JR155 Cruise Report
15-17 December 2006

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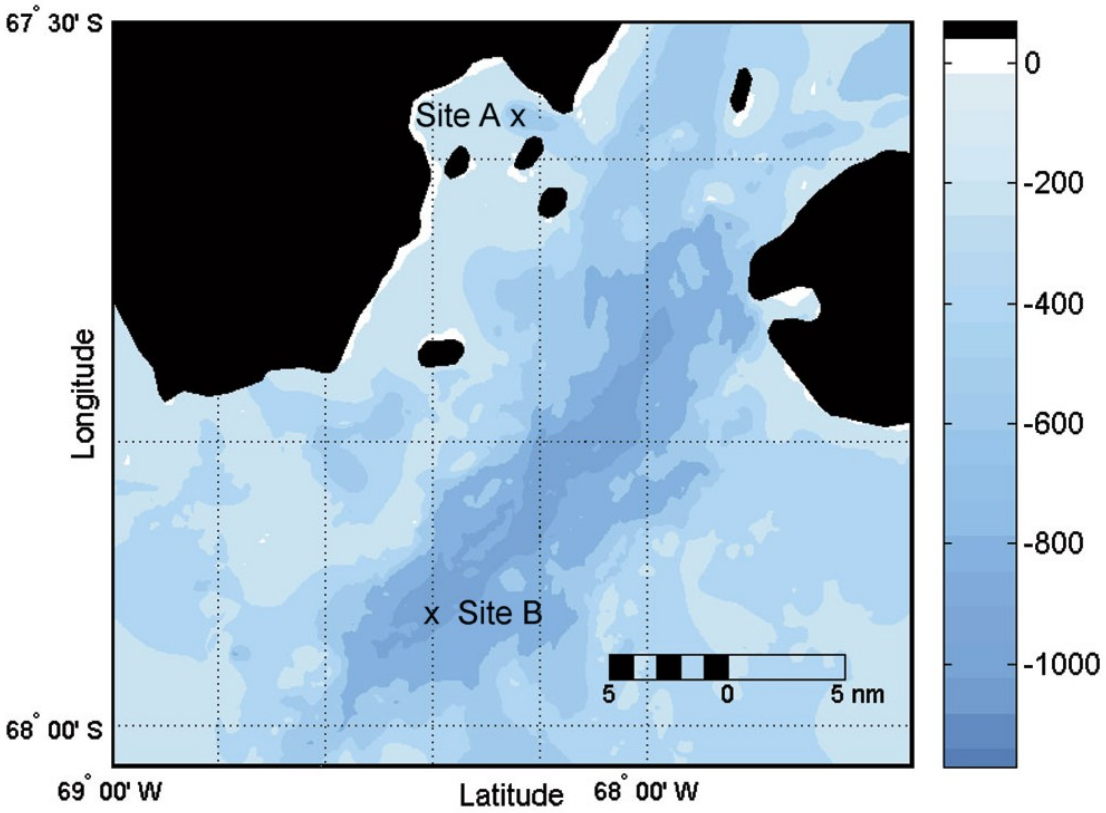
Aim

This short cruise on the RRS *James Clark Ross* was part of a continuing series as part of an AFI project (NERC NER/G/S/2002/00024 Biogeochemical Particle Flux Study in Marguerite Bay Antarctic Peninsula AFI4/13 PIs Jickells, Clarke, Brandon and Meredith) to study the physical and chemical properties, primary productivity processes and sedimentation processes in Marguerite Bay. The work is designed to augment the ongoing BAS Rothera Biogeochemical Times Series (RaTS) programme in Ryder Bay in northern Marguerite Bay, and to extend the programme into the open waters of Marguerite Bay. The sampling is therefore undertaken at two sites, the RaTS station in Ryder Bay and in the deeper water within Marguerite Bay itself. The cruise also contributed to another AFI project (NERC AFI4/02) PIs Elderfield, Ganeshram, Rickerby and de la Rocha "Behaviour of trace elements and isotope ratios of sea-ice brine and microaalgae: reconstructing the Antarctic sea-ice environment."

Intense sampling at the RatS programme site was undertaken during the 2005/6 austral summer. In this second season (2006/7), moorings deployed earlier in the project were continued through a further full season and additional sediment sampling was undertaken. Hence the aim of this cruise was to

- recover, service and redeploy the moorings previously deployed on JR136/7 in 2006,
- conduct CTD casts to describe the physical structure of the water column and to provide water samples for nutrient and particulate matter analyses,
- and take box cores at both sites.

