:17	99	-53.79784	-37.93426	Stren door closed
12/01/2018 21:15	99	-53.79801	-37.9339	Weight released
12/01/2018 20:39	99	-53.80112	-37.92761	Top float deployed
12/01/2018 20:36	99	-53.80123	-37.92739	Stern door open
12/01/2018 20:25	99	-53.8012	-37.92739	moving into wind 0.2kts foe mooring deployment
12/01/2018 20:05	98	-53.79829	-37.93319	Bongo recovered
12/01/2018 19:59	98	-53.79163	-37.93728	Bongo at 50m
12/01/2018 19:56	98	-53.79827	-37.93318	Bongo deployed
12/01/2018 19:55	97	-53.79359	-37.93658	Bongo recovered
12/01/2018 19:47	97	-53.79829	-37.93315	Bongo at 50m
12/01/2018 19:45	97	-53.79828	-37.93316	Bongo deployed
12/01/2018 19:33	96	-53.79831	-37.93318	CTD on deck
12/01/2018 19:30	96	-53.79832	-37.93318	CTD on surface
12/01/2018 19:02	96	-53.79833	-37.93321	Commence Hauling CTD
12/01/2018 18:48	96	-53.79834	-37.93322	CTD Veering to Approx 270m
12/01/2018 18:43	96	-53.79834	-37.93318	CTD in the Water
12/01/2018 18:38	96	-53.79832	-37.9332	Commence Deploying CTD
12/01/2018 18:30		-53.79779	-37.9316	VSL on DP
12/01/2018 18:24		-53.79888	-37.94337	Commence Turning on Station
12/01/2018 18:00		-53.79056	-38.01648	Commence Turning off Station

12/01/2018 17:32	95	-53.79188	-37.99707	MOCNESS Recovered to Deck and Stern Bulwark Door Closed
12/01/2018 17:27	95	-53.86256	-37.91569	Stern Bulwark Door Open
12/01/2018 16:37	95	-53.79795	-37.9366	Commence Hauling MOCNESS
12/01/2018 16:35	95	-53.79809	-37.93462	MOCNESS Stopped at 197m Wire Out
12/01/2018 16:21	95	-53.79974	-37.91799	MOCNESS in the Water
12/01/2018 16:15	95	-53.80015	-37.91109	Stern Bulwark Door Open
12/01/2018 16:06		-53.79901	-37.90729	On station HDG285 @ 2Knts STW into Wind
12/01/2018 15:48		-53.80499	-37.93517	End of Acoustic Transect
12/01/2018 15:17		-53.89013	-37.90656	Commence Transect back to WCB Mooring
12/01/2018 15:07		-53.88839	-37.90697	End of Acoustic Transect
12/01/2018 07:00		-53.77622	-37.9427	On Passage
12/01/2018 06:48		-53.79828	-37.93308	VSL off DP
12/01/2018 06:35	94	-53.79828	-37.93307	MUDL Recovered to Deck
12/01/2018 06:32	94	-53.79829	-37.93308	Commence Hauling MUDL
12/01/2018 06:08	94	-53.79829	-37.93309	MUDL Stopped at 20m
12/01/2018 06:06	94	-53.79831	-37.93311	MUDL in the Water
12/01/2018 06:05	94	-53.79831	-37.93309	Commence Deploying MUDL
12/01/2018 05:58	93	-53.7983	-37.93309	MUDL Recovered to Deck
12/01/2018 05:52	93	-53.7983	-37.93309	Commence Hauling MUDL
12/01/2018 05:24	93	-53.79831	-37.93315	MUDL Stopped at 100m
12/01/2018 05:21	93	-53.79828	-37.93309	MUDL in the Water
12/01/2018 05:19	93	-53.79827	-37.9331	Commence Deploying MUDL
12/01/2018 04:20	92	-53.79832	-37.93309	MUDL Recovered to Deck
12/01/2018 04:17	92	-53.7983	-37.93309	Commence Hauling MUDL
12/01/2018 03:52	92	-53.7983	-37.93309	MUDL Stopped at 20m
12/01/2018 03:50	92	-53.79831	-37.93311	MUDL in the Water
12/01/2018 03:49	92	-53.7983	-37.93311	Commence Deploying MUDL
12/01/2018 03:42	91	-53.79831	-37.93314	MUDL Recovered to Deck
12/01/2018 03:36	91	-53.79831	-37.9331	Commence Hauling MUDL
12/01/2018 03:10	91	-53.79829	-37.93311	MUDL Stopped at 100m
12/01/2018 03:06	91	-53.79831	-37.93309	MUDL in the Water
12/01/2018 03:03	91	-53.79835	-37.93307	Commence Deploying MUDL
12/01/2018 02:17	90	-53.79552	-38.01704	All secure move off station
12/01/2018 02:03	90	-53.79606	-38.00279	MOCNESS on deck
12/01/2018 01:59	90	-53.79616	-37.99875	MOCNESS out of water
12/01/2018 01:18	90	-53.79756	-37.95673	Commence recovery MOCNESS
12/01/2018 01:04	90	-53.79811	-37.94162	MOCNESS in water
12/01/2018 01:02	90	-53.79814	-37.93948	Start deploy MOCNESS
12/01/2018 00:58	90	-53.79827	-37.93517	Heading into wind COG 275 @ 2.0kts
12/01/2018 00:54	90	-53.79834	-37.93333	Off DP mode
12/01/2018 00:37	89	-53.79834	-37.93331	MUDL on deck
12/01/2018 00:35	89	-53.79834	-37.9333	start recovery
12/01/2018 00:10	89	-53.79832	-37.93332	Stop at 20m depth
12/01/2018 00:08	89	-53.79832	-37.93333	MUDL in water
12/01/2018 00:06	89	-53.79831	-37.93332	Start deploy MUDL
11/01/2018 23:57	88	-53.79835	-37.93333	MUDL on deck
11/01/2018 23:56	88	-53.79834	-37.93334	MUDL out of water
11/01/2018 23:52	88	-53.79833	-37.93333	Commence recovery
11/01/2018 23:26	88	-53.79829	-37.93328	Stopped at 100m depth
11/01/2018 23:20	88	-53.79829	-37.9333	Start deploy MUDL
11/01/2018 22:52	87	-53.79833	-37.93332	CTD on deck
11/01/2018 22:49	87	-53.79833	-37.93334	CTD at surface
11/01/2018 22:21	87	-53.79834	-37.93335	Max wire 277m commence haul
11/01/2018 22:11	87	-53.79834	-37.93333	Going down to 275m
11/01/2018 22:09	87	-53.79833	-37.93332	CTD in water
11/01/2018 22:07	87	-53.79833	-37.93333	CTD off deck
11/01/2018 21:53		-53.79829	-37.93156	On DP

11/01/2018 21:42		-53.80071	-37.90934	Commence slow down
11/01/2018 20:41		-53.79701	-37.6245	Transit to WCB Mooring psn
11/01/2018 20:39	86	-53.7973	-37.62167	RMT recovered
11/01/2018 20:35	86	-53.79788	-37.61613	RMT on surface
11/01/2018 20:32	86	-53.79825	-37.61215	stern door open
11/01/2018 19:57	86	-53.80089	-37.56813	RMT deployed
11/01/2018 19:55	86	-53.80082	-37.56567	RMT in water
11/01/2018 19:53	86	-53.80063	-37.56299	Stern door opened
11/01/2018 19:45	86	-53.80037	-37.57448	Turn into wind for RMT
11/01/2018 18:42	85	-53.86088	-37.59104	Moving off for Target Fishing
