The Changing Arctic Ocean: Cruise Report

RRS James Clarke Ross JR17007
10th July-5th August, 2018



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Abstract

JR17007 is the second in a series of three cruises to the Barents Sea within "The Changing Arctic Ocean Seafloor (ChAOS) - how changing sea ice conditions impact biological communities, biogeochemical processes and ecosystems" project (NE/N015894/1 and NE/P006426/1, 2017-2021) supporting the diet of scientific research within the *Changing Arctic Ocean* research programme, funded by NERC. The cruise also supported research on methane that is related to, but not directly funded by, this programme. The primary objective of the cruise was to collect a suite of pelagic and benthic samples across the 30˚ longitude water mass and sea-ice gradient occupied by the first cruise, JR16006, in 2017. The report includes a description of the sampling and data collection across 6 benthic focus sites, a series of water mass stations, continuous atmospheric methane sampling whilst underway, experimental observations and sampling of sea ice at and beyond the ice edge achieved during July-August, 2018. These were occupied as part of ongoing effort aimed at understanding the effect of changing sea ice cover on organic matter quality, benthic biodiversity, biological transformations of carbon and nutrient pools, and resulting ecosystem functioning at the Arctic Ocean seafloor.



Acknowledgements: *We are extremely grateful to the Captain, Officers and crew of the RRS James Clark Ross and the various logistical and support teams within The British Antarctic Survey and at NERC for their substantive efforts in ensuring a successful scientific programme. We also acknowledge and appreciate the extensive technical support afforded to us by National Marine Facilities in the lead up to, during, and the period following the cruise.*

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Part I: Introduction and rationale

Introduction

1.1 Scientific rationale

Rates of warming in the high northern latitudes are amongst the highest globally. One of the most obvious manifestations is the dramatic reduction in summer sea ice extent and thickness over the past few decades. These changes in ice cover exert cascading effects on Arctic Ocean carbon and nutrient dynamics, causing important feedbacks on the local ecosystems, regional processes and the global climate system. The Arctic Ocean accounts for up to 14% of the global atmospheric CO_2 uptake and is therefore of fundamental importance to the global carbon cycle. However, changes to components of Arctic ecosystems that are important determinants of regional processes, such as benthic faunal assemblages or the extent of carbon and nutrient burial, are comparatively understudied

1.2 Scientific personnel

The scientific party cruise included 22 participants (59%F, 41%M) from 11 institutions as follows:

Name	***Nationality***	***Affiliation***
Bates, Stephanie	British	University of Bristol
Beja de Almeida E Silva, Joana	Portuguese	British Oceanographic Data Centre
Coppock, Rachel	British	Plymouth Marine Laboratory
Downes, Patrick	British	Plymouth Marine Laboratory
Doyle, Katherine	Irish	University of Leeds
England, Andrew	British	British Antarctic Survey
Faust, Johan	German	University of Leeds
Febbrari, Ivan	Italian	University of Edinburgh
Goodger, David	British	British Antarctic Survey
Grange, Laura	British	University of Southampton
Henley, Sian**	British	University of Edinburgh
Jaques, Caroline	Belgium	Université Libre de Bruxelles
Norman, Louisa	British	Liverpool University
Poole, Benjamin	British	National Marine Facilities
Richardson, Phillip	British	British Antarctic Survey
Ruhl, Saskia	German	Plymouth Marine Laboratory
Solan, Martin*	British	University of Southampton
Souster, Terri	British	British Antarctic Survey
Stevenson, Mark	British	Newcastle University
Talbot, Sarah Elizabeth	British	Plymouth Marine Laboratory
Tessin, Allyson	American	University of Leeds
Ward, Ellen	British	University of Southampton

* Principal Scientific Officer
**Deputy Principal Scientific Officer

1.3 Ship personnel

The crew included 30 participants (10%F, 90%M) as follows:

Name	***Nationality***	***Rank***
Page, Timothy	British	Master
Kirkaldy-Willis, Annalaara	British	Chief Officer
Bellis, Robert	British	2nd Officer
Chapman, Matthew	British	3rd Officer
Greenhow, Jordan	British	3rd Officer
Gloistein, Michael	British	ETO Comms
Lloyd, Gareth	British	Chief engineer
Murray, Euan	British	2nd engineer
Little, Amanda	British	3rd engineer
Vivian, Oliver	British	4th engineer
Jackman, Jonathan	British	Deck engineer
Amner, Stephen	British	ETO
Turner, Richard	British	Purser
Dubois, Andre	British	Doctor
Peck, David	British	Bosun/Sci'Ops
Bowen, Albert	British	Bosun
Dale, George	British	Bosun's mate
Smith, Sheldon	British	SG1A
English, Samuel	British	SG1A
Waylett, Samuel	British	SG1A
Hernandez, Francisco	British	SG1A
Peck, Daeyln	British	SG1B
Wale, Gareth	British	MG1
Henry, Glyndor	British OT	MG1
Walton, Christopher	British	Chief cook
Fileva, Zhivka	Bulgarian	2nd cook
Greenwood, Nicholas	British	Senior steward
Raworth, Graham	British	Steward
Winton, Brian	British	Steward
Fileva, Dessislava	Bulgarian	Steward

1.4 Location of scientific stations

The foci locations for JR17007 are a subset of 'benthic' stations within a larger network of benthic and pelagic stations (JR16006 cruise report, Hopkins et al., 2017), specifically programme stations B03, B13, B14, B15, B16 and B17. An additional benthic station (designated X_s, = X south) was fully characterized, and a second benthic station (designated Y) was visited to obtain megacores for geochemical analyses. We also carried out water mass characterisations to supplement and refine water mass information (at station B34, and at stations designated X_n [=X north], B16A, B16B, B16C and ice stations ZEBRA. The locations of all foci and additional study sites are depicted in Figure 1.1, with station centroid and Depth information in Table 1.1.

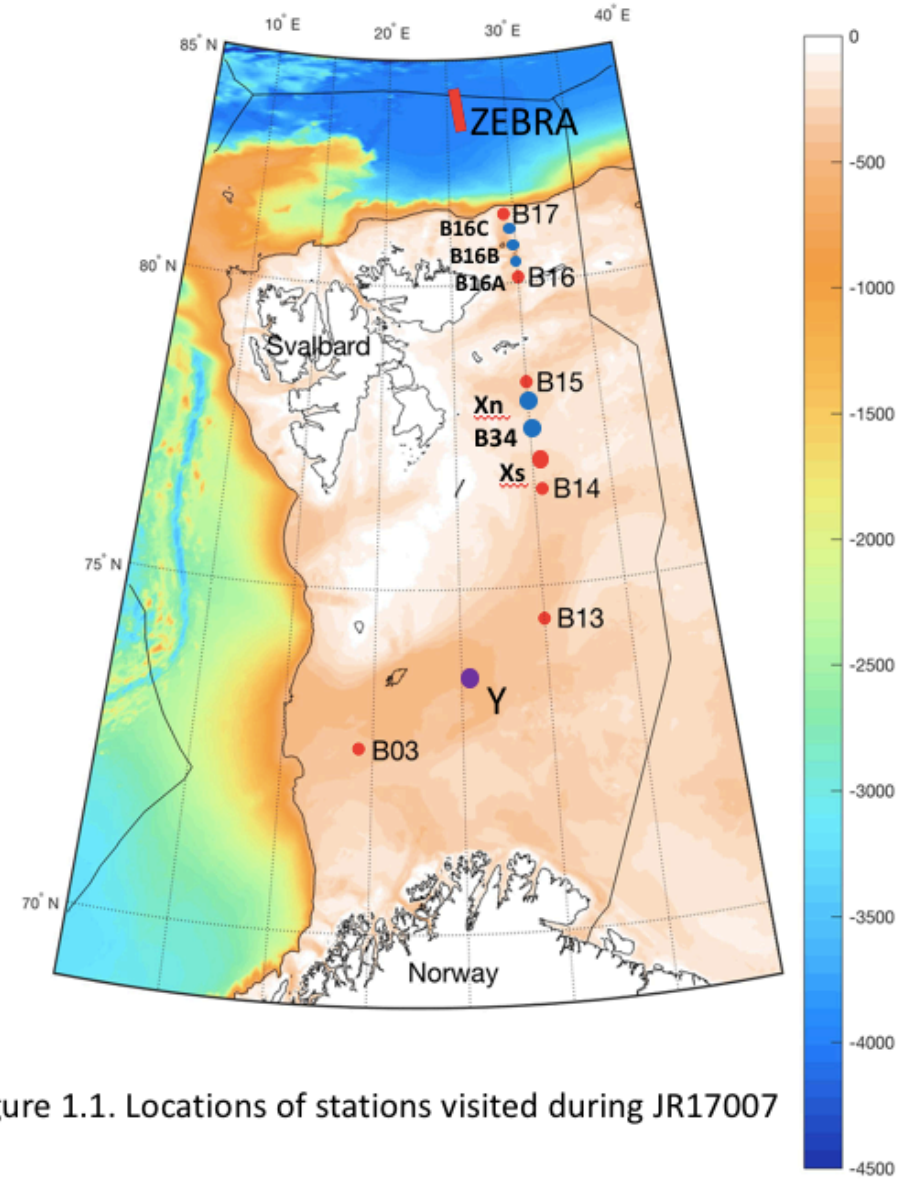


Figure 1.1. Locations of stations visited during JR17007

Station	Latitude (N)	Longitude (E)	Indicative depth (m)	Date and time at centroid (bottom times, in UTC)*
A	83.04621	27.6543	-	20/07/2018 22:31h
R	82.54386	27.17177	-	21/07/2018 09:06h
B	82.0445	27.27501	-	21/07/2018 16:20h
E	81.79997	27.79268	-	21/07/2018 20:11h
Z	81.52645	29.46436	-	19/07/2018 22:03h
B17	81.28161	29.3269	340	18/07/2018 06:50h
B16C	80.99021	29.52143	-	22/07/2018 02:57h
B16B	80.69906	29.709	-	22/07/2018 05:21h
B16A	80.40784	29.89152	-	22/07/2018 07:57h
B16	80.1167	30.06827	283	22/07/2018 10:28h
B15	78.25166	30.00021	315	16/07/2018 11:50h
Xn	77.81239	30.13137	-	24/07/2018 12:56h
B34	77.33003	30.00018	-	24/07/2018 16:55h
Xs	77.03333	29.33347	228	26/07/2018 17:02h
B14	76.50002	30.50026	306	25/07/2018 02:04h
B13	74.50007	30.00027	364	14/07/2018 07:52h
Y	73.88666	26.33525	450	28/07/2018 16:18h
B03	72.63331	19.25181	365	11/07/2018 03:23h

*dates and times are for primary visit to site. Repeat visits not included here and readers should refer to the cruise event log (Appendix 1).

Table 1.1. Station GPS co-ordinates, indicative depths and time and date of initial occupation. Stations indicated in bold are focal locations.

Due to benign weather, lack of ice south of station B17, and sea state conditions, there was sufficient time to incorporate a deviation to visit the ice edge (~81.5-83.0˚ N). In this region, measurements were taken across the ice transition for atmospheric methane and we attempted to refine the location of major water masses using additional CTD deployments. Work took place at five newly designated ice stations (hereafter, Ice Stations ZEBRA), positioned in relation to a nominal ice edge and relative to the furthest northward point of passage we were able to make into the ice flows. Figure 1.2 provides a diagrammatic representation of the sampling design.