The locations were, as on previous cruises for this project, one 'deep' mooring 22 miles from Rothera research station with a ~840m water column depth and one 'shallow' mooring at the Ryder Bay site (RaTS) 2 miles from Rothera with a ~500 m water column depth (exact positions are described in the cruise narrative).



Map of Marguerite Bay showing location of RaTS mooring site (Site A) and deep water mooring site (Site B).

Cruise Narrative

Note all times are local i.e. GMT – 3hours, all lat and long as decimal degrees from bridge log.

The party joined the JCR in Port Stanley 7 Dec. 2006 and sailed south assisting where appropriate the JR 163 Drake Passage work. We arrived at Rothera 15 Dec. and immediately commenced cargo unloading to clear the back deck.
We then sailed 15 Dec. about 19.00 to the first mooring (deep water) site latitude 67.92177 S, longitude 68.39137 W. Hydrophones were lowered and communication attempted with the mooring release starting at 21.07. There were some confusing and erratic responses but no viable response. Attempts were abandoned at about 23.00 to consider options overnight and attempt communication with UKORS. We conducted swathbathymetry survey for a few hours overnight in sediment trap mooring area to identify suitable sites for box coring.

We tried communication again from 08.00 on 16th Dec. and even attempted a release but all to no avail. Subsequently we were able to confirm the position (67.92564S 68.40855W) of the mooring and determine with the echo sounder that it appeared to be intact. The shallowest echo was consistent with the upper part of the mooring being about 200m below the surface as deployed. We abandoned attempts at recovery at 11.02. The most likely cause of failure was loss of power in the release, rather than ice damage to the upper mooring. Another possibility was a strong thermocline interfering with the acoustic signal, but this is thought to be unlikely.

We decided against dragging for the mooring at this time. There was limited time available, the chance of success and recovery of the mooring was not high and damage to components/data/samples was likely. There was the opportunity to ask if a subsequent cruise using the ROV ISIS could attempt to cut the mooring above the weight allowing recovery under fully controlled conditions. The sediment traps and other devices were programmed to continue recording for some months as an insurance against difficulties with access to the area due to sea ice as in previous years, so data and samples will not be lost during the intervening period.

Note subsequently ISIS visited the area and located the weights from the mooring but the mooring array itself was no longer attached.

We then conducted a CTD (JCR 163 -32) to full depth at 67.92526S 68.40262W (about 200m from mooring site) in about 800m water starting at 11.39 (Appendix 1). We then undertook some local swath bathymetry to identify optimum coring sites while changing winch wire for box coring. Two box cores were then collected at a suitable site 67.92138S 68.40593 W without risk of contamination of mooring with sediment disturbed by coring. The first one (JR 155-BC01) BC466 was only partly subsampled (1 subcore and 2 surface scrapes) in favour of the second, BC 467 (JR155-BC02), which was an excellent core. This provided 4 subcores and 2 surface scrapes. Box cores of about 30 cm were subsampled using 80mm diameter core liners, capped and stored at 4^{o}C before being sectioned on board into 05-2cm intervals. Surface scrapes were also collected.

We left the area at about 14.30 and sailed to the Ryder Bay site (67.56558S 68.22871W) arriving about 16.00.

The Ryder bay site was covered in ice which still allowed relatively easy ship access but was continuous and would not allow mooring release and recovery. The JCR therefore broke ice for about 2.5 hours to create an area of open water. The water was thick with filamentous algae as the ice broke up. Hydrophones were then lowered and immediate contact established with the mooring followed by its release (19.39). The mooring was located on the surface 19.49 and successfully recovered by about 20.51. It was decided to stand the crew down for the night, although work continued to stabilise the sediment trap samples and download data from the recovered mooring instrumentation. Sediment trap samples 1 (late austral summer 2006) and 14 (open at time of recovery early austral spring 2006) were very full and there is a large amount of material in the funnel. Collection of this material from the cone within the shallower mooring was successful but not from deeper one.

17th Dec. Ice has drifted back around the JCRT and we did some ice breaking prior to a short period of swathbathymetry followed by collection of a box core at 09.31 BC 468 (JR155-BC03) at 67.56915S 68.22431W in 500m water. A good core was retrieved with 4 subcores (sectioned as previously described) and 3 surface scrapes collected. . The decks were cleared of mud from the coring and we moved back onto station at 67.56899S 68.22438W for a CTD JR163-33 (Appendix 1) finishing at 11.14.