11/01/2018 18:38	85	-53.85379	-37.59371	XBT 36 Deployed
11/01/2018 18:33	85	-53.84146	-37.59744	Start slow down to 7kts
11/01/2018 17:36	84	-53.68739	-37.65036	Increase speed to 10kts
11/01/2018 17:30	84	-53.67621	-37.65426	XBT 37 Deployed
11/01/2018 17:27	84	-53.66923	-37.65664	Start slow down to 7kts
11/01/2018 16:28	83	-53.50963	-37.71047	Increase speed to 10kts
11/01/2018 16:23	83	-53.50068	-37.71358	XBT 38 Deployed
11/01/2018 16:20	83	-53.49437	-37.7157	Start slow down to 7kts
11/01/2018 15:20	82	-53.34408	-37.76879	Increase speed to 10kts
11/01/2018 15:15	82	-53.32342	-37.77332	XBT 39 Deployed
11/01/2018 15:11	82	-53.31278	-37.77676	Start slow down to 7kts
11/01/2018 14:13	81	-53.15635	-37.82963	Increase speed to 10kts
11/01/2018 14:08	81	-53.14772	-37.83292	XTB 40 deployed
11/01/2018 14:05	81	-53.14108	-37.83571	Start slow down to 7kts
11/01/2018 13:32	80	-53.15523	-37.96717	Increase speed to 10kts
11/01/2018 13:27	80	-53.16458	-37.96416	XTB 31 deployed
11/01/2018 13:24	80	-53.17144	-37.96165	start slow down to 7kts
11/01/2018 12:26	79	-53.32709	-37.90713	Increase speed to 10kts
11/01/2018 12:21	79	-53.3366	-37.90405	XBT 32 deployed
11/01/2018 12:18	79	-53.34352	-37.90166	Start slow down to 7kts
11/01/2018 11:16	78	-53.51053	-37.84849	increase spd to 10kts
11/01/2018 11:12	78	-53.51821	-37.84601	XBT 33 deployed
11/01/2018 11:09	78	-53.52512	-37.84381	Start slow down to 7kts
11/01/2018 10:07		-53.52474	-37.84391	Inc to 10kts
11/01/2018 10:06	77	-53.69321	-37.78694	XBT-34 deployed at 7kts
11/01/2018 09:02		-53.86544	-37.72811	Inc to 10kts
11/01/2018 09:00	76	-53.52925	-37.84249	XBT-35 deployed
11/01/2018 08:50		-53.87344	-37.71429	Off DP
11/01/2018 06:30		-53.87308	-37.71348	VSL on DP
11/01/2018 05:24		-53.79474	-37.57272	On Passage
11/01/2018 05:16	75	-53.78783	-37.56075	RMT 8 Recovered to Deck and Stern Bulwark Door Closed
11/01/2018 05:12	75	-53.78573	-37.55584	Stern Bulwark Door Open
11/01/2018 05:07	75	-53.7836	-37.5499	Commence Hauling RMT 8
11/01/2018 05:03	75	-53.78225	-37.54575	RMT 8 Stopped at 47m Wire Out
11/01/2018 05:01	75	-53.78161	-37.54347	Commence Hauling RMT 8
11/01/2018 04:56	75	-53.77987	-37.53761	RMT 8 Stopped at 53m Wire Out
11/01/2018 04:54	75	-53.7791	-37.53507	Commence Hauling RMT 8
11/01/2018 04:53	75	-53.77872	-37.53383	RMT 8 Stopped at 60m Wire Out
11/01/2018 04:51	75	-53.77794	-37.53141	Commence Veering RMT 8
11/01/2018 04:48	75	-53.77682	-37.52781	RMT 8 Stopped at 46m Wire Out
11/01/2018 04:47	75	-53.77648	-37.52691	Commence Hauling RMT 8
11/01/2018 04:26	75	-53.76931	-37.5062	RMT 8 Stopped at 52m Wire Out
11/01/2018 04:23	75	-53.76823	-37.50317	RMT 8 in the Water
11/01/2018 04:19	75	-53.76688	-37.499	Stern Bulwark Door Open
11/01/2018 04:18		-53.76643	-37.49756	Vessel Proceeding at 2.8knts Head to Wind (240 COG)
11/01/2018 04:12		-53.76484	-37.50603	Commence Turning on to Station

11/01/2018 03:48		-53.79056	-37.57284	Turning to Relocate
11/01/2018 03:40	74	-53.78681	-37.56298	RMT 8 Recovered to Deck and Stern Bulwark Door Closed
11/01/2018 03:35	74	-53.78479	-37.55721	Stern Bulwark Door Open
11/01/2018 03:32	74	-53.7837	-37.55301	Commence Hauling RMT 8
11/01/2018 03:31	74	-53.78337	-37.55177	RMT 8 Stopped at 35m
11/01/2018 03:28	74	-53.7824	-37.54846	Commence Hauling RMT 8
11/01/2018 03:22	74	-53.78021	-37.54124	RMT 8 Stopped at 49m Wire Out
11/01/2018 03:20	74	-53.77941	-37.53892	RMT 8 at 38m
11/01/2018 03:11	74	-53.77702	-37.52834	RMT 8 Stopped at 47m Wire Out
11/01/2018 03:07	74	-53.77598	-37.52378	RMT 8 in the Water
11/01/2018 03:05	74	-53.7754	-37.5215	Commence Deploying RMT 8
11/01/2018 02:57	74	-53.77309	-37.51211	stern door open
11/01/2018 02:55	74	-53.77278	-37.50974	vessel heading into wind spd 2.5kts
11/01/2018 02:22	73	-53.77444	-37.55324	net on deck
11/01/2018 02:20	73	-53.77439	-37.55077	stern door open
11/01/2018 02:10	73	-53.77444	-37.53816	Commence recovery
11/01/2018 01:52	73	-53.77402	-37.51593	net deployed
11/01/2018 01:49	73	-53.77387	-37.5123	Stern door open
11/01/2018 01:47	73	-53.77369	-37.50958	vessel in position heading into wind @ 2.5KTS
11/01/2018 01:27	72	-53.77462	-37.54572	stern door closed. Retern to origional position
11/01/2018 01:24	72	-53.77461	-37.54242	stern door open
11/01/2018 01:18	72	-53.7746	-37.53429	commence recovery
11/01/2018 01:04	72	-53.77404	-37.5165	net deployed
11/01/2018 01:00	72	-53.77383	-37.51148	stern door open
11/01/2018 00:59	72	-53.77373	-37.5102	Vessel heading into wind COG 270 spd 2.5kts
10/01/2018 22:09		-53.71548	-37.98747	Commence target fishing Course 085
10/01/2018 22:02	71	-53.7185	-37.98459	Stern door closed
10/01/2018 22:00	71	-53.71789	-37.98177	RMT on deck
10/01/2018 21:57	71	-53.71123	-37.92224	Stern door opened
10/01/2018 21:47	71	-53.71435	-37.96615	Passing through position CTD 3.1S
10/01/2018 21:41	71	-53.71292	-37.95945	Max wire 174m
10/01/2018 21:25	71	-53.70888	-37.94133	Stern door closed
10/01/2018 21:23	71	-53.71169	-37.93076	RMT deployed
10/01/2018 21:19				Stern door open
10/01/2018 21:16		-53.70603	-37.93075	Speed 2.5kts heat to wind for RMT
10/01/2018 21:12		-53.70426	-37.93528	Turn into wind for RMT
10/01/2018 20:54	70	-53.71324	-37.96583	Vsl off DP