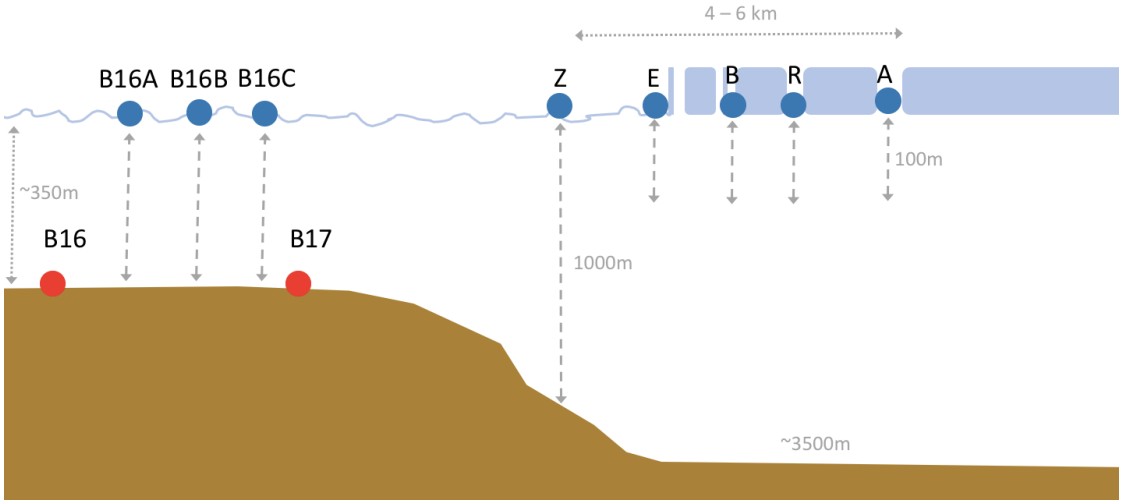


Figure 1.2. Diagrammatic representation of the location of Ice Stations ZEBRA in relation to benthic focus sites B16 and B17, the nominal ice edge (blue band) and shelf bathymetry. Vertical dashed lines depict additional CTD cast locations (ZEBRA + B16A, B16B and B16C) and profile depths (100, 350 or 1000m).

1.5 Sampling design

At each benthic foci station (i.e. B03, B13-B17 and X_s), we designated a 200 x 200m box around a centroid point (Figure 1.3). The centroid approximates the mean location of the megacore deployments taken in JR16006.

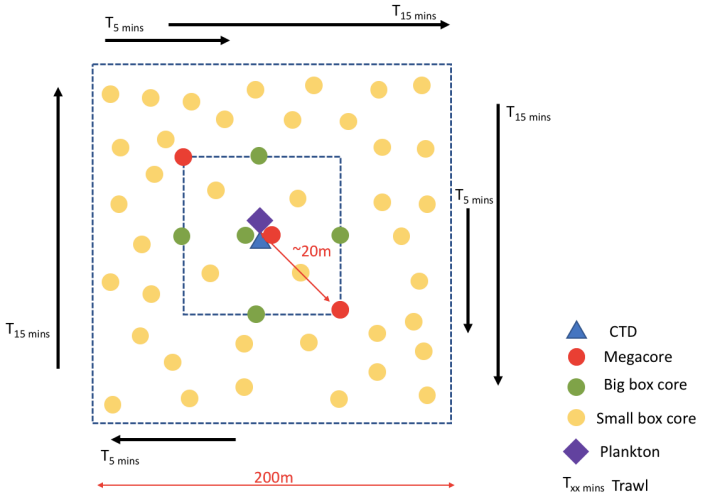


Figure 1.3. Representation of the sampling design employed at all benthic foci stations.

1.6. Sequence of activity

The sequence of activities during station occupancy was ordered, where practicable, to minimize the influence of active sampling on subsequent work. The preferred order of practice and geolocation relative to the station centroid was as follows:

Order	Activity	Location
1	CTD cast	On station centroid
2	3 x megacore deployments	5m to E of centroid, 20m NW of centroid 20m SE of centroid
3	5 x 0.25m^2 box cores	5m to W of centroid, 20m N of centroid 20m E of centroid 20m S of centroid 20m W of centroid
4	18 x 0.10m^2 box cores	Allocated sequentially using bearings from bottom location within the 200 x 200m box, excluding locations already sampled. See description of how bearings were assigned*.
5	6 x trawls (3 x 5 min tows) + (3 x 15 min tows)	Outer perimeter of 200 x 200m box, opting for each side in clockwise direction as sea state and conditions allow until all achieved.
6	1 x Phytoplankton net (short vertical haul, variable depths between stations)	On station centroid.

*For the 0.1m^2 box cores, we used the station centroid as the starting reference point (not sampled) and moved ~20m in the direction of a sequence of bearings (degrees from North; in order of preference: 187, 269, 300, 201, 158, 93, 239, 209, 121, 54, 347, 285, 188, 61, 90, 33, 66, 279, 282, 186, 142, 23, 31, 10, 183, 176, 15, 146, 16, 214, 207, 104, 203, 149, 346, 314, 289, 249, 181 and 12˚). Where sampling failed, or the bearing took the ship out of the 200 x 200m station box, we opted for the next available bearing in the sequence to maintain compliance. i.e. the first box core was taken 20m from the station centroid in a 187˚ direction, the second a further 20m away from the first in a 269˚ direction, and so on.

Where necessary (e.g. to facilitate the allocation of personnel rest periods and/or appropriate scientific processing timings), trawling activity would advance in the timeline and take place immediately after the CTD cast.

1.7 Cruise event log

A dedicated watch person, in co-ordination with the Bridge, was responsible for logging all research activities and issuing a unique event number. The abbreviated log is presented here (Table 1.2) and the full ship log is appended as Appendix A.

			START			BOTTOM			END					
EVENT	ID	TYPE	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	WDEPTH	RESPONSIBLE	COMMENTS
1	B3	CTD001	11/07/2018 03:10	72.63333	19.25178	11/07/2018 03:23	72.63331	19.25181	11/07/2018 03:53	72.63333	19.25179	365	Jo	
2	B3	MC001	11/07/2018 04:37	72.63329	19.25193	11/07/2018 04:49	72.63328	19.25196	11/07/2018 05:01	72.63332	19.25198	364	Ally	Deployed 5m E of B3
3	B3	MC002	11/07/2018 05:13	72.6333	19.25199	11/07/2018 05:25	72.63329	19.25196	11/07/2018 05:41	72.63325	19.25198	364	Ally	Deployed at same position as previous event
4	B3	MC003	11/07/2018 06:10	72.63347	19.25145	11/07/2018 06:16	72.63346	19.25143	11/07/2018 06:42	72.63348	19.25141	374	Ally	Deployed 20m NW of B3
5	B3	MC004	11/07/2018 07:10	72.63348	19.25146	11/07/2018 07:24	72.63348	19.25136	11/07/2018 07:40	72.63346	19.2514	374	Ally	Deployed at same position as previous event
6	B3	MC005	11/07/2018 08:15	72.6332	19.25227	11/07/2018 08:27	72.6332	19.25227	11/07/2018 08:43	72.63321	19.25222	375	Ally	Deployed 20m SE of B3
7	B3	MC006	11/07/2018 09:20	72.63318	19.25228	11/07/2018 09:30	72.63319	19.25226	11/07/2018 09:48	72.63321	19.25223	376	Ally	Deployed at same position as previous event
8	B3	SMBA001	11/07/2018 10:25	72.63328	19.25173	11/07/2018 10:37	72.63333	19.25178	11/07/2018 10:50	72.63333	19.25172	366	Rachel	Deployed 5m W of B3
9	B3	SMBA002	11/07/2018 11:05	72.63348	19.25181	11/07/2018 11:17	72.63349	19.25179	11/07/2018 11:28	72.6335	19.25179	370	Rachel	Moved 20m
10	B3	SMBA003	12/07/2018 15:23	72.63331	19.2524	12/07/2018 15:34	72.63331	19.25238	12/07/2018 15:46	72.6333	19.2524	365	Rachel	Moved 20m E
11	B3	SMBA004	12/07/2018 16:00	72.63314	19.25189	12/07/2018 16:13	72.63313	19.25193	12/07/2018 16:29	72.63314	19.2519	366	Rachel	Moved 20m S
12	B3	SMBA005	12/07/2018 16:39	72.63329	19.25118	12/07/2018 16:52	72.63329	19.25113	12/07/2018 17:06	72.63331	19.25115	366	Rachel	Moved 20m W
13	B3	USNL001	12/07/2018 17:37	72.63313	19.25114	12/07/2018 17:49	72.63313	19.25116	12/07/2018 18:03	72.63314	19.25113	366	Liz	Moved 20m, Heading 187
14	B3	USNL002	12/07/2018 18:18	72.63313	19.25053	12/07/2018 18:30	72.63313	19.25057	12/07/2018 18:43	72.63312	19.25054	366	Liz	Moved 20m, heading 269
15	B3	USNL003	12/07/2018 18:57	72.6332	19.25004	12/07/2018 19:09	72.63319	19.25003	12/07/2018 19:22	72.63321	19.25004	368	Liz	Moved 20m, heading 300, No sample taken
16	B3	USNL004	12/07/2018 19:33	72.63305	19.24979	12/07/2018 19:45	72.63304	19.24982	12/07/2018 19:59	72.63304	19.24981	367	Liz	Moved 20m, heading 201
17	B3	USNL005	12/07/2018 20:09	72.63289	19.24999	12/07/2018 20:22	72.63288	19.25001	12/07/2018 20:35	72.63288	19.24999	367	Saskia	Moved 20m, heading 158
18	B3	USNL006	12/07/2018 20:46	72.63289	19.25064	12/07/2018 20:58	72.63288	19.25059	12/07/2018 21:09	72.63287	19.25065	368	Saskia	Moved 20m, heading 093
19	B3	USNL007	12/07/2018 21:25	72.63278	19.25009	12/07/2018 21:38	72.63278	19.25009	12/07/2018 21:51	72.63278	19.25008	368	Saskia	Moved 20m, heading 239
20	B3	USNL008	12/07/2018 22:06	72.63264	19.2498	12/07/2018 22:18	72.63263	19.24982	12/07/2018 22:30	72.63263	19.2498	368	Saskia	Moved 20m, heading 209
21	B3	USNL009	12/07/2018 22:42	72.63252	19.25031	12/07/2018 22:54	72.63253	19.25032	12/07/2018 23:06	72.63254	19.25032	368	Saskia	Moved 20m, heading 121, No sample taken
22	B3	USNL010	12/07/2018 23:15	72.63265	19.25079	12/07/2018 23:27	72.63266	19.25078	12/07/2018 23:40	72.63264	19.2508	368	Saskia	Moved 20m, heading 054, no sample taken
23	B3	USNL011	12/07/2018 23:51	72.63268	19.25018	13/07/2018 00:03	72.63269	19.25022	13/07/2018 00:14	72.63268	19.25024	367	Saskia	Moved 20m, heading 285
24	B3	USNL012	13/07/2018 00:23	72.6325	19.25016	13/07/2018 00:35	72.63249	19.25017	13/07/2018 00:47	72.63249	19.25017	368	Saskia	Moved 20m, heading 188, no sample taken
25	B3	USNL013	13/07/2018 00:56	72.63255	19.25072	13/07/2018 01:08	72.63258	19.25066	13/07/2018 01:20	72.63258	19.25067	368	Saskia	Moved 20m, heding 061
26	B3	USNL014	13/07/2018 01:29	72.63258	19.25128	13/07/2018 01:41	72.63258	19.25126	13/07/2018 01:53	72.63258	19.25122	368	Saskia	Moved 20m, heading 090
27	B3	USNL015	13/07/2018 02:04	72.63273	19.25157	13/07/2018 02:16	72.63272	19.25159	13/07/2018 02:29	72.63271	19.25157	368	Rachel	Moved 20m, heading 033, Core didn't close
28	B3	USNL016	13/07/2018 02:47	72.63278	19.25212	13/07/2018 02:59	72.63281	19.25218	13/07/2018 03:12	72.63278	19.25215	367	Rachel	Moved 20m, heading 066, corer didn't close
29	B3	USNL017	13/07/2018 03:26	72.6328	19.25219	13/07/2018 03:38	72.6328	19.25219	13/07/2018 03:51	72.63281	19.25214	367	Rachel	Ship did not move
30	B3	USNL018	13/07/2018 04:00	72.63283	19.25161	13/07/2018 04:12	72.63284	19.25153	13/07/2018 04:26	72.63283	19.25154	367	Rachel	Moved 20m, heading 279
31	B3	USNL019	13/07/2018 04:35	72.63286	19.25097	13/07/2018 04:46	72.63287	19.25097	13/07/2018 04:59	72.63287	19.25094	366	Rachel	Moved 20m, heading 282
32	B3	USNL020	13/07/2018 05:09	72.63302	19.25131	13/07/2018 05:21	72.63302	19.25129	13/07/2018 05:35	72.63299	19.25133	366	Rachel	Moved 20m, heading 031
33	B3	USNL021	13/07/2018 05:43	72.63318	19.2514	13/07/2018 05:55	72.63319	19.25152	13/07/2018 06:08	72.6332	19.25152	366	Rachel	Moved 20m, heading 010, corer didn't close
34	B3	USNL022	13/07/2018 06:25	72.63322	19.25147	13/07/2018 06:37	72.63321	19.25149	13/07/2018 06:50	72.63321	19.2515	362	Rachel	Ship did not move
35	B3	AGT001	13/07/2018 07:33	72.63232	19.25735	13/07/2018 07:48	72.63231	19.25262	13/07/2018 08:19	72.63231	19.24055		Terri	5min trawl
36	B3	AGT002	13/07/2018 08:35	72.63204	19.2517	13/07/2018 08:47	72.63204	19.24804	13/07/2018 09:20	72.63203	19.2354		Terri	5min trawl
37	B3	AGT003	13/07/2018 09:36	72.63188	19.25963	13/07/2018 09:48	72.63185	19.25596	13/07/2018 10:14	72.63173	19.24444		Terri	5min trawl
38	B3	AGT004	13/07/2018 10:30	72.63154	19.26316	13/07/2018 10:41	72.63144	19.25943	13/07/2018 11:19	72.63101	19.24371	370	Laura	15min trawl
39	B3	AGT005	13/07/2018 11:32	72.63115	19.26396	13/07/2018 11:44	72.63104	19.25984	13/07/2018 12:25	72.63058	19.24535	370	Laura	15min trawl
40	B3	AGT006	13/07/2018 12:37	72.63047	19.26599	13/07/2018 12:48	72.63039	19.26181	13/07/2018 13:28	72.63008	19.2452	370	Laura	15min trawl
41	B13	CTD002	14/07/2018 07:38	74.50002	30.0003	14/07/2018 07:52	74.50007	30.00027	14/07/2018 08:24	74.50006	30.00032		Jo	
42	B13	MC007	14/07/2018 08:56	74.49999	30.00043	14/07/2018 09:08	74.49999	30.00045	14/07/2018 09:22	74.49999	30.00044	364	Ally	Ship moved 5m E
43	B13	MC008	14/07/2018 09:46	74.50012	29.99964	14/07/2018 09:59	74.50013	29.99972	14/07/2018 10:12	74.50013	29.9997	365	Ally	Ship moved 20m NW
44	B13	MC009	14/07/2018 10:31	74.49988	30.00068	14/07/2018 10:42	74.4999	30.0007	14/07/2018 10:56	74.4999	30.00066	364	Ally	Ship moved 20m SE
45	B13	SMBA006	14/07/2018 11:24	74.49998	29.9999	14/07/2018 11:36	74.49997	30.0002	14/07/2018 11:50	74.49997	30.00011	361	Rachel	Ship moved 5m W, Corer failed