Servicing of sediment trap mooring continued, since essentially the same mooring was redeployed. We then finalised mooring set up which was delayed slightly by discovering some battery failures in a sediment trap, requiring replacement. Deployment began 13.50 and was complete by 15.00. A diagram of the deployed mooring system is attached (Figure 1) and the sample cup programming is listed in Appendix 2.

We sailed to Rothera and tied up about 16.00 and commence demobilisation.

Samples from sediment traps and water and particulate samples collected from the CTDs after appropriate stabalisation were stored at either 4^{o}C with formalin (trap samples) or stored frozen (-20^{O}C) for nutrients and particulates from CTD. These will be shipped back to the UK on JCR. Sediment core samples and scrapes were stored at 4^{o}C and after sectioning were either shipped directly back to the UK or stored for transport on JCR. CTD data from these 2 cruises were calibrated using collected salinity samples. Results from these 2 CTDs were incorporated into the JR163 data set and submitted together to BODC for simplicity.

Overall the cruise met all its objectives bar the recovery of the first mooring. The support of the ships crew and the scientists in making this short intense cruise successful is greatly appreciated. The professionalism of the UKORS and ship crew team in the safe and effective mooring recovery and deployment operation was very impressive.

T. Jickells
Jan 2007.

Appendix 1 CTD Stations

Station 163-32/ JR155 -01 16/12/06 Depth 830m
Time Start 14.23, bottom 14.39, end 15.03
Samples collected for salinity(CTD calibration), nutrients, particulate carbon (POC) and biogenic Si (BSi)

Nominal Depth	Wire Out
Bottom	804
750	750
500	500
400	400
300	300
200	200
100	100
75	75
50	50
25	25
15	15
0(surface)	0

Salinity samples 10-1 (bottom) to 10-12.
Nutrient samples from all depths.
POC from all depths; 804-50m inclusive 1000ml filtered, 25m 900ml, 15m 500ml, 0m 500ml.
BSi from all depths; 804-50m inclusive 500ml, 25m 300ml, 15 and 0m 250ml.

Station 163-33/ JR155 -02 16/12/06 Depth 495m
Time Start 13.54, bottom 14.15, end 14.34
Samples collected for salinity(CTD calibration), nutrients, particulate carbon (POC) and biogenic Si (BSi)

Nominal Depth	Wire Out
Bottom	495
350	350
300	300
250	250
200	200
150	150
100	100
75	75
50	50
25	25
15	15
0(surface)	0

Salinity samples 10-13 (bottom) to 10-24.
Nutrient samples from all depths.
POC from all depths 1000ml filtered.
BSi from all depths; 500ml.

Appendix 2 Sediment Trap Cup Programming

Bottle	Start	End
1	19/12/06 00.00	28/12/06 00.00
2	28/12/06 00.00	4/1/07 00.00
3	4/1/07 00.00	11/1/07 00.00
4	11/1/07 00.00	18/1/07 00.00
5	18/1/07 00.00	25/1/07 00.00
6	25/1/07 00.00	1/2/07 00.00
7	1/1/07 00.00	8/2/07 00.00
8	8/2/07 00.00	15/2/07 00.00
9	15/2/07 00.00	22/2/07 00.00
10	22/2/07 00.00	1/3/07 00.00
11	28/2/07 00.00	8/3/07 00.00
12	8/3/07 00.00	15/3/07 00.00
13	15/3/07 00.00	22/3/07 00.00
14	22/3/07 00.00	25/3/07 00.00
15	25/3/07 00.00	1/4/07 00.00
16	1/4/07 00.00	1/6/07 00.00
17	1/6/07 00.00	1/8/07 00.00
18	1/8/07 00.00	1/10/07 00.00
19	1/10/07 00.00	1/12/07 00.00
20	1/12/07 00.00	1/2/08 00.00
21	1/2/08 00.00	1/4/08 00.00