10/01/2018 20:50	70	-53.71323	-37.96589	CTD on deck
10/01/2018 20:48	70	-53.71323	-37.96588	CTD at surface
10/01/2018 20:36	70	-53.71323	-37.96582	CTD at depth 118m
10/01/2018 20:34	70	-53.71321	-37.96584	CTD going down to 120m EA600 depth 131m
10/01/2018 20:30	70	-53.71321	-37.96584	CTD in water
10/01/2018 20:27	70	-53.71321	-37.96582	CTD off deck
10/01/2018 20:18	70	-53.71289	-37.96659	Vsl on Dp for CTD 3.1S
10/01/2018 20:06	70	-53.7237	-37.96039	Start slow down
10/01/2018 19:08		-53.89742	-37.9044	Completed Transect 3.2 and relocating to CTD Station 3.2S
10/01/2018 14:48		-53.18364	-38.14118	Commence transect 3.2. Spd 10kts. COG 179
10/01/2018 13:34	69	-53.20855	-38.45281	Increase speed to 10kts COT 080
10/01/2018 13:28	69	-53.21985	-38.44976	Deployed XBT-25
10/01/2018 13:24	69	-53.22879	-38.4464	Start slow down to 7kts
10/01/2018 12:28	68	-53.38151	-38.3972	Increase speed to 10kts
10/01/2018 12:20	68	-53.39729	-38.3921	Deployed XBT-24
10/01/2018 12:18	68	-53.40152	-38.39068	Start slow down 7kts
10/01/2018 11:18	67	-53.56363	-38.33847	Increase speed to 10kts
10/01/2018 11:12	67	-53.57486	-38.33466	Deployed XBT-23
10/01/2018 11:09	67	-53.58171	-38.3325	Start slow down 7kts

10/01/2018 10:08		-53.56213	-38.33886	Inc to 10kts
10/01/2018 10:07	66	-53.56553	-38.33783	XBT-22 deployed
10/01/2018 10:05		-53.75254	-38.27736	slow to 7kts
10/01/2018 09:02		-53.92286	-38.22165	Inc to 10kts for WCB 3.1
10/01/2018 09:00	65	-53.92657	-38.22144	XBT-21 deployed @ WCB 3.1
10/01/2018 07:30		-53.78624	-38.57103	On transit to WCB 3.1S
10/01/2018 07:24	64	-53.78517	-38.58386	Off DP
10/01/2018 07:14	64	-53.78517	-38.58387	CTD on deck
10/01/2018 07:10	64	-53.78514	-38.58391	CTD at surface
10/01/2018 07:05	64	-53.78516	-38.5839	CTD Stopped at 189m
10/01/2018 07:01	64	-53.78517	-38.58385	CTD Veering to 180m
10/01/2018 06:55	64	-53.78515	-38.58387	CTD in the Water
10/01/2018 06:51	64	-53.7852	-38.58374	Commence Deploying CTD
10/01/2018 06:48		-53.78542	-38.58336	VSL on DP
10/01/2018 06:36		-53.7806	-38.58025	Commence Slowing Down
10/01/2018 06:30		-53.76943	-38.55845	On Passage
10/01/2018 06:24		-53.76921	-38.5537	Commence Turning off Station
10/01/2018 06:21	63	-53.77087	-38.557	RMT 8 Recovered to Deck and Stern Bulwark Door Closed
10/01/2018 06:16	63	-53.77354	-38.56215	Stern Bulwark Door Open
10/01/2018 05:48	63	-53.78815	-38.58975	RMT 8 Stopped at 266m Wire Out
10/01/2018 05:21	63	-53.80216	-38.61562	RMT 8 in the Water and Stern Bulwark Door Closed
10/01/2018 05:16	63	-53.80441	-38.62057	Stern Bulwark Door Open
10/01/2018 05:12		-53.8063	-38.62389	Vessel Proceeding at 2.8knts Head to Wind (048 COG) Station CTD 2.2S
10/01/2018 04:54		-53.81503	-38.59204	Commence Turning on to Station
10/01/2018 03:15		-53.71064	-38.15105	A/C to 254 Hdg back to 2.2S
09/01/2018 23:40	62	-53.3872	-38.66476	RMT secured
09/01/2018 23:28	62	-53.39557	-38.67236	RMT on deck
09/01/2018 23:25	62	-53.39766	-38.67403	Stern door open
09/01/2018 22:53	62	-53.41948	-38.68808	Max wire out 359m start haul
09/01/2018 22:35	62	-53.43229	-38.69538	Passing through position CTD2.2
09/01/2018 22:16	62	-53.44589	-38.70274	Stern doors closed
09/01/2018 22:14	62	-53.44717	-38.70349	RMT deployed
09/01/2018 22:09		-53.45038	-38.70512	Vsl at 2.6kts head to wind for RMT
09/01/2018 22:04		-53.44834	-38.70843	Slow down and turn for RMT
09/01/2018 21:49		-53.43194	-38.69301	Off DP
09/01/2018 21:42	61	-53.43194	-38.69302	CTD on deck
09/01/2018 21:40	61	-53.43193	-38.69302	CTD at surface
09/01/2018 21:05	61	-53.4319	-38.693	CTD stopped at 1000m
09/01/2018 20:45	61	-53.43189	-38.69302	going down to 1000m
09/01/2018 20:43	61	-53.43189	-38.69301	CTD in water
09/01/2018 20:41	61	-53.43193	-38.69293	CTD off deck
09/01/2018 20:38	61	-53.43225	-38.6931	On station CTD 2.2N
09/01/2018 20:30		-53.42933	-38.69106	Commence slow down
09/01/2018 19:21		-53.25756	-38.75	Finished transect 2.2
09/01/2018 17:54		-53.4967	-38.6745	Prop Motor Fault Resolved - Resumed Survey
09/01/2018 17:30		-53.5092	-38.67089	Propulsion Lost due to Propulsion Motor Fault - WCB Suspended
09/01/2018 14:45	2.2S	-53.96263	-38.52687	Pass over WCB-2.2s @ 10kts
09/01/2018 13:37	60	-53.99532	-38.81862	Increase speed to 10kts
09/01/2018 13:36	60	-53.99351	-38.81917	XTB-15 deployed. Pass WCB-2.1
09/01/2018 13:34	60	-53.98944	-38.82039	Start slow down to 7kts
09/01/2018 12:32	59	-53.82087	-38.87297	Increase speed to 10kts
09/01/2018 12:30	59	-53.81732	-38.8741	XBT-14 deployed
09/01/2018 12:29	59	-53.81536	-38.87468	Start slow down to 7kts
09/01/2018 11:27	58	-53.64862	-38.92652	Increase speed to 10kts
09/01/2018 11:22	58	-53.63896	-38.92955	XBT-13 deployed

09/01/2018 11:20	58	-53.63475	-38.93086	Start slow down to 7kts
09/01/2018 10:20	57	-53.47362	-38.98054	Inc to 10kts
09/01/2018 10:15	57	-53.46397	-38.98298	XBT-12 deployed
09/01/2018 10:12	57	-53.45808	-38.98483	Slow to 7kts
09/01/2018 09:14	56	-53.30238	-39.03194	Inc to 10kts
09/01/2018 09:08	56	-53.28678	-39.03729	XBT-11 deployed
09/01/2018 09:00		-53.28675	-39.03733	Vsl off DP
09/01/2018 07:54		-53.28663	-39.03628	Vsl on DP at XBT-11
09/01/2018 07:30		-53.26996	-39.03599	MUDL failed on deck
09/01/2018 07:18		-53.26985	-39.03572	Vsl on DP for MUDL