			START			BOTTOM			END					
EVENT	ID	TYPE	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	WDEPTH	RESPONSIBLE	COMMENTS
46	B13	SMBA007	14/07/2018 12:02	74.49998	30.00019	14/07/2018 12:14	74.49998	30.00021	14/07/2018 12:25	74.49998	30.00022	363	Rachel	Ship did not move
47	B13	SMBA008	14/07/2018 12:38	74.50021	30.00024	14/07/2018 12:48	74.50017	30.00026	14/07/2018 12:59	74.50017	30.00026	361	Rachel	Ship moved 20m N
48	B13	SMBA009	14/07/2018 13:10	74.49996	30.00086	14/07/2018 13:22	74.49996	30.00083	14/07/2018 13:34	74.49996	30.00082	364	Rachel	Ship moved 20m E
49	B13	SMBA010	14/07/2018 13:44	74.4998	30.00026	14/07/2018 13:56	74.49981	30.00024	14/07/2018 14:10	74.49981	30.00022	364	Rachel	Ship moved 20m S
50	B13	SMBA011	14/07/2018 14:20	74.50003	29.99952	14/07/2018 14:32	74.50007	29.9995	14/07/2018 14:47	74.50006	29.99955	363	Rachel	Ship moved 20m W
51	B13	USNL023	14/07/2018 15:14	74.49977	29.99943	14/07/2018 15:28	74.49978	29.99945	14/07/2018 15:45	74.49978	29.99939	362	Martin	Ship moved 20m, heading 187
52	B13	USNL024	14/07/2018 16:36	74.49979	29.99875	14/07/2018 16:48	74.49977	29.99872	14/07/2018 17:02	74.49978	29.99869	362	Martin	Ship moved 20m, heading 269
53	B13	USNL025	14/07/2018 17:31	74.49988	29.9981	14/07/2018 17:42	74.49987	29.99815	14/07/2018 17:57	74.49988	29.99811	362	Martin	Ship moved 20m, heading 300
54	B13	USNL026	14/07/2018 18:24	74.49971	29.99786	14/07/2018 18:36	74.4997	29.99781	14/07/2018 18:48	74.49969	29.99785	366	Martin	Ship moved 20m, heading 201
55	B13	USNL027	14/07/2018 18:56	74.49953	29.99819	14/07/2018 19:09	74.49957	29.99819	14/07/2018 19:21	74.49955	29.99821	366	Saskia	Ship moved 20m, heading 158
56	B13	USNL028	14/07/2018 19:31	74.49954	29.99884	14/07/2018 19:44	74.49955	29.99886	14/07/2018 19:55	74.49955	29.9988	367	Saskia	Ship moved 20m, heading 093
57	B13	USNL029	14/07/2018 20:02	74.49945	29.99826	14/07/2018 20:14	74.49945	29.9983	14/07/2018 20:26	74.49931	29.99795	367	Saskia	Ship moved 20m, heading 239
58	B13	USNL030	14/07/2018 20:34	74.49931	29.99794	14/07/2018 20:46	74.49931	29.99792	14/07/2018 20:57	74.4993	29.99797	367	Saskia	Ship moved 20m, heading 209
59	B13	USNL031	14/07/2018 21:04	74.49922	29.99843	14/07/2018 21:15	74.49923	29.99841	14/07/2018 21:28	74.49923	29.99842	366	Saskia	Ship moved 20m, heading 121
60	B13	USNL032	14/07/2018 22:16	74.49932	29.99899	14/07/2018 22:28	74.49934	29.99894	14/07/2018 22:39	74.49931	29.99895	364	Liz	Ship moved 20m, heading 054
61	B13	USNL033	14/07/2018 22:48	74.49949	29.99882	14/07/2018 22:59	74.4995	29.99878	14/07/2018 23:10	74.49951	29.99887	360	Liz	Ship moved 20m, heading 347
62	B13	USNL034	14/07/2018 23:19	74.49956	29.99819	14/07/2018 23:30	74.49955	29.99814	14/07/2018 23:42	74.49955	29.99812	360	Liz	Ship moved 20m, heading 285
63	B13	USNL035	14/07/2018 23:53	74.49937	29.99805	15/07/2018 00:04	74.49938	29.99807	15/07/2018 00:15	74.4994	29.9981	361	Rachel	Ship moved 20m, heading 188
64	B13	USNL036	15/07/2018 00:24	74.49944	29.99868	15/07/2018 00:34	74.49944	29.9987	15/07/2018 00:46	74.49945	29.99867	361	Rachel	Ship moved 20m, heading 061
65	B13	USNL037	15/07/2018 00:55	74.49947	29.9993	15/07/2018 01:06	74.49947	29.99929	15/07/2018 01:17	74.49947	29.99933	360	Rachel	Ship moved 20m, heading 090
66	B13	USNL038	15/07/2018 01:24	74.49962	29.99966	15/07/2018 01:35	74.49962	29.99966	15/07/2018 01:47	74.49961	29.99963	360	Rachel	Ship moved 20m, heading 033, Failed
67	B13	USNL039	15/07/2018 01:53	74.4996	29.99962	15/07/2018 02:04	74.49959	29.99964	15/07/2018 02:16	74.49961	29.99961	362	Rachel	Ship did not move
68	B13	USNL040	15/07/2018 02:27	74.49967	30.00015	15/07/2018 02:38	74.49968	30.00025	15/07/2018 02:50	74.49967	30.00024	362	Rachel	Ship moved 20m, heading 066
69	B13	AGT007	15/07/2018 03:40	74.49952	30.00697	15/07/2018 03:57	74.49888	30.00172	15/07/2018 04:42	74.49633	29.98116	360	Terri	5 min trawl
70	B13	AGT008	15/07/2018 04:59	74.49931	30.01046	15/07/2018 05:12	74.49882	30.00661	15/07/2018 06:04	74.49627	29.98598	360	Terri	5 min trawl
71	B13	AGT009	15/07/2018 06:19	74.49913	30.00944	15/07/2018 06:31	74.49866	30.00619	15/07/2018 07:10	74.49607	29.99049	360	Terri	5 min trawl, failed, net opened and sample was lost
72	B13	AGT010	15/07/2018 07:32	74.49904	30.00965	15/07/2018 07:42	74.4985	30.00678	15/07/2018 08:24	74.49524	29.98936	361	Terri	5 min trawl
73	B13	AGT011	15/07/2018 08:48	74.50281	30.00295	15/07/2018 08:58	74.50217	30.0003	15/07/2018 09:40	74.49783	29.98235	324	Laura	15 min trawl
74	B13	AGT012	15/07/2018 09:55	74.50365	30.00714	15/07/2018 10:06	74.50295	30.00419	15/07/2018 10:44	74.49823	29.98735	360	Laura	15 min trawl
75	B13	AGT013	15/07/2018 11:08	74.50407	30.00267	15/07/2018 11:19	74.50333	29.99987	15/07/2018 11:56	74.49876	29.98302	365	Laura	15 min trawl
76	B13	Net001	15/07/2018 12:27	74.49707	29.97672	15/07/2018 12:29	74.49707	29.97673	15/07/2018 12:32	74.49709	29.97669		Patrick	Net deployed to 40m
77	B15	CTD003	16/07/2018 11:37	78.25166	29.99992	16/07/2018 11:50	78.25166	30.00021	16/07/2018 12:21	78.25165	30.00043		Jo	
78	B15	AGT014	16/07/2018 12:43	78.25065	30.00463	16/07/2018 12:52	78.25001	30.00109	16/07/2018 13:24	78.24635	29.9796	315	Terri	5 min trawl
79	B15	AGT015	16/07/2018 13:43	78.25061	30.00321	16/07/2018 13:51	78.25018	30.0004	16/07/2018 14:30	78.24686	29.97761	316	Terri	5 min trawl
80	B15	AGT016	16/07/2018 14:42	78.25082	30.00442	16/07/2018 14:52	78.25032	29.99983	16/07/2018 15:27	78.24779	29.97596	317	Terri	5 min trawl
81	B15	AGT017	16/07/2018 15:40	78.25077	30.00108	16/07/2018 15:50	78.2506	29.99624	16/07/2018 16:30	78.24954	29.96685	318	Laura	15 min trawl
82	B15	AGT018	16/07/2018 16:44	78.25046	29.98937	16/07/2018 16:53	78.25131	29.98939	16/07/2018 17:35	78.25763	29.99027	316	Laura	15 min trawl
83	B15	AGT019	16/07/2018 17:47	78.25045	29.99142	16/07/2018 17:57	78.25151	29.9914	16/07/2018 18:41	78.25865	29.99139	317	Laura	15 min trawl
84	B15	USNL041	16/07/2018 19:28	78.25146	29.99975	16/07/2018 19:39	78.25146	29.99971	16/07/2018 19:51	78.25147	29.9996	319	Rachel	Ship moved 20m, heading 187
85	B15	USNL042	16/07/2018 19:56	78.25147	29.99881	16/07/2018 20:07	78.25146	29.99883	16/07/2018 20:20	78.25147	29.99872	318	Rachel	Ship moved 20m, heading 269
86	B15	USNL043	16/07/2018 20:39	78.25157	29.99807	16/07/2018 20:50	78.25154	29.99799	16/07/2018 21:01	78.25156	29.9981	314	Rachel	Ship moved 20m, heading 300
87	B15	USNL044	16/07/2018 21:08	78.25138	29.99769	16/07/2018 21:17	78.25139	29.99773	16/07/2018 21:28	78.2514	29.9977	315	Rachel	Ship moved 20m, heading 201
88	B15	USNL045	16/07/2018 21:34	78.25122	29.99806	16/07/2018 21:44	78.25123	29.99801	16/07/2018 21:55	78.25122	29.99804	315	Rachel	Ship moved 20m, heading 158
89	B15	USNL046	16/07/2018 22:44	78.25121	29.99897	16/07/2018 22:54	78.25122	29.99896	16/07/2018 23:05	78.25121	29.99898	312	Saskia	Ship moved 20m, heading 093
90	B15	USNL047	16/07/2018 23:19	78.25114	29.99818	16/07/2018 23:28	78.25112	29.99809	16/07/2018 23:38	78.25113	29.99809	311	Martin	Ship moved 20m, heading 239