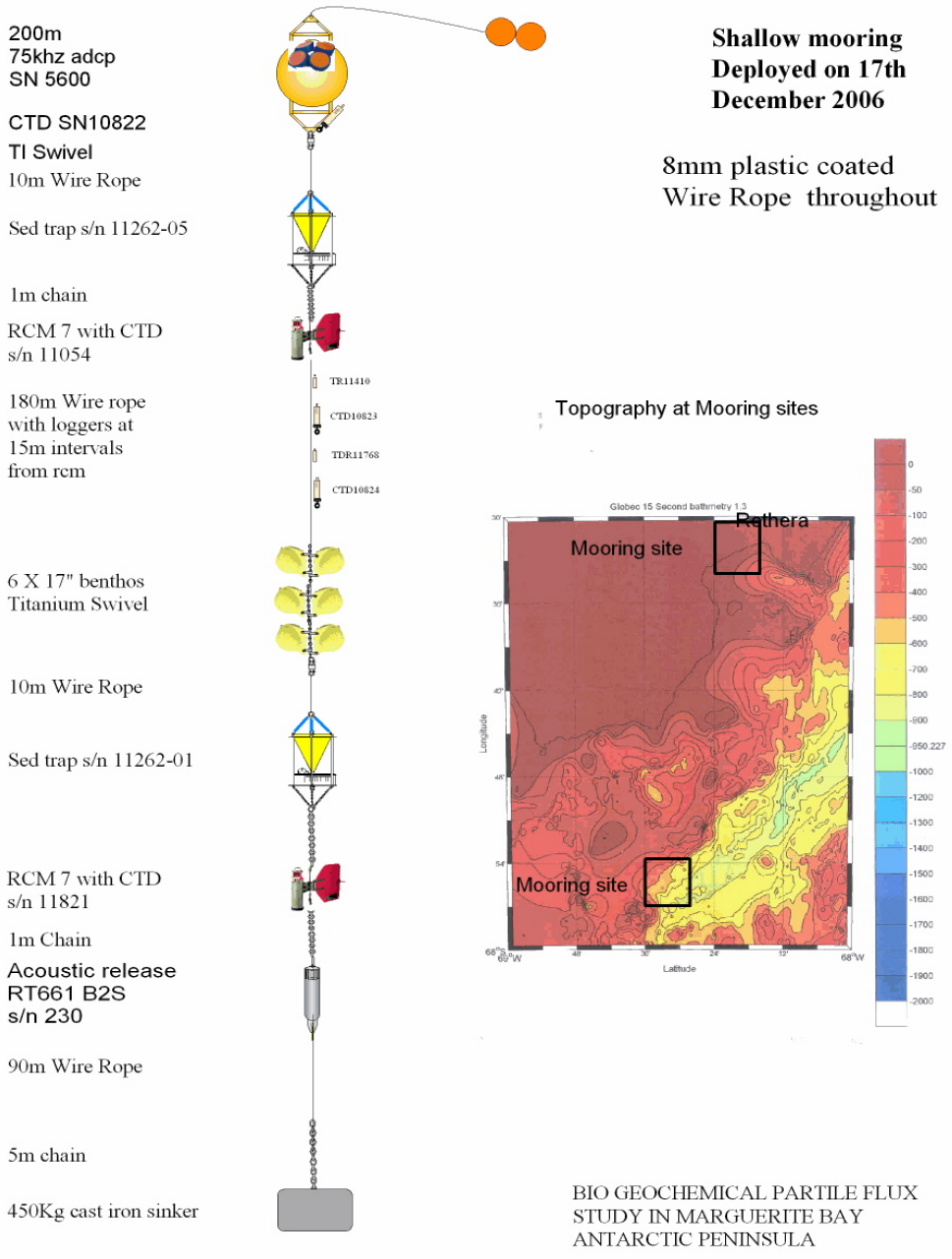

200m
75khz adcp
SN 5600
CTD SN10822
TI Swivel
10m Wire Rope
Sed trap s/n 11262-05
1m chain
RCM 7 with CTD
s/n 11054
180m Wire rope
with loggers at
15m intervals
from rcm
6 X 17" benthos
Titanium Swivel
10m Wire Rope
Sed trap s/n 11262-01
RCM 7 with CTD
s/n 11821
1m Chain
Acoustic release
RT661 B2S
s/n 230
90m Wire Rope
5m chain
450Kg cast iron sinker
TR11410
CTD10823
TDR11768
CTD10824
Shallow mooring
Deployed on 17th
December 2006
8mm plastic coated
Wire Rope throughout
Topography at Mooring sites
Globec 15 Second bathmetry 1.3
Rothera
Mooring site
Mooring site
Longitude
Latitude
BIO GEOCHEMICAL PARTILE FLUX
STUDY IN MARGUERITE BAY
ANTARCTIC PENINSULA

Figure 1

Personnel on board for JR 155.