09/01/2018 07:12		-53.28681	-39.03731	Start slow down
09/01/2018 05:36		-53.49397	-39.29381	On Passage
09/01/2018 05:30		-53.50401	-39.30123	Commence Turning off Station
09/01/2018 05:27	55	-53.50342	-39.29749	RMT 8 Recovered to Deck and Stern Bulwark Door Closed
09/01/2018 05:18	55	-53.50177	-39.28915	Stern Bulwark Door Open
09/01/2018 04:46	55	-53.49438	-39.25716	RMT 8 Stopped at 264m Wire Out
09/01/2018 04:12	55	-53.48949	-39.22271	RMT 8 in the Water and Stern Bulwark Door Closed
09/01/2018 04:09	55	-53.48955	-39.21979	Stern Bulwark Door Open
09/01/2018 04:06		-53.48905	-39.21693	Vessel Proceeding at 2knts Head to Wind (045 COG) Station CTD 1.2N
09/01/2018 04:00		-53.4938	-39.20344	Commence Turning onto Station
09/01/2018 00:55	54	-53.80503	-38.62033	all secure
09/01/2018 00:43	54	-53.8009	-38.61318	RMT on deck
09/01/2018 00:36	54	-53.79841	-38.60831	stern door open
09/01/2018 00:04	54	-53.78608	-38.58616	Start recovery of RMT
09/01/2018 00:00	54	-53.78466	-38.58355	pass over CTD 2.2s
08/01/2018 23:37	54	-53.77569	-38.56853	start lowering RMT
08/01/2018 23:35	54	-53.77469	-38.56724	stern door open
08/01/2018 23:32	54	-53.77378	-38.56519	in position 1nm from CTD 2.2s @ 2.0kts
08/01/2018 23:25		-53.76836	-38.56592	Start turn head into wind and slow down
08/01/2018 22:44		-53.74108	-38.74056	Commence transit to CTD2.2S
08/01/2018 20:16		-53.93575	-39.11186	Set course 051 (downwind) at 7kts for target fishing
08/01/2018 19:37		-54.02827	-39.08751	End of transit 1.2
08/01/2018 15:15	1.2N	-53.31436	-39.30561	Commence Start of Transect WCB 1.2 (Hdg 170 Speed 10knts)
08/01/2018 15:10		-53.30749	-39.32277	Commence Turning onto Transect
08/01/2018 14:06	53	-53.33751	-39.60508	Increase speed to 10kts COT 080
08/01/2018 14:01	53	-53.34695	-39.60244	XBT5 deployed
08/01/2018 13:58	53	-53.35313	-39.60058	start slow down to 7kts
08/01/2018 12:59	52	-53.51356	-39.5532	Increase speed to 10kts
08/01/2018 12:54	52	-53.5228	-39.55047	XBT 4 Deployed
08/01/2018 12:50	52	-53.53066	-39.54811	start slow down to 7kts
08/01/2018 11:51	51	-53.69003	-39.50076	Increase speed to 10kts
08/01/2018 11:45	51	-53.7008	-39.49757	XBT 3 Deployed
08/01/2018 11:42	51	-53.70784	-39.49552	Start Slow down to 7kts
08/01/2018 10:40	50	-53.87538	-39.4451	Increase speed to 10kts
08/01/2018 10:38	50	-53.87912	-39.44417	XBT2 deployed
08/01/2018 10:30	50	-53.77556	-39.47531	Start Slowdown to 7kts
08/01/2018 09:36	49	-54.04295	-39.39569	XBT deployed
08/01/2018 09:33	49	-54.04879	-39.39385	XBT1 deployed
08/01/2018 09:30	1.1S	-54.05441	-39.39159	Vsl at WCB 1.1S Set course 350 at 7kts
08/01/2018 02:40		-53.91988	-37.34033	All equipment secured
08/01/2018 02:35	48	-53.92191	-37.33811	Net on deck
08/01/2018 02:30	48	-53.91988	-37.33492	Stern door open
08/01/2018 02:17	48	-53.91452	-37.32684	Commence recovery
08/01/2018 02:14	48	-53.91314	-37.32539	Start lowering net
08/01/2018 02:11	48	-53.91197	-37.32366	Net in water

08/01/2018 02:10	48	-53.91156	-37.32297	Stern door open
08/01/2018 02:08	48	-53.91021	-37.32149	At position
08/01/2018 01:54	47	-53.92115	-37.33273	Stern door open
08/01/2018 01:48	47	-53.91842	-37.32952	Commence net recovery
08/01/2018 01:40	47	-53.91454	-37.32502	Stern door closed
08/01/2018 01:36	47	-53.91337	-37.32213	In postion clear to deploy
08/01/2018 01:36	47	-53.91337	-37.32213	start to deploy
08/01/2018 01:19		-53.91445	-37.35293	Marker set start slow down and swing to std for position 0.5nm downwind
07/01/2018 19:34	46	-54.15963	-36.6971	Doughnut recovered
07/01/2018 18:30	46	-54.15961	-36.69713	Doughnut in the Water
07/01/2018 18:24	46	-54.15946	-36.6979	VSL on DP
07/01/2018 16:12		-54.159	-36.69858	VSL off DP
07/01/2018 16:10	45	-54.15907	-36.69854	Mammoth Recovered to Deck
07/01/2018 16:05	45	-54.15907	-36.69851	Commence Recovering Mammoth
07/01/2018 16:03	45	-54.15907	-36.69851	Commence Redeploying Mammoth
07/01/2018 15:59	45	-54.15905	-36.69853	Mammoth Recovered to Stern Door
07/01/2018 15:54	45	-54.15903	-36.69853	Mammoth stopped at 13m
07/01/2018 15:51	45	-54.15902	-36.69855	Mammoth in the Water
07/01/2018 15:46	45	-54.15905	-36.69855	Commence Deploying Mammoth
07/01/2018 15:36		-54.15904	-36.69854	VSL on DP
07/01/2018 09:00		-54.15891	-36.69554	Vsl off DP for EK60 callibration
07/01/2018 08:54	44	-54.15891	-36.69552	CTD on deck
07/01/2018 08:52	44	-54.15891	-36.69551	CTD on surface
07/01/2018 08:47	44	-54.15891	-36.69552	CTD stopped at 60m
07/01/2018 08:44	44	-54.15891	-36.69569	CTD going down to 60m in water depth 73m
07/01/2018 08:39	44	-54.15889	-36.69551	CTD in water
07/01/2018 08:35	44	-54.15889	-36.6955	CTD off deck
07/01/2018 08:18	44	-54.15899	-36.69543	Vsl on DP for CTD
06/01/2018 18:30		-53.79846	-37.93054	On Passage
06/01/2018 18:18	43	-53.7983	-37.93319	VSL off DP
06/01/2018 18:08	43	-53.7983	-37.93329	CTD Recovered to Deck
06/01/2018 17:50	43	-53.79835	-37.93328	CTD Stopped at 246m
06/01/2018 17:43	43	-53.79837	-37.93324	CTD Veering to approx 250m
06/01/2018 17:38	43	-53.79833	-37.93325	CTD in the Water
06/01/2018 17:32	43	-53.79817	-37.93626	Commence Deploying CTD
06/01/2018 16:34	42	-53.79817	-37.93614	Mooring Recovery Completed
06/01/2018 16:33	42	-53.79817	-37.9362	Acoustic Release Recovered to Deck