			START			BOTTOM			END					
EVENT	ID	TYPE	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	WDEPTH	RESPONSIBLE	COMMENTS
91	B15	USNL048	16/07/2018 23:46	78.25096	29.99764	16/07/2018 23:56	78.25095	29.99772	17/07/2018 00:07	78.25096	29.99774	311	Saskia	Ship moved 20m, heading 209
92	B15	USNL049	17/07/2018 00:30	78.25086	29.99847	17/07/2018 00:40	78.25089	29.99848	17/07/2018 00:50	78.25088	29.99851	310	Martin+Rachel	Ship moved 20m, heading 121
93	B15	USNL050	17/07/2018 00:59	78.25098	29.99919	17/07/2018 01:09	78.25098	29.99917	17/07/2018 01:19	78.25097	29.99914	311	Saskia	Ship moved 20m, heading 054
94	B15	USNL051	17/07/2018 01:45	78.25114	29.99897	17/07/2018 01:55	78.25114	29.999	17/07/2018 02:06	78.25114	29.99895	311	Saskia	Ship moved 20m, heading 347
95	B15	USNL052	17/07/2018 02:14	78.25123	29.99973	17/07/2018 02:24	78.25123	29.99972	17/07/2018 02:34	78.25122	29.99971	312	Saskia	Ship moved 20m, heading 061
96	B15	USNL053	17/07/2018 02:47	78.25124	30.00058	17/07/2018 02:57	78.25122	30.00062	17/07/2018 03:07	78.25124	30.00064	312	Martin+Rachel	Ship moved 20m, heading 090
97	B15	USNL054	17/07/2018 03:15	78.25139	30.00116	17/07/2018 03:24	78.25139	30.00116	17/07/2018 03:35	78.25138	30.00118	312	Martin+Rachel	Ship moved 20m, heading 033
98	B15	USNL055	17/07/2018 03:45	78.25147	30.00192	17/07/2018 03:54	78.25147	30.00194	17/07/2018 04:05	78.25147	30.00189	312	Liz+Rachel	Ship moved 20m, heading 066
99	B15	USNL056	17/07/2018 04:12	78.25149	30.00101	17/07/2018 04:22	78.25148	30.00104	17/07/2018 04:33	78.25149	30.00106	312	Liz+Rachel	Ship moved 20m, heading 279
100	B15	USNL057	17/07/2018 04:40	78.25131	30.00096	17/07/2018 04:50	78.2513	30.00094	17/07/2018 05:02	78.25135	30.00093	312	Liz	Ship moved 20m, heading 186
101	B15	MC010	17/07/2018 05:28	78.25163	30.00015	17/07/2018 05:38	78.25167	30.00013	17/07/2018 05:51	78.25168	30.00007	312	Ally	Ship moved 5m E
102	B15	MC011	17/07/2018 06:12	78.25174	29.99928	17/07/2018 06:22	78.25174	29.99924	17/07/2018 06:35	78.25173	29.99927	318	Ally	Ship moved 20m NW
103	B15	MC012	17/07/2018 07:00	78.25149	30.00059	17/07/2018 07:10	78.25149	30.00055	17/07/2018 07:25	78.25149	30.00056	319	Ally	Ship moved 20m SE
104	B15	SMBA012	17/07/2018 07:48	78.25163	29.99975	17/07/2018 07:59	78.25163	29.99974	17/07/2018 08:12	78.25163	29.99975	317	Rachel	Ship moved 5m W
105	B15	SMBA013	17/07/2018 08:21	78.25178	29.99987	17/07/2018 08:30	78.25178	29.99979	17/07/2018 08:43	78.25178	29.99989	317	Rachel	Ship moved 20m N
106	B15	SMBA014	17/07/2018 08:52	78.25161	30.00082	17/07/2018 09:00	78.25162	30.00083	17/07/2018 09:11	78.25162	30.00077	315	Rachel	Ship moved 20m E
107	B15	SMBA015	17/07/2018 09:23	78.25144	29.99977	17/07/2018 09:32	78.25143	29.99976	17/07/2018 09:42	78.25144	29.99979	316	Rachel	Ship moved 20m S
108	B15	SMBA016	17/07/2018 09:52	78.25163	29.99882	17/07/2018 10:02	78.25163	29.9988	17/07/2018 10:13	78.25163	29.99882	315	Rachel	Ship moved 20m W
109	B15	Net003	17/07/2018 10:37	78.25166	29.99988	17/07/2018 10:39	78.25166	29.99987	17/07/2018 10:41	78.25166	29.99983		Patrick	Net deployed to 40m
110	B17	CTD004	18/07/2018 06:37	81.28163	29.32675	18/07/2018 06:50	81.28161	29.3269	18/07/2018 07:18	81.2816	29.32686		Jo	
111	B17	AGT020	18/07/2018 07:50	81.28007	29.34901	18/07/2018 08:00	81.28014	29.3435	18/07/2018 08:48	81.28084	29.28688	324	Terri	5 min trawl
112	B17	AGT021	18/07/2018 09:03	81.27941	29.34432	18/07/2018 09:13	81.2796	29.33682	18/07/2018 09:57	81.28076	29.28519	349	Terri	5 min trawl
113	B17	AGT022	18/07/2018 10:12	81.27922	29.34515	18/07/2018 10:13	81.27922	29.3446	18/07/2018 11:21	81.27979	29.26345	340	Terri	5 min trawl, no mud collected, few animals collected for Mart
114	B17	AGT023	18/07/2018 11:45	81.2802	29.35526	18/07/2018 11:54	81.28022	29.34901	18/07/2018 12:37	81.28088	29.29652	337	Terri	5 min trawl
115	B17	AGT024	18/07/2018 12:58	81.27939	29.33728	18/07/2018 13:00	81.27938	29.33635	18/07/2018 13:46	81.27885	29.2882	344	Laura	15 min trawl
116	B17	AGT025	18/07/2018 14:05	81.27882	29.28686	18/07/2018 14:15	81.27876	29.2797	18/07/2018 14:42	81.27847	29.24346	339	Laura	15 min trawl
117	B17	AGT026	18/07/2018 15:16	81.28334	29.35586	18/07/2018 15:26	81.28324	29.34905	18/07/2018 15:49	81.28277	29.31516	339	Laura	15 min trawl, failed, no mud collected
118	B17	AGT027	18/07/2018 16:15	81.28354	29.35273	18/07/2018 16:32	81.28332	29.33683	18/07/2018 16:51	81.28297	29.30954	339	Laura	15 min trawl
119	B17	AGT028	18/07/2018 17:22	81.28378	29.34869	18/07/2018 17:33	81.28366	29.3407	18/07/2018 17:58	81.28322	29.30639	340	Martin	15 min trawl, failed, no mud collected
120	B17	AGT029	18/07/2018 18:26	81.28397	29.34701	18/07/2018 18:36	81.28388	29.34098	18/07/2018 19:05	81.28342	29.30313	354	Martin	15 min trawl
121	B17	AGT030	18/07/2018 19:36	81.28394	29.34459	18/07/2018 19:46	81.2831	29.34406	18/07/2018 20:14	81.2774	29.34019	350	Martin	15 min trawl
122	B17	AGT031	18/07/2018 20:45	81.28475	29.33391	18/07/2018 20:56	81.28415	29.33843	18/07/2018 21:33	81.27814	29.38193	340	Martin	25 min trawl
123	B17	USNL058	18/07/2018 23:20	81.28151	29.3263	18/07/2018 23:30	81.28151	29.32635	18/07/2018 23:40	81.28151	29.32643	337	Rachel	
124	B17	USNL059	18/07/2018 23:47	81.28151	29.32525	18/07/2018 23:57	81.28151	29.32527	19/07/2018 00:07	81.28151	29.32538	334	Rachel	Ship moved 20m, heading 269, Sample lost
125	B17	USNL060	19/07/2018 00:14	81.2816	29.32434	19/07/2018 00:24	81.28144	29.32382	19/07/2018 00:34	81.2816	29.32427	332	Rachel	Ship moved 20m, heading 300
126	B17	USNL061	19/07/2018 00:40	81.28144	29.32384	19/07/2018 00:50	81.28144	29.32383	19/07/2018 01:00	81.28142	29.32383	332	Rachel	Ship moved 20m, heading 201
127	B17	USNL062	19/07/2018 01:12	81.28126	29.32423	19/07/2018 01:22	81.28126	29.32422	19/07/2018 01:31	81.28126	29.32419	333	Rachel	Ship moved 20m, heading 158
128	B17	USNL063	19/07/2018 01:39	81.28127	29.32536	19/07/2018 01:49	81.28125	29.3254	19/07/2018 01:59	81.28124	29.32543	334	Saskia	Ship moved 20m, heading 093
129	B17	USNL064	19/07/2018 02:08	81.28115	29.32436	19/07/2018 02:18	81.28114	29.32433	19/07/2018 02:28	81.28113	29.3243	334	Saskia	Ship moved 20m, heading 239
130	B17	USNL065	19/07/2018 02:37	81.28099	29.32378	19/07/2018 02:47	81.28099	29.32381	19/07/2018 02:58	81.28098	29.32388	333	Saskia	Ship moved 20m, heading 209
131	B17	USNL066	19/07/2018 03:05	81.28088	29.32489	19/07/2018 03:15	81.28089	29.32487	19/07/2018 03:27	81.28094	29.32518	334	Saskia	Ship moved 20m, heading 121
132	B17	USNL067	19/07/2018 03:33	81.28099	29.32578	19/07/2018 03:43	81.281	29.32565	19/07/2018 03:54	81.281	29.32572	335	Saskia	Ship moved 20m, heading 054
133	B17	USNL068	19/07/2018 04:07	81.28108	29.32673	19/07/2018 04:16	81.28107	29.32666	19/07/2018 04:27	81.28107	29.3267	335	Saskia	Ship moved 20m, heading 061
134	B17	USNL069	19/07/2018 04:35	81.28105	29.32795	19/07/2018 04:45	81.28105	29.32781	19/07/2018 04:56	81.28108	29.32762	337	Martin+Rachel	Ship moved 20m, heading 090
135	B17	USNL070	19/07/2018 05:05	81.28122	29.32831	19/07/2018 05:15	81.28124	29.32828	19/07/2018 05:26	81.28125	29.3284	337	Martin+Rachel	Ship moved 20m, heading 066