Crew

BURGAN Michael JS	Master
PAGE Timothy S	Ch Officer
KING David J	2nd Officer
COX Joanna L	3rd Officer
GILL Andrew D	Dk Cadet
GLOISTEIN Michael EP	ETO Comms
ANDERSON Duncan E	Ch Engineer
ARMOUR Gerald J	2nd Engineer
STEVENSON, James S	3rd Engineer
BALFE Thomas	4th Engineer
TREVETT Douglas P	Deck Engineer
ROWE Anthony Keith	ETO Engineer
TURNER Richard J	Purser
PECK, David J	Bosun
BOWEN, Albert Martin	Bosun's Mate
CHAPPELL, Kelvin E	SG1
RAPER, Ian	SG1
DALE, George A	SG1
HOLMES Kevin J	SG1
ESTIBEIRO Anthony John J	SG1
SMITH, Bruce D	MG1
MACKASKILL, Angus L	MG1
HUNTLEY, Ashley Alan	Chief Cook
LEE, Jamie Edward	2nd Cook
JONES, Lee J	Sr Steward
GREENWOOD, Nicholas R	Steward
RAWORTH, Graham	Steward
WEIRS, Michael	Steward

Science Party

Note the large scientific party were present from JR 163 but their assistance in JR 155 is gratefully acknowledged

Atkinson, Christopher P
Clarke, Andrew C
Contardo, Stephanie
Del la Rosa, Sara
Fleming, Andrew
Ganeshram, Raja S
Hadfield, Rachel E
Hargreaves, Geoffrey
Holligan, Patrick M
Jickells, Timothy D
Keen, Peter
Lay, Terrance K
Massey, Alison J
Mack, Steven
Phipps, Richard
Preston, Mark O
Watson, Sue-Ann
Williams, Adam P
Willis, Douglas D
Young Nicholas J
Fretwell, Peter T
Rosetti, Helen L
Annett, Amber L
Hendry, Katharine R

Bridge Event Log Note Times UTC

Time	Event	Lat	Lon	Comment	User
18.00		-	-		
17/12/06	7	67.5668	68.2334	mooring deployed	bridge
17.47		-	-		
17/12/06	7	67.5668	68.2334	2nd sediment trap deployed	bridge
17.38		-	-		
17/12/06	7	67.5668	68.2334	CTD 10823 deployed	bridge
17.35		-	-		
17/12/06	7	67.5668	68.2334	TDR 11768 deployed	bridge
17.30		-	-		
17/12/06	7	67.5668	68.2334	CTD 10824 deployed	bridge
17.18		-	-		
17/12.06	7	67.5668	68.2334	benthos floats deployed	bridge
17.06		-	-		RCM7 & 1st sediment trap
17/12/06	7	67.5668	68.2334	Acoustic release	deployed
16.52		-	-		
17/12/06	7	67.5668	68.2334	weights deployed	bridge
16.50		-	-		
17/12/06	7	67.5668	68.2334	commence deploying Shallow mooring	bridge
15.43		-	-	vessel on DP in vicinity of shallow	
17/12/06	7	67.5674	68.2327	mooring	bridge
14.43		-	-		
17/12/06		67.5689	68.2244	V/L off DP proceeding to mooring site	bridge
14.36		-	-		
17/12/06	6	67.5689	68.2244	CTD recovered	bridge
14.14			-		
17/12/06	6	-67.569	68.2244	CTD @ 495m	bridge
13.59		-	-		
17/12/06	6	67.5691	68.2244	CTD deployed	bridge
13.44		-	-		move 170m to clear water for
17/12/06		67.5704	68.2242	Completed wash down from box core	CTD
13.00		-	-		
17/12/06	5	67.5691	68.2243	Box corer recovered	bridge
12.48		-	-		
17/12/06	5	67.5691	68.2243	Box corer clear of sea bed	hauling for recovery
12.45		-	-		
17/12/06	5	67.5691	68.2243	Box corer on seabed 513m	bridge
12.31		-	-		
17/12/06	5	67.5692	68.2243	Box corer deployed	bridge
12.20		-	-		
17/12/06	5	67.5694	68.2244	V/L on DP for box core	bridge
23.52				V/L on DP in pool of open water for	
16/12/06				night	bridge
23.51		-			
16/12/06	4	67.5697	-68.225	Recovery of shallow mooring complete	bridge
23.49		-	-		CTD and Current meter
16/12/06	4	67.5697	68.2252	Sediment trap	recovered
23.43		-			
16/12/06	4	67.5695	-68.226	6 x Benthos recovered	bridge
23.12			-		
16/12/06	4	-67.568	68.2305	1st sediment trap recovered	bridge
23.02		-			
16/12/06	4	67.5673	-68.233	Commence heaving buoy onboard	bridge
22.57		-	-		
16/12/06	4	67.5669	68.2326	Mooring grapelled	bridge