06/01/2018 16:30	42	-53.7982	-37.93645	Sediment Trap Recovered to Deck
06/01/2018 16:19	42	-53.7983	-37.9375	ADCP Buoy Recovered to Deck
06/01/2018 16:13	42	-53.79846	-37.93841	Stern Bulwark Door Opened
06/01/2018 16:11	42	-53.7986	-37.93825	Mooring Connected to Winch
06/01/2018 16:09	42	-53.79868	-37.93817	Mooring Grappled
06/01/2018 16:00		-53.79841	-37.9391	VSL on DP
06/01/2018 15:48		-53.79869	-37.94481	VSL off DP
06/01/2018 15:47	42	-53.7987	-37.94479	Mooring on the Surface and Sighted
06/01/2018 15:44	42	-53.79869	-37.9448	Mooring Release Confirmed
06/01/2018 15:43	42	-53.7987	-37.94479	WCB Mooring Release Signal Sent
06/01/2018 15:09	41	-53.79867	-37.94481	MUDL Recovered to Deck
06/01/2018 15:03	41	-53.79868	-37.94478	Commence Recovering MUDL
06/01/2018 14:36	41	-53.79871	-37.94482	Stopped lowering MUDL at 100m
06/01/2018 14:34	41	-53.7987	-37.94484	MUDL in water
06/01/2018 14:30	41	-53.7987	-37.9448	Vessel in position
06/01/2018 14:17	40	-53.79872	-37.94483	BONGO on deck
06/01/2018 14:15	40	-53.79871	-37.94481	BONGO out of water
06/01/2018 14:11	40	-53.79872	-37.94482	Stopped lowering at 50m
06/01/2018 14:10	40	-53.79873	-37.94484	Commence deploying BONGO
06/01/2018 14:09	39	-53.79873	-37.94484	BONGO on deck

06/01/2018 14:07	39	-53.79873	-37.94485	BONGO out of water
06/01/2018 14:04	39	-53.79873	-37.94478	Stop lowering BONGO at 50m
06/01/2018 14:02	39	-53.79871	-37.94483	BONGO in water
06/01/2018 13:58	39	-53.7987	-37.94482	BONGO off deck
06/01/2018 13:54	39	-53.79873	-37.94479	Vessel in position. swing out gantry crane for BONGO deployment
06/01/2018 13:44	38	-53.79872	-37.94482	CTD on deck
06/01/2018 13:41	38	-53.79873	-37.94481	CTD out of water
06/01/2018 13:24	38	-53.79872	-37.94482	Stopped lowering at 100m
06/01/2018 13:20	38	-53.7987	-37.94481	Commence lowering
06/01/2018 13:17	38	-53.7987	-37.94484	CTD in water
06/01/2018 13:15	38	-53.79872	-37.94482	Start deploy CTD
06/01/2018 13:12	38	-53.79874	-37.94427	gantry crane lowered
06/01/2018 12:18		-53.79919	-37.94884	ON DP. At station. Heading into wind 080
06/01/2018 12:00		-53.7988	-37.94741	Start slow down for WCB mooring
06/01/2018 06:36		-53.46178	-39.16816	On Passage to WCB Mooring
06/01/2018 06:24		-53.45767	-39.19398	Commence Turning off Station
06/01/2018 06:05	37	-53.46052	-39.19816	RMT 8 Recovered to Deck and Stern Bulwark Door Closed
06/01/2018 06:01	37	-53.46846	-39.21129	Stern Bulwark Door Open
06/01/2018 05:33	37	-53.48137	-39.23231	Commence Hauling RMT 8
06/01/2018 05:31	37	-53.4823	-39.23364	RMT 8 Stopped at 284m Wire Out
06/01/2018 04:57	37	-53.49867	-39.26069	RMT 8 in the Water and Stern Bulwark Door Closed
06/01/2018 04:52	37	-53.50128	-39.26434	Stern Bulwark Door Open
06/01/2018 04:48		-53.5035	-39.26722	Vessel Proceeding at 2knts Head to Swell (041 COG) Station CTD 1.2N
06/01/2018 04:36		-53.52295	-39.26058	Commence Turning onto Station
06/01/2018 02:48		-53.86931	-39.16115	On passage to CTD 1.2N
06/01/2018 02:45	36	-53.86787	-39.15996	RMT on deck
06/01/2018 02:42	36	-53.86644	-39.15879	RMT out of water
06/01/2018 02:39	36	-53.86498	-39.15749	Stern door open
06/01/2018 02:10	36	-53.84995	-39.14675	Stop lowering
06/01/2018 01:36	36	-53.83226	-39.13458	commence lowering RMT
06/01/2018 01:35	36	-53.82957	-39.13306	RMT in water
06/01/2018 01:30	36	-53.82908	-39.13273	vessel head into wind
06/01/2018 00:24		-53.79482	-38.84953	Steam towards 1nm down wind of CTD 1.2S
05/01/2018 23:54	35	-53.8209	-38.72364	vessel heading down wind
05/01/2018 23:50	35	-53.82103	-38.72784	RMT on deck
05/01/2018 23:40	35	-53.81872	-38.73612	stern door open
05/01/2018 23:32	35	-53.81677	-38.74291	start retrieving RMT
05/01/2018 23:30	35	-53.81625	-38.74449	Stopped deploying RMT @ 30m
05/01/2018 23:26	35	-53.81516	-38.74806	stern door closed
05/01/2018 23:21	35	-53.81381	-38.752	stern door open start to deploy
05/01/2018 23:15	35	-53.81039	-38.7602	Turn complete spd 2.0kts
05/01/2018 23:11		-53.81	-38.77362	Start turn
05/01/2018 23:10		-53.81552	-38.74641	Mark chart
05/01/2018 23:00		-53.82404	-38.72235	Vsl turned down wind target fishing
05/01/2018 22:00		-53.75597	-38.98612	vsl turned into wind for target fishing
05/01/2018 21:12		-53.84438	-39.1352	VSL on Passage
05/01/2018 21:06	34	-53.84698	-39.14411	Vsl off DP
05/01/2018 20:54	34	-53.83631	-39.12264	CTD on deck
05/01/2018 20:52	34	-53.84699	-39.14538	CTD out of water
05/01/2018 20:44	34	-53.84696	-39.14539	CTD stopped at 283m
05/01/2018 20:38	34	-53.84701	-39.14542	CTD going down to 283m water depth 291m
05/01/2018 20:34	34	-53.84701	-39.14542	CTD in water
05/01/2018 20:32	34	-53.84702	-39.14541	CTD off deck
05/01/2018 20:24	34	-53.84702	-39.14538	Vsl on DP @ CTDW1.25
05/01/2018 20:06	34	-53.83218	-39.15673	Commence slow down

05/01/2018 18:18		-53.50609	-39.24439	On Passage
05/01/2018 18:06		-53.49545	-39.25209	VSL off DP
05/01/2018 17:59	33	-53.49545	-39.25212	CTD Recovered to Deck
05/01/2018 17:35	33	-53.49546	-39.25211	CTD Stopped at 1000m
05/01/2018 17:16	33	-53.49545	-39.25211	CTD Veering to 1000m
05/01/2018 17:12	33	-53.49546	-39.25216	CTD in the Water
05/01/2018 17:06	33	-53.4955	-39.25213	Commence Deploying CTD
05/01/2018 17:00		-53.49549	-39.25217	VSL on DP