			START			BOTTOM			END					
EVENT	ID	TYPE	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	WDEPTH	RESPONSIBLE	COMMENTS
136	B17	USNL071	19/07/2018 05:33	81.28133	29.32931	19/07/2018 05:43	81.28133	29.32941	19/07/2018 05:54	81.28132	29.32929	337	Martin+Rachel	Ship moved 20m, heading 066
137	B17	USNL072	19/07/2018 06:01	81.28138	29.32805	19/07/2018 06:13	81.28136	29.32802	19/07/2018 06:25	81.28136	29.32801	345	Martin+Rachel	Ship moved 20m, heading 282
138	B17	USNL073	19/07/2018 09:12	81.28135	29.32762	19/07/2018 09:22	81.28136	29.32721	19/07/2018 09:32	81.28134	29.32724	340	Liz+Rachel	Ship moved 20m, heading 282
139	B17	USNL074	19/07/2018 09:39	81.2812	29.32669	19/07/2018 09:46	81.28121	29.3267	19/07/2018 09:59	81.28119	29.32671	340	Liz	Ship moved 20m, heading 142
140	B17	USNL075	19/07/2018 10:08	81.28105	29.32746	19/07/2018 10:18	81.28106	29.32739	19/07/2018 10:29	81.28107	29.32743	336	Liz	Ship moved 20m, heading 188
141	B17	MC013	19/07/2018 10:50	81.28163	29.3272	19/07/2018 11:00	81.28163	29.32727	19/07/2018 11:14	81.28162	29.32732	335	Ally	Ship moved 5m E
142	B17	MC014	19/07/2018 11:32	81.28175	29.32601	19/07/2018 11:41	81.28176	29.32599	19/07/2018 11:53	81.28174	29.32601	335	Ally	Ship moved 20m NW
143	B17	MC015	19/07/2018 12:14	81.28146	29.32788	19/07/2018 12:23	81.28157	29.3278	19/07/2018 12:36	81.28156	29.32777	334	Ally	Ship moved 20m SE
144	B17	MC016	19/07/2018 12:58	81.28157	29.32778	19/07/2018 13:07	81.28157	29.32775	19/07/2018 13:22	81.28157	29.32775	336	Ally	Ship did not move
145	B17	SMBA017	19/07/2018 13:53	81.28169	29.32667	19/07/2018 14:02	81.2817	29.32669	19/07/2018 14:15	81.2817	29.32673	334	Rachel	Ship moved 5m W
146	B17	SMBA018	19/07/2018 14:23	81.28186	29.32676	19/07/2018 14:32	81.28186	29.32682	19/07/2018 14:45	81.28185	29.3268	334	Rachel	Ship moved 20m N
147	B17	SMBA019	19/07/2018 14:53	81.2817	29.32781	19/07/2018 15:03	81.2817	29.32776	19/07/2018 15:15	81.28169	29.32778	334	Rachel	Ship moved 20m S
148	B17	SMBA020	19/07/2018 15:23	81.28149	29.32673	19/07/2018 15:32	81.28148	29.32673	19/07/2018 15:48	81.28149	29.32668	334	Rachel	Ship moved 20m W
149	B17	SMBA021	19/07/2018 16:12	81.28169	29.32558	19/07/2018 16:19	81.28169	29.32559	19/07/2018 16:31	81.28168	29.32549	335	Rachel	Ship moved 20m E
150	B17	SMBA022	19/07/2018 16:40	81.28175	29.3255	19/07/2018 16:50	81.28176	29.32551	19/07/2018 17:03	81.28176	29.32553	334	Martin	Ship moved 5m, heading 000
151	B17	SMBA023	19/07/2018 17:14	81.28176	29.32595	19/07/2018 17:24	81.28176	29.32601	19/07/2018 17:36	81.28176	29.32594	334	Martin	Ship moved 5m, heading 180
152	B17	SMBA024	19/07/2018 17:46	81.28168	29.326	19/07/2018 17:55	81.28169	29.32593	19/07/2018 18:08	81.28168	29.3259	335	Martin	Ship moved 5m, heading 091
153	B17	SMBA025	19/07/2018 18:15	81.28163	29.32589	19/07/2018 18:26	81.2816	29.3259	19/07/2018 18:37	81.28162	29.32593	339	Martin	Ship moved 5m, heading 180
154	B17	SMBA026	19/07/2018 18:44	81.28153	29.32591	19/07/2018 18:54	81.28153	29.32597	19/07/2018 19:07	81.28154	29.326	339	Martin	Ship moved 10m, heading 180
155	B17	Net002	19/07/2018 19:33	81.28169	29.32681	19/07/2018 19:36	81.28169	29.32675	19/07/2018 19:40	81.28169	29.32677		Patrick	Net deployed to 40m
156	Z	CTD005	19/07/2018 21:40	81.52603	29.46549	19/07/2018 22:03	81.52645	29.46436	19/07/2018 22:43	81.52647	29.46425		Jo	
157	Test	CTD006	20/07/2018 12:29	82.50441	28.52317	20/07/2018 12:36	82.50331	28.52862	20/07/2018 12:54	82.50133	28.53761		Jo	CTD deployed to 100m
158	A	CTD007	20/07/2018 22:24	83.04647	27.65231	20/07/2018 22:31	83.04621	27.6543	20/07/2018 22:52	83.04453	27.6579		Jo	CTD deployed to 100m
		Ice001	20/07/2018 23:19	83.04907	27.68574								Mark+Caroline	Ice sampling
		Ice002	20/07/2018 23:36	83.04697	27.68809								Mark+Caroline	Ice sampling
159	R	CTD008	21/07/2018 08:58	82.54386	27.1717	21/07/2018 09:06	82.54386	27.17177	21/07/2018 09:24	82.54387	27.17176		Jo	CTD deployed to 100m
		Ice003	21/07/2018 09:58	82.56536	27.30297								Mark+Caroline	Ice sampling
160	B	CTD009	21/07/2018 16:11	82.04443	27.2773	21/07/2018 16:20	82.0445	27.27501	21/07/2018 16:41	82.04445	27.2703		Jo	CTD deployed to 100m
		Ice004	21/07/2018 17:10	82.04443	27.24785								Mark+Caroline	Ice sampling
161	E	CTD010	21/07/2018 20:04	81.79997	27.79274	21/07/2018 20:11	81.79997	27.79268	21/07/2018 20:25	81.79995	27.79275		Jo	CTD deployed to 100m
162	B16C	CTD011	22/07/2018 02:46	80.99026	29.52108	22/07/2018 02:57	80.99021	29.52143	22/07/2018 03:06	80.99022	29.52144		Jo	
163	B16B	CTD012	22/07/2018 05:09	80.69905	29.70899	22/07/2018 05:21	80.69906	29.709	22/07/2018 05:31	80.69908	29.70897		Jo	
164	B16A	CTD013	22/07/2018 07:50	80.40785	29.89155	22/07/2018 07:57	80.40784	29.89152	22/07/2018 08:04	80.40785	29.89147		Jo	
165	B16	CTD014	22/07/2018 10:18	80.1167	30.06826	22/07/2018 10:28	80.1167	30.06827	22/07/2018 10:51	80.11669	30.06834		Jo	
166	B16	AGT032	22/07/2018 11:16	80.11751	30.07503	22/07/2018 11:24	80.11674	30.07768	22/07/2018 12:00	80.11071	30.09771	283	Terri	5 min trawl
167	B16	AGT033	22/07/2018 12:27	80.11735	30.07433	22/07/2018 12:36	80.1165	30.07665	22/07/2018 13:04	80.11202	30.08818	288	Terri	5 min trawl
168	B16	AGT034	22/07/2018 13:25	80.11735	30.0743	22/07/2018 13:35	80.11624	30.07492	22/07/2018 14:09	80.11158	30.07791	282	Terri	5 min trawl
169	B16	AGT035	22/07/2018 14:26	80.11578	30.07398	22/07/2018 14:36	80.1147	30.07459	22/07/2018 15:12	80.10913	30.07787	289	Laura	15min trawl
170	B16	AGT036	22/07/2018 15:30	80.11569	30.07218	22/07/2018 15:40	80.1146	30.07288	22/07/2018 16:14	80.10903	30.0762	288	Laura	15min trawl
171	B16	AGT037	22/07/2018 16:36	80.11552	30.06882	22/07/2018 16:44	80.11469	30.06933	22/07/2018 17:17	80.1091	30.0726	286	Laura	15min trawl
172	B16	AGT038	22/07/2018 17:39	80.11647	30.04722	22/07/2018 17:48	80.11562	30.05017	22/07/2018 18:27	80.10993	30.06896	282	Martin+Laura	15min trawl
173	B16	AGT039	22/07/2018 18:47	80.11593	30.046	22/07/2018 18:57	80.11504	30.04885	22/07/2018 19:41	80.10932	30.06622	292	Martin+Laura	15min trawl
174	B16	AGT040	22/07/2018 19:56	80.11518	30.04508	22/07/2018 20:06	80.11409	30.04837	22/07/2018 20:48	80.10897	30.06422	292	Martin+Laura	15min trawl
175	B16	USNL076	23/07/2018 02:01	80.11652	30.06792	23/07/2018 02:10	80.11651	30.06787	23/07/2018 02:26	80.11653	30.06797	278	Rachel	
176	B16	USNL077	23/07/2018 02:48	80.11632	30.06793	23/07/2018 02:56	80.11634	30.06789	23/07/2018 03:06	80.11635	30.06783	277	Rachel	Ship moved 20m, heading 187