22.49		-	-	Intermediate buoys at the surface.	
16/12/06	4	67.5656	68.2287	Vessel moving in for recovery.	bridge
22.44		-	-		
16/12/06	4	67.5656	68.2287	Buoy at the surface.	bridge
22.39		-	-		
16/12/06	4	67.5656	68.2287	Buoy released.	bridge
22.31		-	-	Vessel set up in D.P. for buoy mooring	
16/12/06		67.5656	68.2287	recovery.	bridge
17.41		-	-		proceeding to shallow
16/12/06	3	67.9212	68.4061	vessel off dp	mooring
17.35		-			
16/12/06	3	67.9213	-68.406	box core recovered	bridge
17.17		-			
16/12/06	3	67.9213	-68.406	Box core on seabed @ 820m	bridge
17.15		-	-		
16/12/06	3	67.9212	68.4059	box core 50m off Sea bed	bridge
17.00		-			
16/12/06	3	67.9213	-68.406	box core deployed	bridge
16.57		-			
16/12/06	3	67.9213	-68.406	vessel stopped @ box core site	bridge
16.48		-	-		
16/12/06		67.9213	68.4109	vessel proceeding back to box core site	bridge
16.28		-	-	vessel moving 200m down current to	
16/12/06		67.9213	68.4064	wash decks	bridge
16.05		-	-		
16/12/06	2	67.9213	68.4062	box core recovered	bridge
15.45		-	-		
16/12/06	2	67.9213	68.4059	Box core on seabed @ 821m	bridge
15.43		-	-		
16/12/06	2	67.9213	68.4059	box core 50m off Sea bed	bridge
15.26		-			
16/12/06	2	67.9212	-68.406	box core deployed	bridge
15.22		-	-		
16/12/06	2	67.9214	68.4059	Vessel on D.P. @ box core site	bridge
15.07		-	-		vessel relocating to box core
16/12/06	1	67.9252	68.4027	CTD recovered	site
14.39		-	-		
16/12/06	1	67.9253	68.4026	CTD @ 804m	bridge
14.18		-	-		
16/12/06	1	67.9253	68.4026	CTD deployed	V/L 200m from mooring site
14.02		-	-	Mooring still not released. Recovery abandoned for this cruise. V/L on DP	
16/12/06		67.9251	68.4024	for CTD	bridge
13.48		-	-	V/L 40m from mooring position. Transducer deployed. Stopped and drifiting while final attempt is made to	
16/12/06		67.9236	68.4012	activate release.	bridge
13.24		-	-		transducer recovered. Proceeding back to mooring
16/12/06		67.9309	68.4184	Mooring still not surfaced	location
12.42		-	-		
16/12/06		67.9257	68.4087	Mooring release signal sent	bridge
12.38		-			V/L drifing with thrusters and
16/12/06		67.9255	-68.408	Transducer deployed	prop stopped
12.30		-	-	Mooring located on sounder. Moving	
16/12/06		67.9256	68.4086	350m downwind	bridge
11.00		-	-	Resume attempts to locate mooring. V/L on DP in vicinity of mooring to try	
16/12/06		67.9308	68.4206	and obtain positive confirmation of	bridge

			position on sounders	
02.15	-		Commence swath survey in vicinity of	
16/12/06	67.9114	-68.331	mooring	bridge
01.55	-	-		unable to establish communication. Descision made to abandon further
16/12/06	67.9139	68.3455	Mooring not released	release attempts for the night.
00.49	-	-	vessel off DP and drifting to reduce noise while attempting to communicate	
16/12/06	67.9217	68.3911	with accoustic release	bridge
00.07	-	-		
16/12/06	67.9218	68.3914	Hydrophone deployed	bridge
00.05	-	-	Vessel on full DP 400m down wind from	
16/12/06	67.9218	68.3914	deep mooring	bridge