05/01/2018 16:48		-53.49168	-39.25515	Commence Slowing Down
05/01/2018 11:30		-52.81183	-40.16053	Relocate to Western Core Box CTD 1.2N
05/01/2018 11:18		-52.81265	-40.16505	Off DP
05/01/2018 07:46		-52.81269	-40.16512	Vsl at P3 on DP
05/01/2018 07:13		-52.79029	-40.12249	Vsl off DP
05/01/2018 06:45	32	-52.79038	-40.12243	MUDL Recovered to Deck
05/01/2018 06:36	32	-52.79086	-40.12222	Commence Recovering MUDL
05/01/2018 06:12	32	-52.79199	-40.12173	MUDL Stopped at 45m Depth
05/01/2018 06:09	32	-52.792	-40.12172	MUDL in the Water
05/01/2018 06:08	32	-52.792	-40.12171	Commence Deploying MUDL
05/01/2018 06:01	31	-52.79199	-40.12172	MUDL Recovered to Deck
05/01/2018 05:53	31	-52.79244	-40.12185	Commence Recovering MUDL
05/01/2018 05:23	31	-52.79329	-40.12221	MUDL Stopped at 100m Depth
05/01/2018 05:17	31	-52.79345	-40.12227	MUDL in the Water
05/01/2018 05:16	31	-52.79344	-40.12227	Commence Deploying MUDL
05/01/2018 05:00		-52.79342	-40.1223	VSL on DP
05/01/2018 04:54		-52.79	-40.12329	Commence Turning onto Station
05/01/2018 04:30		-52.73967	-40.01537	On Passage
05/01/2018 04:24		-52.73309	-39.99991	Commence Turning off of Station
05/01/2018 04:21	30	-52.73482	-40.00128	MOCNESS Recovered to Deck
05/01/2018 04:14	30	-52.73803	-40.00605	MOCNESS on Surface
05/01/2018 02:43	30	-52.77596	-40.0662	1947m wire out. Commence hauling MOCNESS
05/01/2018 01:31	30	-52.79516	-40.12251	MOCNESS in water
05/01/2018 01:26	30	-52.79662	-40.12639	Start deploy MOCNESS
05/01/2018 01:24	30	-52.79729	-40.1279	On Station. Stern door open. Speed 2.0kts HDG 050
05/01/2018 01:06	30	-52.81295	-40.1632	Off DP. On Passage to station for MOCNESS deployment
05/01/2018 00:43	29	-52.8129	-40.16323	MUDL on deck
05/01/2018 00:42	29	-52.81292	-40.16321	MUDL out of water
05/01/2018 00:39	29	-52.81292	-40.16322	start retreaving MUDL
05/01/2018 00:16	29	-52.81295	-40.1632	Stopped lowering MUDL at 45m
05/01/2018 00:12	29	-52.81292	-40.1632	Start Deploying MUDL
05/01/2018 00:05	28	-52.81293	-40.16321	MUDL on deck
05/01/2018 00:04	28	-52.81293	-40.16321	MUDL out of water
05/01/2018 00:00	28	-52.81293	-40.16319	start recovering MUDL
04/01/2018 23:21	28	-52.81293	-40.16322	Stopped lowering MUDL at 100m
04/01/2018 23:14	28	-52.81293	-40.16322	MUDL in water commence lowering
04/01/2018 23:12	28	-52.81293	-40.16323	At station. start to deploy MUDL from std gantry crane
04/01/2018 22:52	27	-52.81293	-40.16323	MUDL on deck
04/01/2018 22:50	27	-52.81295	-40.16322	MUDL at surface
04/01/2018 22:45	27	-52.81293	-40.16321	Commence recovery
04/01/2018 22:35	27	-52.81294	-40.16321	MUDL stopped at 50m
04/01/2018 22:30	27	-52.81294	-40.16321	MUDL in water
04/01/2018 22:29	27	-52.81294	-40.16321	MUDL off deck
04/01/2018 22:06		-52.81297	-40.1632	Vsl on station @ P3 in full DP
04/01/2018 21:17	26	-52.7426	-40.09555	MOCNESS on deck
04/01/2018 21:15	26	-52.74358	-40.09589	MOCNESS on surface
04/01/2018 21:14	26	-52.74411	-40.09602	Bullwalk door down
04/01/2018 19:45	26	-52.7881	-40.10629	MOCNESS stop veer @ 1818m wire out

04/01/2018 18:43	26	-52.82177	-40.10949	MOCNESS veering to 1000m
04/01/2018 18:42	26	-52.82232	-40.10951	MOCNESS in the Water
04/01/2018 18:38	26	-52.82404	-40.10983	Commence Deploying MOCNESS
04/01/2018 18:36		-52.82508	-40.10925	VSL HDG 005 into wind at 2knts
04/01/2018 18:30		-52.82778	-40.14625	Commence Slowing Down
04/01/2018 18:18		-52.8273	-40.1612	On Passage
04/01/2018 18:12		-52.82877	-40.16336	VSL off DP
04/01/2018 18:06	25	-52.82877	-40.16338	CTD Recovered to Deck
04/01/2018 17:09	25	-52.8288	-40.1634	CTD Stopped at 1000m
04/01/2018 16:52	25	-52.8288	-40.16342	CTD Veering to 100m
04/01/2018 16:42	25	-52.8288	-40.16341	CTD in the Water
04/01/2018 16:38	25	-52.82878	-40.16344	Commence Deploying CTD
04/01/2018 16:12	24	-52.82876	-40.16344	Bongo Net Recovered to Deck
04/01/2018 16:02	24	-52.8288	-40.1634	Bongo Net in the Water
04/01/2018 15:59	23	-52.82879	-40.16339	Bongo Net Recovered to Deck
04/01/2018 15:53	23	-52.82879	-40.16341	Bongo Net in the Water
04/01/2018 15:46	23	-52.82877	-40.1634	Commence Deploying Bongo Nets
04/01/2018 15:42		-52.82888	-40.16321	VSL on DP
04/01/2018 15:24	22	-52.81262	-40.16492	Glider Deployment Completed
04/01/2018 15:20	22	-52.81261	-40.16493	JR1 and 10t Crane and Stowed and Secured
04/01/2018 14:55	22	-52.81264	-40.16494	Glider on Surface and Sighted
04/01/2018 14:26	22	-52.81267	-40.16492	Glider dived
04/01/2018 14:00	22	-52.81276	-40.16518	JR1 out of water
04/01/2018 13:50	22	-52.81257	-40.16476	Vessel shift 100m due ESE of glider
04/01/2018 13:43	22	-52.81247	-40.16444	rope disconnected from glider
04/01/2018 13:40	22	-52.81246	-40.16443	JR1 released and clear
04/01/2018 13:36	22	-52.81246	-40.16443	S Fielding back on board AB C Devitt on JR1
04/01/2018 13:33	22	-52.81247	-40.16444	JR1 alongside
04/01/2018 13:28	22	-52.81246	-40.16443	Glider in water attached to rope
04/01/2018 12:55	22	-52.81247	-40.16443	JR1 released and clear
04/01/2018 12:54	22	-52.81246	-40.16443	S Fielding enter JR1
04/01/2018 12:50	22	-52.81247	-40.16442	Glider in JR1. JR1 in water alongside. 2/O D Muller-Tolk on JR1
04/01/2018 11:17	22	-52.81245	-40.16441	JR1 on ships side out of water