			START			BOTTOM			END					
EVENT	ID	TYPE	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	WDEPTH	RESPONSIBLE	COMMENTS
177	B16	USNL078	23/07/2018 03:13	80.11635	30.0668	23/07/2018 03:21	80.11634	30.06678	23/07/2018 03:32	80.11635	30.06666	277	Rachel	Ship moved 20m, heading 289
178	B16	USNL079	23/07/2018 03:38	80.11643	30.06582	23/07/2018 03:47	80.11642	30.06585	23/07/2018 03:57	80.11639	30.06588	279	Rachel	Ship moved 20m, heading 300
179	B16	USNL080	23/07/2018 04:07	80.11626	30.06544	23/07/2018 04:16	80.11626	30.06548	23/07/2018 04:25	80.11625	30.0655	279	Rachel	Ship moved 20m, heading 201
180	B16	USNL081	23/07/2018 04:35	80.11608	30.06585	23/07/2018 04:50	80.11608	30.06591	23/07/2018 05:01	80.11606	30.06594	278	Saskia	Ship moved 20m, heading 158,
181	B16	USNL082	23/07/2018 05:09	80.11605	30.06703	23/07/2018 05:17	80.11607	30.06703	23/07/2018 05:28	80.11608	30.06698	278	Saskia	Ship moved 20m, heading 093
182	B16	USNL083	23/07/2018 05:39	80.11599	30.06605	23/07/2018 05:47	80.11599	30.06607	23/07/2018 06:00	80.116	30.06607	278	Saskia	Ship moved 20m, heading 239, failed, no sample collected
183	B16	USNL084	23/07/2018 06:04	80.116	30.06609	23/07/2018 06:12	80.116	30.06609	23/07/2018 06:25	80.11599	30.06608	278	Saskia	Core didn't close
184	B16	USNL085	23/07/2018 06:36	80.11584	30.06557	23/07/2018 06:44	80.11581	30.06556	23/07/2018 06:57	80.11583	30.06556	283	Saskia	Ship moved 20m, heading 209
185	B16	USNL086	23/07/2018 07:03	80.11593	30.06644	23/07/2018 07:13	80.11595	30.06635	23/07/2018 07:25	80.11594	30.0664	283	Saskia	Ship moved 20m, heading 054
186	B16	USNL087	23/07/2018 07:36	80.11613	30.06611	23/07/2018 07:45	80.11612	30.06618	23/07/2018 07:58	80.11612	30.06614	283	Saskia	Ship moved 20m, heading 347, failed, no sample collected
187	B16	USNL088	23/07/2018 08:05	80.11616	30.06518	23/07/2018 08:14	80.11615	30.06514	23/07/2018 08:24	80.11616	30.06512	283	Saskia	Ship moved 20m, heading 285, failed, no sample collected
188	B16	USNL089	23/07/2018 08:35	80.11597	30.06506	23/07/2018 08:43	80.11597	30.06514	23/07/2018 08:55	80.116	30.06504	284	Saskia	Ship moved 20m, heading 188
189	B16	USNL090	23/07/2018 09:05	80.11618	30.06728	23/07/2018 09:13	80.1162	30.06719	23/07/2018 09:24	80.11618	30.06716	283	Martin+Rachel	
190	B16	USNL091	23/07/2018 09:31	80.11618	30.0682	23/07/2018 09:39	80.11618	30.06817	23/07/2018 09:49	80.11618	30.06825	285	Martin+Rachel	Ship moved 20m, heading 090
191	B16	USNL092	23/07/2018 09:56	80.11634	30.06879	23/07/2018 10:04	80.11634	30.06881	23/07/2018 10:15	80.11635	30.06881	279	Martin+Rachel	Ship moved 20m, heading 033
192	B16	USNL093	23/07/2018 10:27	80.11642	30.06972	23/07/2018 10:35	80.11642	30.06969	23/07/2018 10:46	80.11641	30.06976	280	Martin+Rachel	Ship moved 20m, heading 066
193	B16	USNL094	23/07/2018 10:54	80.11645	30.06872	23/07/2018 11:03	80.11643	30.06873	23/07/2018 11:14	80.11644	30.06872	281	Liz+Rachel	Ship moved 20m, heading 279
194	B16	USNL095	23/07/2018 11:24	80.11626	30.06858	23/07/2018 11:32	80.11625	30.06868	23/07/2018 11:43	80.11626	30.0687	281	Liz	Ship moved 20m, heading 186
195	B16	USNL096	23/07/2018 11:50	80.11611	30.06937	23/07/2018 11:59	80.11611	30.06935	23/07/2018 12:09	80.11611	30.06932	282	Liz	Ship moved 20m, heading 142
196	B16	MC017	23/07/2018 14:22	80.11678	30.06764	23/07/2018 14:30	80.11672	30.06855	23/07/2018 14:43	80.11672	30.06859	279	Ally	Ship moved to 5m E
197	B16	MC018	23/07/2018 14:57	80.11684	30.06767	23/07/2018 15:06	80.11684	30.06765	23/07/2018 15:19	80.11684	30.06759	278	Ally	Ship moved 20m NW
198	B16	MC019	23/07/2018 15:40	80.11662	30.06899	23/07/2018 15:48	80.11659	30.069	23/07/2018 15:58	80.11659	30.069	278	Ally	Ship moved 20m SE
199	B16	SMBA027	23/07/2018 16:16	80.11671	30.0677	23/07/2018 16:24	80.11671	30.06794	23/07/2018 16:36	80.1167	30.06794	278	Rachel	Ship moved 5m W
200	B16	SMBA028	23/07/2018 16:45	80.1169	30.06823	23/07/2018 16:53	80.11689	30.0682	23/07/2018 17:05	80.11689	30.0683	279	Rachel	Ship moved 20m N
201	B16	SMBA029	23/07/2018 17:20	80.1167	30.06926	23/07/2018 17:29	80.11671	30.06923	23/07/2018 17:41	80.11671	30.06923	278	Rachel	Ship moved 20m E
202	B16	SMBA030	23/07/2018 17:47	80.11651	30.0681	23/07/2018 17:55	80.1165	30.06809	23/07/2018 18:06	80.1165	30.06805	278	Rachel	Ship moved 20m S
203	B16	SMBA031	23/07/2018 18:13	80.11669	30.0674	23/07/2018 18:21	80.1167	30.06744	23/07/2018 18:31	80.1167	30.06746	284	Rachel	Ship moved 20m W
204	B16	Net004	23/07/2018 19:01	80.11671	30.06839	23/07/2018 19:03	80.11671	30.06836	23/07/2018 19:08	80.11671	30.06835		Patrick	Net deployed to 40m
205	B15	USNL097	24/07/2018 07:54	78.25152	30.00006	24/07/2018 08:04	78.25151	30.00001	24/07/2018 08:15	78.25152	30.0001	317	Laura+Martin	Ship moved 20m, heading 187
206	B15	USNL098	24/07/2018 08:21	78.2515	29.99922	24/07/2018 08:32	78.25149	29.99928	24/07/2018 08:44	78.25154	29.99888	318	Laura+Martin	Ship moved 20m, heading 269
207	B15	USNL099	24/07/2018 08:51	78.2516	29.99842	24/07/2018 09:01	78.25161	29.99843	24/07/2018 09:12	78.25152	29.99833	318	Laura+Martin	Ship moved 20m, heading 300
208	B15	USNL100	24/07/2018 09:22	78.25141	29.99806	24/07/2018 09:32	78.25142	29.99809	24/07/2018 09:42	78.25141	29.99808	319	Laura+Martin	01Ship moved 20m, heading 271
209	X-North	CTD015	24/07/2018 12:46	77.8124	30.13137	24/07/2018 12:56	77.81239	30.13137	24/07/2018 13:03	77.81239	30.13137		Jo	
210	B34	CTD016	24/07/2018 16:47	77.33004	30.00026	24/07/2018 16:55	77.33003	30.00018	24/07/2018 17:01	77.33004	30.00028		Jo	
211	B34	USNL101	24/07/2018 17:21	77.33021	30.00024	24/07/2018 17:27	77.33021	30.00016	24/07/2018 17:38	77.33019	30.00022	189	Bhavani	Ship did not move, failed, no sample collected
212	B34	USNL102	24/07/2018 17:44	77.33011	30.00043	24/07/2018 17:50	77.3302	30.00008	24/07/2018 17:59	77.33017	30.00003	190	Bhavani	Ship moved 20m N, failed, no sample collected
213	B34	USNL103	24/07/2018 18:07	77.33003	30.00102	24/07/2018 18:17	77.33002	30.00115	24/07/2018 18:24	77.33005	30.00107	197	Bhavani	Ship moved 20m E
214	B34	USNL104	24/07/2018 18:31	77.32979	30.00044	24/07/2018 18:38	77.32981	30.00023	24/07/2018 18:46	77.32981	30.00024	197	Bhavani	Ship moved 20m S
215	B34	USNL105	24/07/2018 18:55	77.33	29.99944	24/07/2018 19:01	77.33001	29.99927	24/07/2018 19:14	77.33	29.99933	194	Bhavani	Ship moved 20m W, failed, no sample collected
216	B34	USNL106	24/07/2018 19:23	77.32989	29.99873	24/07/2018 19:30	77.32988	29.99878	24/07/2018 19:39	77.32989	29.99868	194	Bhavani	Ship moved 65m, heading 235, failed
217	B34	USNL107	24/07/2018 19:47	77.32978	29.99818	24/07/2018 19:52	77.32979	29.99805	24/07/2018 20:05	77.32976	29.99798	194	Bhavani	Ship moved 45m, heading 235, failed, no sample collected
218	B14	CTD017	25/07/2018 01:53	76.50003	30.50024	25/07/2018 02:04	76.50002	30.50026	25/07/2018 02:31	76.50003	30.5003		Jo	
219	B14	AGT041	25/07/2018 02:58	76.4995	30.50671	25/07/2018 03:08	76.49888	30.50347	25/07/2018 03:41	76.49635	30.49061	306	Terri	5 min trawl
220	B14	AGT042	25/07/2018 03:53	76.49966	30.50907	25/07/2018 04:04	76.49892	30.50518	25/07/2018 04:33	76.49642	30.4922	307	Terri	5 min trawl
221	B14	AGT043	25/07/2018 04:51	76.49959	30.50872	25/07/2018 05:01	76.49882	30.50576	25/07/2018 05:28	76.49575	30.49435	307	Terri	5 min trawl, no sample collected

			START			BOTTOM			END					
EVENT	ID	TYPE	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	WDEPTH	RESPONSIBLE	COMMENTS
222	B14	AGT044	25/07/2018 05:41	76.49949	30.50938	25/07/2018 05:51	76.49869	30.50655	25/07/2018 06:23	76.49492	30.4933	306	Terri	5 min trawl
223	B14	AGT045	25/07/2018 06:39	76.49872	30.50939	25/07/2018 06:48	76.49809	30.50697	25/07/2018 07:27	76.49352	30.49	310	Laura+Martin	15 min trawl
224	B14	AGT046	25/07/2018 07:43	76.49881	30.50874	25/07/2018 07:53	76.49787	30.50597	25/07/2018 08:26	76.49284	30.49183	302	Laura+Martin	15 min trawl, failed, no samples collected
225	B14	AGT047	25/07/2018 08:45	76.49936	30.50926	25/07/2018 08:56	76.49806	30.50918	25/07/2018 09:28	76.49226	30.50887	309	Laura+Martin	15 min trawl
226	B14	AGT048	25/07/2018 09:42	76.49867	30.50861	25/07/2018 09:51	76.49787	30.51013	25/07/2018 10:25	76.49218	30.52146	306	Laura+Martin	15 min trawl
227	B14	USNL108	25/07/2018 11:12	76.49982	30.49981	25/07/2018 11:21	76.49982	30.49977	25/07/2018 11:33	76.49984	30.49985	292	Rachel	
228	B14	USNL109	25/07/2018 11:40	76.49982	30.49906	25/07/2018 11:49	76.49983	30.49897	25/07/2018 12:00	76.49984	30.49896	293	Rachel	Ship moved 20m, heading 269
229	B14	USNL110	25/07/2018 12:07	76.49992	30.49832	25/07/2018 12:15	76.49993	30.49832	25/07/2018 12:24	76.49992	30.4983	291	Rachel	Ship moved 20m, heading 300
230	B14	USNL111	25/07/2018 12:30	76.49976	30.49803	25/07/2018 12:39	76.49975	30.49801	25/07/2018 12:49	76.49974	30.49801	292	Rachel	Ship moved 20m, heading 201
231	B14	USNL112	25/07/2018 12:57	76.49958	30.49828	25/07/2018 13:06	76.49957	30.49825	25/07/2018 13:16	76.49957	30.49825	292	Rachel	Ship moved 20m, heading 158
232	B14	USNL113	25/07/2018 13:23	76.49955	30.49896	25/07/2018 13:32	76.49956	30.49896	25/07/2018 13:42	76.49957	30.49898	292	Saskia	Ship moved 20m, heading 093
233	B14	USNL114	25/07/2018 13:49	76.49948	30.49839	25/07/2018 13:58	76.49949	30.49837	25/07/2018 14:10	76.49948	30.49842	292	Saskia	Ship moved 20m, heading 239
234	B14	USNL115	25/07/2018 14:17	76.49934	30.49806	25/07/2018 14:27	76.49934	30.49808	25/07/2018 14:38	76.49933	30.49805	292	Saskia	Ship moved 20m, heading 209
235	B14	USNL116	25/07/2018 14:44	76.49924	30.49868	25/07/2018 14:53	76.49925	30.49869	25/07/2018 15:05	76.49926	30.49878	293	Saskia	Ship moved 20m, heading 121
236	B14	USNL117	25/07/2018 15:11	76.49934	30.49927	25/07/2018 15:21	76.49934	30.49927	25/07/2018 15:32	76.49935	30.49934	293	Saskia	Ship moved 20m, heading 054
237	B14	USNL118	25/07/2018 15:38	76.49916	30.49922	25/07/2018 15:48	76.49917	30.49924	25/07/2018 16:00	76.49922	30.49976	293	Martin+Rachel	Ship moved 20m, heading 188
238	B14	USNL119	25/07/2018 16:04	76.49923	30.49994	25/07/2018 16:13	76.49923	30.49987	25/07/2018 16:24	76.49925	30.49988	294	Martin+Rachel	Ship moved 20m, heading 061
239	B14	USNL120	25/07/2018 16:31	76.49925	30.50062	25/07/2018 16:40	76.49925	30.50065	25/07/2018 16:52	76.49925	30.50068	294	Martin+Rachel	Ship moved 20m, heading 060
240	B14	USNL121	25/07/2018 16:58	76.49941	30.50113	25/07/2018 17:06	76.4994	30.50113	25/07/2018 17:18	76.4994	30.50111	296	Martin+Rachel	Ship moved 20m, heading 033
241	B14	USNL122	25/07/2018 17:27	76.49946	30.50175	25/07/2018 17:35	76.49947	30.50177	25/07/2018 17:47	76.49946	30.50168	295	Liz	Ship moved 20m, heading 066
242	B14	USNL123	25/07/2018 17:54	76.49949	30.50098	25/07/2018 18:02	76.49949	30.50096	25/07/2018 18:14	76.49948	30.50082	295	Liz+Rachel	Ship moved 20m, heading 279
243	B14	USNL124	25/07/2018 18:21	76.49953	30.50025	25/07/2018 18:31	76.49953	30.50021	25/07/2018 18:42	76.49945	30.5002	298	Liz	Ship moved 20m, heading 282
244	B14	MC020	25/07/2018 19:13	76.49999	30.50029	25/07/2018 19:23	76.50002	30.50039	25/07/2018 19:36	76.50003	30.50039	299	Ally	Ship moved 5m E
245	B14	MC021	25/07/2018 19:52	76.50014	30.49954	25/07/2018 20:02	76.50013	30.49955	25/07/2018 20:14	76.50014	30.49962	299	Ally	Ship moved 20m NW
246	B14	MC022	25/07/2018 20:30	76.49986	30.50064	25/07/2018 20:38	76.49986	30.50066	25/07/2018 20:52	76.49985	30.50064	299	Ally	Ship moved 20m SE
247	B14	SMBA032	25/07/2018 23:12	76.49996	30.49999	25/07/2018 23:22	76.49995	30.50004	25/07/2018 23:32	76.49996	30.50004	295	Rachel	Ship moved 5m W
248	B14	SMBA033	25/07/2018 23:38	76.50013	30.50009	25/07/2018 23:46	76.50014	30.50011	25/07/2018 23:56	76.50014	30.5001	295	Rachel	Ship moved 20m N
249	B14	SMBA034	26/07/2018 00:02	76.5	30.50085	26/07/2018 00:11	76.49999	30.50097	26/07/2018 00:21	76.49999	30.501	295	Rachel	Ship moved 20m E
250	B14	SMBA035	26/07/2018 00:33	76.49981	30.50025	26/07/2018 00:42	76.49979	30.50028	26/07/2018 00:52	76.49979	30.50031	295	Rachel	Ship moved 20m S
251	B14	SMBA036	26/07/2018 00:59	76.49998	30.49956	26/07/2018 01:09	76.49997	30.49949	26/07/2018 01:19	76.49996	30.49953	296	Rachel	Ship moved 20m W, failed, no sample collected
252	B14	SMBA037	26/07/2018 01:26	76.49995	30.49941	26/07/2018 01:35	76.49996	30.49942	26/07/2018 01:46	76.49997	30.49941	296	Rachel	Ship did not move
253	X-South	CTD018	26/07/2018 16:51	77.0333	29.33359	26/07/2018 17:02	77.03333	29.33347	26/07/2018 17:27	77.03332	29.33345		Jo	
254	X-South	AGT049	26/07/2018 17:43	77.03247	29.34055	26/07/2018 17:51	77.0322	29.33696	26/07/2018 18:21	77.03081	29.31781	228	Terri	5 min trawl
255	X-South	AGT050	26/07/2018 18:38	77.03215	29.34291	26/07/2018 18:49	77.03179	29.33734	26/07/2018 19:18	77.03071	29.32	229	Terri	5 min trawl
256	X-South	AGT051	26/07/2018 19:33	77.03203	29.34076	26/07/2018 19:42	77.03164	29.33596	26/07/2018 20:10	77.03025	29.31844	220	Terri	5 min trawl
257	X-South	AGT052	26/07/2018 20:26	77.03209	29.33968	26/07/2018 20:33	77.03176	29.33695	26/07/2018 21:08	77.02914	29.31514	221	Laura	15 min trawl
258	X-South	AGT053	26/07/2018 21:20	77.03193	29.33961	26/07/2018 21:29	77.03143	29.33615	26/07/2018 22:04	77.02925	29.3203	227	Laura	15 min trawl
259	X-South	AGT054	26/07/2018 22:23	77.03218	29.34007	26/07/2018 22:31	77.03155	29.33699	26/07/2018 23:03	77.02753	29.31635	229	Laura	15 min trawl
260	X-South	USNL125	27/07/2018 00:54	77.03314	29.33335	27/07/2018 01:02	77.03315	29.33335	27/07/2018 01:10	77.03313	29.3333	227	Rachel	
261	X-South	USNL126	27/07/2018 01:17	77.03315	29.33256	27/07/2018 01:28	77.03312	29.33251	27/07/2018 01:35	77.03312	29.33251	227	Rachel	Ship moved 20m, heading 269
262	X-South	USNL127	27/07/2018 01:42	77.03323	29.33179	27/07/2018 01:50	77.0332	29.33174	27/07/2018 01:58	77.03321	29.33181	227	Rachel	Ship moved 20m, heading 300
263	X-South	USNL128	27/07/2018 02:09	77.03306	29.33154	27/07/2018 02:17	77.03304	29.3315	27/07/2018 02:26	77.03304	29.33155	227	Rachel	Ship moved 20m, heading 201
264	X-South	USNL129	27/07/2018 02:31	77.03288	29.33183	27/07/2018 02:39	77.03285	29.33192	27/07/2018 02:48	77.03287	29.33197	227	Rachel	Ship moved 20m, heading 158
265	X-South	USNL130	27/07/2018 02:54	77.03287	29.33269	27/07/2018 03:01	77.03288	29.33262	27/07/2018 03:10	77.03286	29.33265	227	Saskia	Ship moved 20m, heading 093
266	X-South	USNL131	27/07/2018 03:20	77.03275	29.33192	27/07/2018 03:27	77.03277	29.33195	27/07/2018 03:36	77.03275	29.33197	227	Saskia	Ship moved 20m, heading 239
267	X-South	USNL132	27/07/2018 03:43	77.03258	29.33147	27/07/2018 03:50	77.03259	29.33152	27/07/2018 03:59	77.0326	29.33155	228	Saskia	Ship moved 20m, heading 209