04/01/2018 11:12	22	-52.81245	-40.16442	Start launch JR1
04/01/2018 02:36	21	-52.81249	-40.16445	motion sensor on deck
04/01/2018 02:35	21	-52.81249	-40.16445	close stern door
04/01/2018 02:31	21	-52.81247	-40.16445	motion sensor out of water
04/01/2018 02:30	21	-52.81247	-40.16446	open stern door
04/01/2018 01:41	21	-52.81247	-40.16444	Stopped at 2000m. Commence hauling
04/01/2018 00:49	21	-52.81248	-40.16441	motion sensor in water
04/01/2018 00:45	21	-52.81245	-40.16442	Extend stern gantry crane
04/01/2018 00:42	21	-52.81247	-40.16442	On station for BIO MOCNESS motion sensor test
04/01/2018 00:06	20	-52.81261	-40.16428	MUDL on deck
04/01/2018 00:04	20	-52.8126	-40.16428	MUDL at surface
04/01/2018 00:00	20	-52.81259	-40.16428	start hauling MUDL
03/01/2018 23:21	20	-52.81262	-40.1643	MUDL stopped at 100m
03/01/2018 23:14	20	-52.81263	-40.16429	MUDL in water
03/01/2018 23:06	20	-52.81262	-40.1643	Extending mid ships gantry crane on station
03/01/2018 22:55	19	-52.81263	-40.16431	CTD on deck
03/01/2018 22:53	19	-52.81263	-40.16431	CTD on surface
03/01/2018 22:38	19	-52.81263	-40.16431	CTD @ 100m
03/01/2018 22:35	19	-52.81263	-40.16429	CDT going down to 100m
03/01/2018 22:30	19	-52.81264	-40.16429	CTD in water
03/01/2018 22:25	19	-52.81263	-40.16429	CTD off deck
03/01/2018 21:19	18	-52.8126	-40.1643	Bongo net on deck
03/01/2018 21:17	18	-52.8126	-40.1643	Bongo net at surface
03/01/2018 21:00	18	-52.81258	-40.1643	Bongo net at 200m

03/01/2018 20:53	18	-52.8126	-40.16431	Bongo net in water
03/01/2018 20:52	18	-52.81259	-40.16431	Bongo net off deck
03/01/2018 20:51	17	-52.81259	-40.16431	Bongo net on deck
03/01/2018 20:50	17	-52.81258	-40.16431	Bongo net at surface
03/01/2018 20:47	17	-52.81258	-40.16431	Bongo net at 50m
03/01/2018 20:45	17	-52.81262	-40.16431	Bongo net in water
03/01/2018 20:44	17	-52.81257	-40.1643	Bongo net off deck
03/01/2018 20:42	16	-52.81261	-40.16431	Bongo net on deck
03/01/2018 20:41	16	-52.8126	-40.16431	Bongo net at surface
03/01/2018 20:38	16	-52.81261	-40.16432	Bongo net @ 50m
03/01/2018 20:36	16	-52.81261	-40.16432	Bongo net in water
03/01/2018 20:34	16	-52.81261	-40.16431	Bongo net off deck
03/01/2018 20:13	15	-52.8126	-40.16429	CTD on deck
03/01/2018 20:12	15	-52.8126	-40.1643	CTD on Surface
03/01/2018 18:55	15	-52.81262	-40.16429	CTD Stopped at 3737m
03/01/2018 17:51	15	-52.81263	-40.16432	CTD Veering to Approx 3780m
03/01/2018 17:45	15	-52.81263	-40.16428	CTD in the Water
03/01/2018 17:40	15	-52.81262	-40.1643	Commence Deploying CTD
03/01/2018 17:30		-52.81244	-40.16348	VSL on DP
03/01/2018 17:18		-52.80972	-40.1846	Commence Slowing Down
03/01/2018 16:48		-52.77441	-40.3229	On Passage
03/01/2018 16:36		-52.76729	-40.34107	VSL Turning off Station
03/01/2018 16:35	14	-52.76752	-40.33985	MOCNESS Recovered to Deck and Stern Bulwark Coor Closed
03/01/2018 16:29	14	-52.76892	-40.33287	MOCNESS At Surface
03/01/2018 15:05	14	-52.78992	-40.24813	MOCNESS Stopped at 1842m
03/01/2018 15:03	14	-52.79046	-40.24625	Continuing to Veer MOCNESS
03/01/2018 15:00	14	-52.79116	-40.2435	MOCNESS Stopped at 1765m
03/01/2018 14:00	14	-52.8075	-40.19441	Stern door closed
03/01/2018 13:59	14	-52.80792	-40.19327	MOCNESS in water
03/01/2018 13:55	14	-52.80939	-40.18904	COG 300 spd 2.0kts. stern door open
03/01/2018 13:48	14	-52.81023	-40.18622	DP Off
03/01/2018 13:22	14	-52.81023	-40.1862	Preparing MOCNESS
03/01/2018 13:17	13	-52.81024	-40.18619	Accoustic release on deck. stern door closed.
03/01/2018 13:00	13	-52.81089	-40.18328	resume hauling
03/01/2018 12:55	13	-52.81106	-40.18244	sediment trap and seagaurd current meter and O2 sensor on deck
03/01/2018 12:40	13	-52.81158	-40.17986	Sediment trap out of water
03/01/2018 12:36	13	-52.8117	-40.17913	Trimson buoy cluster on deck
03/01/2018 12:35	13	-52.81172	-40.17895	Trimson bouy cluster sighted
03/01/2018 12:20	13	-52.81213	-40.1763	Seabird CTD on deck
03/01/2018 12:16	13	-52.81224	-40.17561	Seabird CTD sighted
03/01/2018 12:06	13	-52.81264	-40.17388	Sediment trap and Sono Vault on deck
03/01/2018 11:58	13	-52.81303	-40.17255	Sediment trap out of water
03/01/2018 11:56	13	-52.81314	-40.17225	Trimsin buoy cluster on deck
03/01/2018 11:54	13	-52.81327	-40.17194	Trimsin buoy cluster sighted
03/01/2018 11:45	13	-52.8138	-40.17055	Seagaurd current meter on deck
03/01/2018 11:41	13	-52.81406	-40.16993	Mooring on deck
03/01/2018 11:36	13	-52.81434	-40.16924	Commence recovery
03/01/2018 11:35	13	-52.81437	-40.16916	Stern door open
03/01/2018 11:32	13	-52.81463	-40.16842	Mooring attached to recovery line
03/01/2018 11:18	13	-52.81448	-40.15226	Back on DP
03/01/2018 11:12	13	-52.8145	-40.14987	Mooring surfaced and sighted
03/01/2018 11:12	13	-52.8145	-40.14987	Off DP
03/01/2018 11:06	13	-52.8145	-40.14986	Mooring pinged @ 3939m
03/01/2018 10:00	13	-52.81459	-40.15028	Vsl on station in full DP 1000m down wind of P3
03/01/2018 09:54		-52.81451	-40.14985	commnce slow down @ P3
03/01/2018 00:00	12	-52.70199	-42.53821	Neuston sledge secured vessel on passage

02/01/2018 23:43	12	-52.69574	-42.54594	Neuston sledge on deck
02/01/2018 23:10	12	-52.68094	-42.51988	Neuston sledge in water
02/01/2018 23:06	12	-52.6795	-42.51705	On station 225 COG spd 2.0kts
02/01/2018 23:00	12	-52.67481	-42.51521	Start slow down and turn
02/01/2018 17:36		-52.56365	-43.83658	On Passage
02/01/2018 17:30		-52.56278	-43.852	VSL off DP
02/01/2018 17:02	11	-52.56236	-43.85231	MUDL Recovered to Deck
02/01/2018 16:58	11	-52.5626	-43.85348	Commence Recovering MUDL
02/01/2018 16:38	11	-52.56348	-43.85892	MUDL in the Water
02/01/2018 16:33	11	-52.56347	-43.85895	Commence deploying MUDL
02/01/2018 16:00		-52.56344	-43.85896	VSL on DP
02/01/2018 15:54		-52.56139	-43.86622	Commence Turning onto Station
02/01/2018 11:54	10	-52.55794	-44.94159	On Passage
02/01/2018 11:47	10	-52.5534	-44.9414	Neuston sledge on deck
02/01/2018 11:12	10	-52.53337	-44.94073	Neuston sledge in water
02/01/2018 11:10	10	-52.53214	-44.94047	ON COG 210 @ 2.0kts
02/01/2018 11:00	10	-52.52109	-44.95174	commence turn and slow down off passage
02/01/2018 00:00	9	-52.39559	-47.99159	On passage
01/01/2018 23:46	9	-52.39363	-47.99456	Neuston sledge on deck
01/01/2018 23:10	9	-52.39362	-47.95697	Neuston sledge in water
01/01/2018 23:07	9	-52.39384	-47.95433	vessel head to wind 250 COG 2.5kts
01/01/2018 23:00	9	-52.39075	-47.95226	Commence slow down
01/01/2018 18:06		-52.38248	-49.25333	On Passage
01/01/2018 18:00		-52.38025	-49.25855	VSL off DP
01/01/2018 17:50	8	-52.38016	-49.25814	CTD Recovered to Deck
01/01/2018 17:42	8	-52.38015	-49.2581	CTD Stopped at 150m
01/01/2018 17:38	8	-52.38016	-49.25814	CTD Veering to 150m
01/01/2018 17:35	8	-52.38015	-49.2581	CTD in the Water
01/01/2018 17:29	8	-52.38015	-49.25812	Commence Deploying CTD
01/01/2018 17:18		-52.38015	-49.25811	VSL on DP
01/01/2018 17:08	7	-52.37941	-49.25146	RMT8 Recovered to Deck and Stern Bulwark Door Closed
01/01/2018 16:59	7	-52.37773	-49.23777	Commence Hauling RMT8
01/01/2018 16:53	7	-52.37673	-49.22838	RMT8 Deployed
01/01/2018 16:47	7	-52.37573	-49.21884	RMT8 In the Water
01/01/2018 16:46	7	-52.37551	-49.21714	Commence Deploying RMT 8
01/01/2018 16:37	6	-52.37357	-49.20233	RMT8 Recovered to Deck and Stern Bulwark Door Closed
01/01/2018 16:27	6	-52.3721	-49.18681	Commence Hauling RMT8
01/01/2018 16:15	6	-52.37007	-49.16813	RMT8 Deployed
01/01/2018 16:11	6	-52.36934	-49.16213	RMT8 In the Water
01/01/2018 16:09	6	-52.36905	-49.15884	Commence Deploying RMT 8
01/01/2018 16:06		-52.36869	-49.15527	VSL Proceeding at 2.5knts into Wind
01/01/2018 16:00		-52.36839	-49.15457	VSL off DP
01/01/2018 14:29	5	-52.36515	-49.13063	Mockness on board stern door closed
01/01/2018 14:24	5	-52.36448	-49.12487	Start hauling mockness
01/01/2018 14:13	5	-52.36307	-49.11377	Stopped lowering mockness
01/01/2018 14:10	5	-52.36271	-49.11084	Mockness in water lowering to 30m
01/01/2018 14:08	5	-52.36249	-49.10911	stern door down
01/01/2018 13:49	5	-52.36154	-49.09004	Mockness back on board due to wires connected incorrectly
01/01/2018 13:47	5	-52.36144	-49.08813	start deploying mockness
01/01/2018 13:44	5	-52.36121	-49.08509	start extending stern gantry crane
01/01/2018 13:40	5	-52.36199	-49.09803	All clear to deploy COG 260 spd 2kts
01/01/2018 13:39	5	-52.36062	-49.07964	Off DP start making headway open stern door
01/01/2018 13:36	5	-52.36048	-49.07875	Ready to deploy Mockness
01/01/2018 13:10		-52.36046	-49.07874	Due to technical issues MUDL will be replaced by Mockness deployment

01/01/2018 12:53	4	-52.36047	-49.0787	CTD one deck
01/01/2018 12:48	4	-52.36046	-49.07868	CTD out of water
01/01/2018 12:39	4	-52.36048	-49.07872	CTD at 50m
01/01/2018 12:29	4	-52.36047	-49.07872	CTD in water
01/01/2018 12:26	4	-52.36047	-49.0787	Start deploying CDT
01/01/2018 12:25	4	-52.36047	-49.0787	Std extending mid ship gantry crane
01/01/2018 11:50	4	-52.36017	-49.07738	Vessel on DP mode at station
01/01/2018 11:48	3	-52.35984	-49.07587	Neuston Sledge recovered on deck
01/01/2018 11:43	3	-52.3587	-49.07057	Start recover Neuston sledge
01/01/2018 11:15	3	-52.35287	-49.04196	Commence tow 250 (COG)
01/01/2018 11:12	3	-52.35237	-49.03861	Neuston Sledge in the Water
01/01/2018 11:10	3	-52.36047	-49.07871	Commence Deploying Neuston Sledge
01/01/2018 11:07	3	-52.35126	-49.03301	Vessel Proceeding at 2knts Head to Wind (250 COG)
01/01/2018 11:00	3	-52.34651	-49.02681	Start slow down to Neuston net deployment
31/12/2017 23:59	2	-52.22611	-52.28763	On passage
31/12/2017 23:55	2	-52.22424	-52.29069	Crane and Neuston sledge secured
31/12/2017 23:45	2	-52.22101	-52.27793	Neuston Sledge recovered on deck
31/12/2017 23:41	2	-52.21979	-52.27393	Start recover Neuston sledge
31/12/2017 23:11	2	-52.21226	-52.24549	Commence tow 251 (COG)
31/12/2017 23:10	2	-52.21198	-52.24459	Neuston sledge net in water
31/12/2017 23:06	2	-52.21114	-52.24091	Vessel swung into wind
31/12/2017 23:00	2	-52.20724	-52.24385	Slow down for Neuston sledge net deployment
31/12/2017 17:36	1	-52.13681	-53.85484	On Passage
31/12/2017 17:30	1	-52.13728	-53.87109	Commence Turning off Station
31/12/2017 17:26	1	-52.13775	-53.86687	Neuston Sledge Recovered to Deck
31/12/2017 17:13	1	-52.13638	-53.85548	Neuston Sledge in the Water
31/12/2017 17:10	1	-52.13609	-53.85269	Commence Deploying Neuston Sledge
31/12/2017 17:00	1	-52.13583	-53.84407	Vessel Proceeding at 2knts Head to Wind (261 COG)
31/12/2017 16:54	1	-52.13257	-53.84009	Commence Slowing Down