			START			BOTTOM			END					
EVENT	ID	TYPE	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	DATE/TIME	LAT	LON	WDEPTH	RESPONSIBLE	COMMENTS
268	X-South	USNL133	27/07/2018 04:06	77.03251	29.33229	27/07/2018 04:14	77.03252	29.33222	27/07/2018 04:23	77.03251	29.3322	228	Saskia	Ship moved 20m, heading 121
269	X-South	USNL134	27/07/2018 04:30	77.03263	29.33285	27/07/2018 04:37	77.03259	29.33289	27/07/2018 04:46	77.03258	29.33288	228	Saskia	Ship moved 20m, heading 054
270	X-South	USNL135	27/07/2018 05:19	77.03289	29.33347	27/07/2018 05:27	77.03288	29.33338	27/07/2018 05:36	77.03291	29.33345	229	Martin+Rachel	Ship moved 20m, heading 349
271	X-South	USNL136	27/07/2018 05:19	77.03289	29.33347	27/07/2018 05:27	77.03288	29.33338	27/07/2018 05:36	77.03291	29.33345	229	Martin+Rachel	Ship moved 20m, heading 061
272	X-South	USNL137	27/07/2018 05:43	77.0329	29.3341	27/07/2018 05:50	77.0329	29.33407	27/07/2018 05:59	77.03289	29.33404	230	Martin+Rachel	Ship moved 20m, heading 090
273	X-South	USNL138	27/07/2018 06:04	77.03301	29.33445	27/07/2018 06:13	77.03305	29.33449	27/07/2018 06:22	77.03304	29.33447	235	Martin+Rachel	Ship moved 20m, heading 033
274	X-South	USNL139	27/07/2018 06:27	77.03313	29.33517	27/07/2018 06:35	77.03312	29.33524	27/07/2018 06:45	77.03312	29.33489	235	Liz+Rachel	Ship moved 20m, heading 066
275	X-South	USNL140	27/07/2018 06:51	77.03313	29.33446	27/07/2018 06:58	77.03315	29.33437	27/07/2018 07:07	77.03316	29.33442	235	Liz	Ship moved 20m, heading 279
276	X-South	USNL141	27/07/2018 07:13	77.03309	29.33364	27/07/2018 07:20	77.03306	29.33374	27/07/2018 07:28	77.03307	29.33364	236	Liz	Ship moved 20m, heading 250
277	X-South	MC023	27/07/2018 07:53	77.0333	29.33378	27/07/2018 08:00	77.03331	29.33371	27/07/2018 08:09	77.03329	29.33375	236	Ally	Ship moved 5m E
278	X-South	SMBA038	27/07/2018 08:37	77.03331	29.33332	27/07/2018 08:44	77.03331	29.33337	27/07/2018 08:54	77.03331	29.33331	236	Rachel	Ship moved 4m W
279	X-South	SMBA039	27/07/2018 09:02	77.03344	29.33317	27/07/2018 09:09	77.0335	29.33355	27/07/2018 09:18	77.03348	29.33355	236	Rachel	Ship moved 20m N
280	X-South	SMBA040	27/07/2018 09:25	77.03331	29.33398	27/07/2018 09:32	77.03327	29.33419	27/07/2018 09:40	77.03328	29.33429	236	Rachel	Ship moved 20m E
281	X-South	SMBA041	27/07/2018 09:48	77.03312	29.33326	27/07/2018 09:55	77.03313	29.33322	27/07/2018 10:05	77.03314	29.33318	236	Rachel	Ship moved 20m S, failed
282	X-South	SMBA042	27/07/2018 10:15	77.03311	29.33329	27/07/2018 10:22	77.0331	29.33323	27/07/2018 10:31	77.0331	29.33327	227	Rachel	Ship did not move
283	X-South	SMBA043	27/07/2018 10:38	77.03327	29.33268	27/07/2018 10:45	77.0333	29.33263	27/07/2018 10:55	77.03329	29.33266	231	Rachel	Ship moved 20m W
284	X-South	Net005	27/07/2018 11:12	77.0333	29.33285	27/07/2018 11:14	77.03328	29.33273	27/07/2018 11:17	77.03328	29.33272		Patrick	Net deployed to 40m
285	B13	CTD019	28/07/2018 03:54	74.49999	30.00018	28/07/2018 04:05	74.49996	30.00019	28/07/2018 04:16	74.49998	30.00022		Jo	
286	B13	USNL142	28/07/2018 04:53	74.49993	29.9996	28/07/2018 05:04	74.49995	29.99954	28/07/2018 05:16	74.49995	29.99952	358	Saskia	Ship moved 20m, heading 254
287	B13	USNL143	28/07/2018 05:22	74.49995	29.99891	28/07/2018 05:34	74.49993	29.99889	28/07/2018 05:45	74.49993	29.99886	358	Saskia	Ship moved 20m, heading 270
288	B13	USNL144	28/07/2018 05:52	74.5001	29.99885	28/07/2018 06:02	74.50011	29.99884	28/07/2018 06:14	74.50009	29.99879	360	Martin+Laura	Ship moved 20m, heading 000, failed
289	B13	USNL145	28/07/2018 06:17	74.5001	29.99816	28/07/2018 06:28	74.5001	29.99813	28/07/2018 06:40	74.50018	29.99814	358	Martin+Laura	Ship moved 20m, heading 270
290	B13	USNL146	28/07/2018 06:47	74.50028	29.99818	28/07/2018 06:57	74.50028	29.99815	28/07/2018 07:11	74.50028	29.99769	358	Martin+Laura	Ship moved 20m, heading 000, failed
291	B13	USNL147	28/07/2018 07:17	74.50029	29.99748	28/07/2018 07:27	74.50028	29.99748	28/07/2018 07:40	74.50023	29.99743	359	Martin+Laura	Ship moved 20m, heading 270
292	B13	USNL148	28/07/2018 07:46	74.5001	29.99745	28/07/2018 07:57	74.50008	29.99748	28/07/2018 08:08	74.50004	29.99746	360	Martin+Laura	Ship moved 20m, heading 180
293	B13	USNL149	28/07/2018 08:15	74.49988	29.99755	28/07/2018 08:25	74.4999	29.99755	28/07/2018 08:38	74.49988	29.99746	359	Martin+Laura	Ship moved 20m, heading 180
294	Y	MC024	28/07/2018 16:05	73.88677	26.33549	28/07/2018 16:18	73.88666	26.33525	28/07/2018 16:34	73.88665	26.33523	450	Ally	

End of event log. Refer to Appendix 1 for Ship report.

1.8 Downtime and miscellaneous notes

There were 11 downtimes during cruise JR17007 (Table 1.3), totaling 35h 15m.

Start		End		Summary	
Date	Time (h m)	Date	Time (h m)	Downtime (h m)	Reason
11/07/2018	13:48	12/07/2018	16:54	27:06	Crew member repatriation
14/07/2018	17:58	14/07/2018	18:33	00:35	Mid-ships gantry hydraulics
14/07/2018	19:10	14/07/2018	19:26	00:16	Mid-ships gantry hydraulics
14/07/2018	20:05	14/07/2018	20:22	00:17	Mid-ships gantry hydraulics
16/07/2018	22:24	16/07/2018	22:36	00:12	Mid-ships gantry hydraulics
17/07/2018	02:12	17/07/2018	02:28	00:16	Mid-ships gantry hydraulics
17/07/2018	03:24	17/07/2018	03:43	00:19	Mid-ships gantry hydraulics
20/07/2018	08:06	20/07/2018	11:35	03:29	Stern thruster repair
22/07/2018	00:42	22/07/2018	04:00	03:18	Vessel blacked out
22/07/2018	04:32	22/07/2018	04:47	00:15	Mid-ships gantry hydraulics
24/07/2018	16:06	24/07/2018	16:18	00:12	DP desk testing

Table 1.3. Summary of downtime during JR17007.

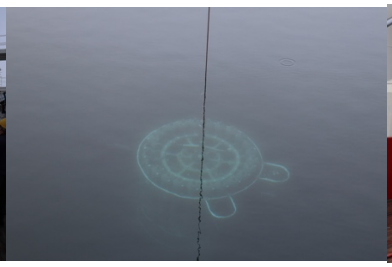
It is worth noting that we encountered a fleet (6 vessels) of Russian bottom trawlers in the area. Conversation with the Captain of one of the vessels by radio revealed that fleets of large vessels were common in the region, including in the vicinity of our sampling stations.

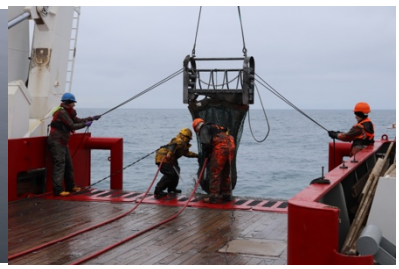


Part II. Science activity









2.1 Conductivity Temperature Depth system
Joana Beja (BODC)

Operation

The CTD system is comprised of a SeaBird911plus with two temperature, two conductivity, one oxygen, one par, one transmissometer, one fluorometer, one independent temperature sensor and one altimeter attached to the frame. Two LADCP were also attached to the frame and recorded data on all deployments. The CTD sensors details (serial numbers and manufacturer's calibration dates) are included in the AME report included as an Annex at the end of this document.

A total of 20 CTD casts were performed during the cruise. The deployment operation is described in the AME section but it briefly comprises deploying the CTD and once it reaches ~10m, allow it to stand for a few minutes until the sensors stabilise. After this time the CTD is brought back to as close of the surface as possible and then the deployment starts with the frame being sent to maximum depth at about 1 m/s, a speed that is reduced as the system is approaching the sea floor. Water samples are collected through the firing of 20 litre Niskin bottles at specified depths during the upcast. Independent temperature readings are recorded at each bottle firing and these will be used to determine a calibration for the CTD temperature sensors.

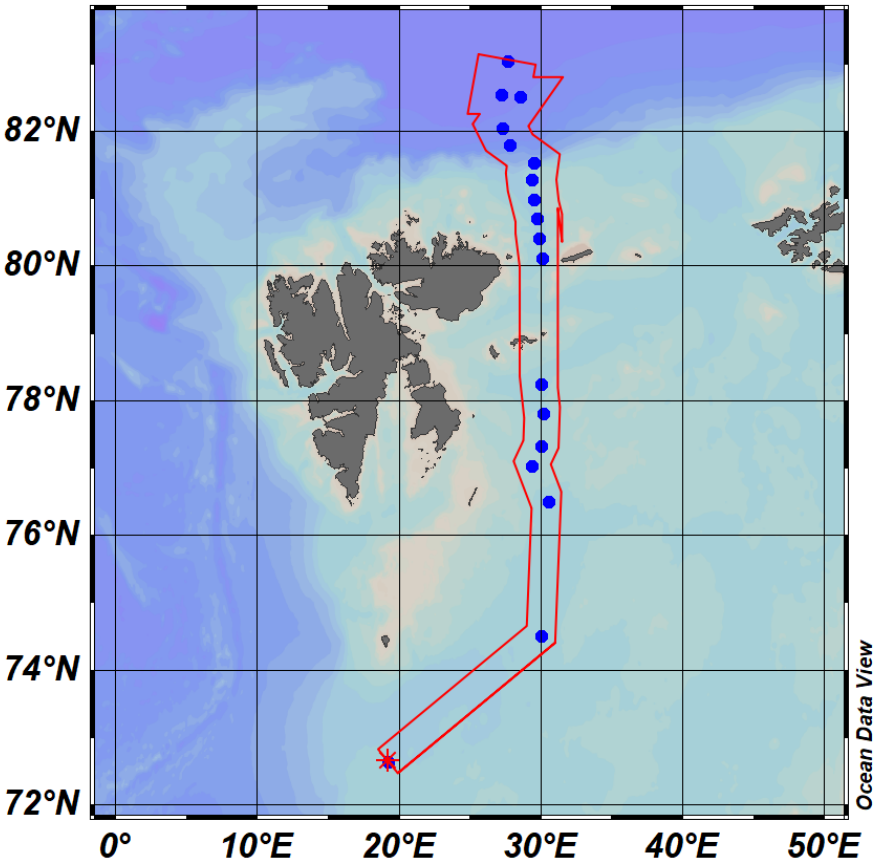
Data Processing

Initial data processing took place on board by running the CTD files through the SeaBird software (version 7.26.7.114) and producing uncalibrated files at 0.2dbar intervals. The following steps were used on all files:
DATCNV: Conversion of raw data from engineering units to ascii .cnv files and creation of the .ros files
BOTTLESUM: Creation of bottle file (.btl), using a 5 seconds window centered around the bottle firing time (as set at the Data Conversion stage).
WILDEDIT: Flagging of major spikes. Wild Edit's algorithm requires two passes through the data: the first pass removed data points over 2 standard deviations of a 100 scans average, while the second pass removed the data over 20 standard deviations of a 100 scans average
FILTER: Smoothing of the high frequency pressure and depth data using a low-pass filter using 0.15s, as recommended by SeaBird
ALIGNCTD: aligns parameter data in time, relative to pressure. This ensures that calculations of salinity, dissolved oxygen concentration, and other parameters are made using measurements from the same parcel of water.
CENTRAL THERMAL MASS: filters conductivity cell thermal mass effects from the measured conductivity, values of $\alpha=0.03$ and thermal anomaly time constant $1/\beta=7$ were used
SOAK: Identifying the period of soak, i.e. the period where the CTD remained in shallow water before deployment to allow for the sensors to equilibrate
SECTION: This procedure removed the soak period from all files which was defined by the cycle number (scan counts)

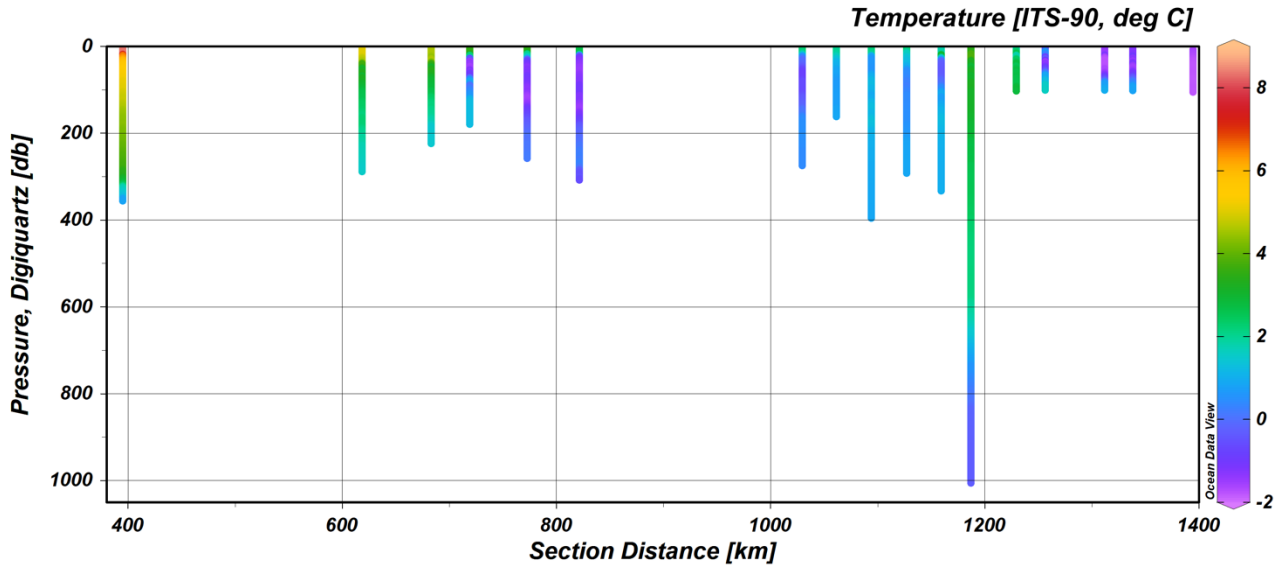
LOOPEDIT: Marks scans with a bad flag wherever there is a pressure slowdown or reversal (typically caused by ship heave). A minimum velocity of 0 m/s was used on this procedure
DERIVE: Derives pre-determined parameters once all corrections are applied to the data. The parameters derived were salinity, oxygen saturation (%) and oxygen concentration (ml/l)

For the purposes of presenting the data in this document, two more steps were applied,
BINAVERAGE: Average of all data to one dbar, as recommended for shallow water CTDs
STRIP: Removal of unwanted channels, more specifically the original salinity and oxygen concentration channels

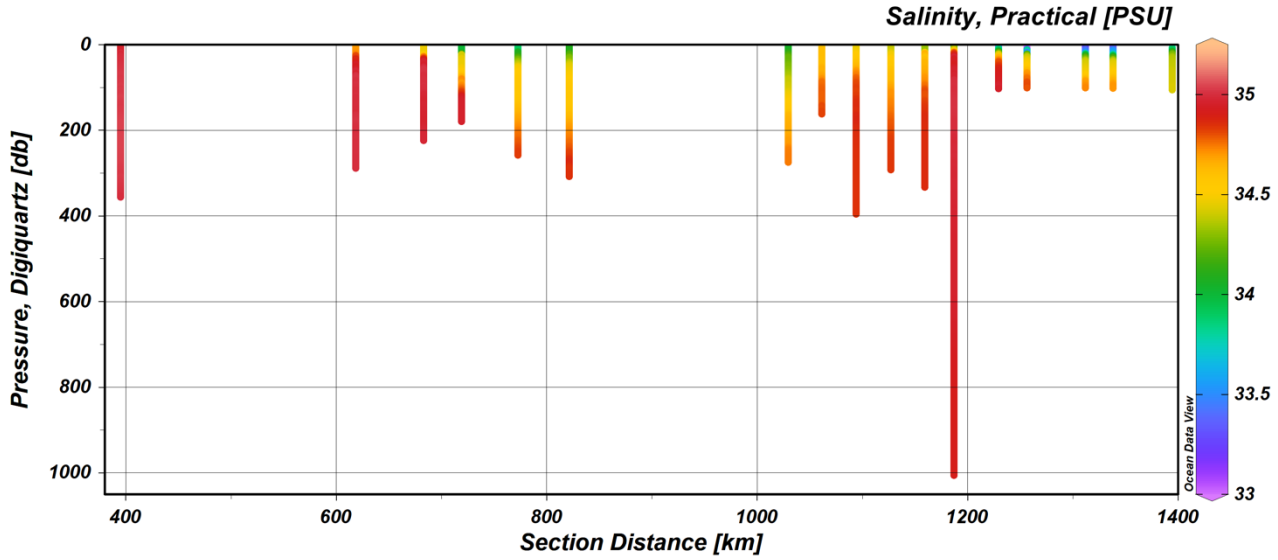
The preliminary procedures applied resulted in 20 CTD files with uncalibrated data. Samples for salinity, oxygen and independent temperature readings will allow for calibrations to be determined and applied if deemed to increase the quality of the data. These procedures will be applied post-cruise so will not be described on this report.



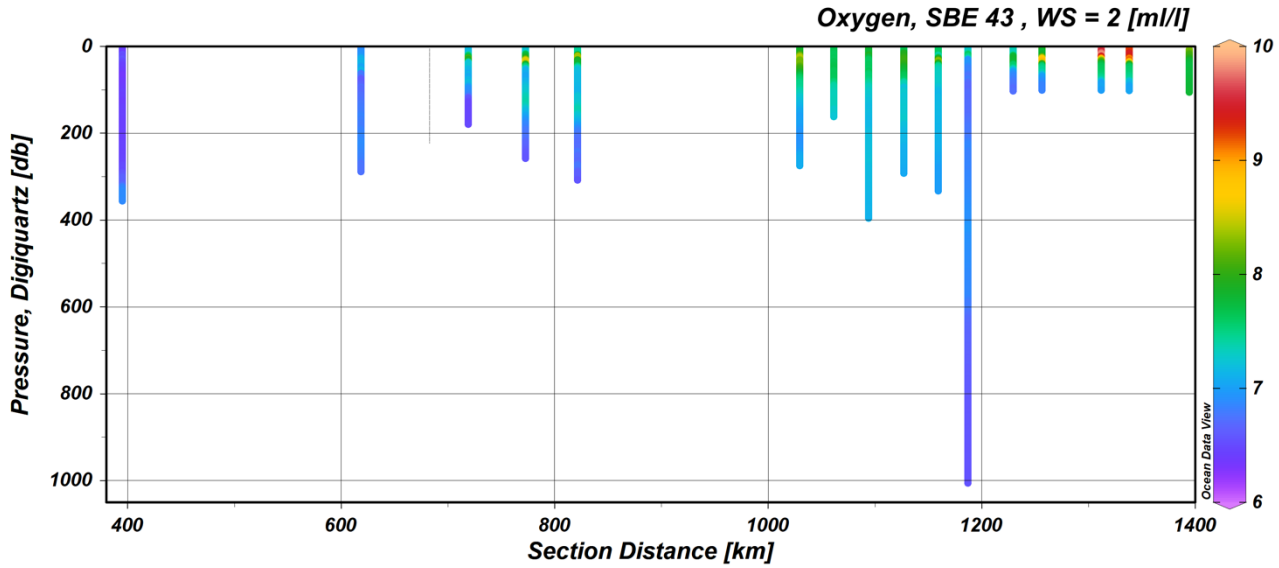
JR17007 CTD section (section defined S-N)



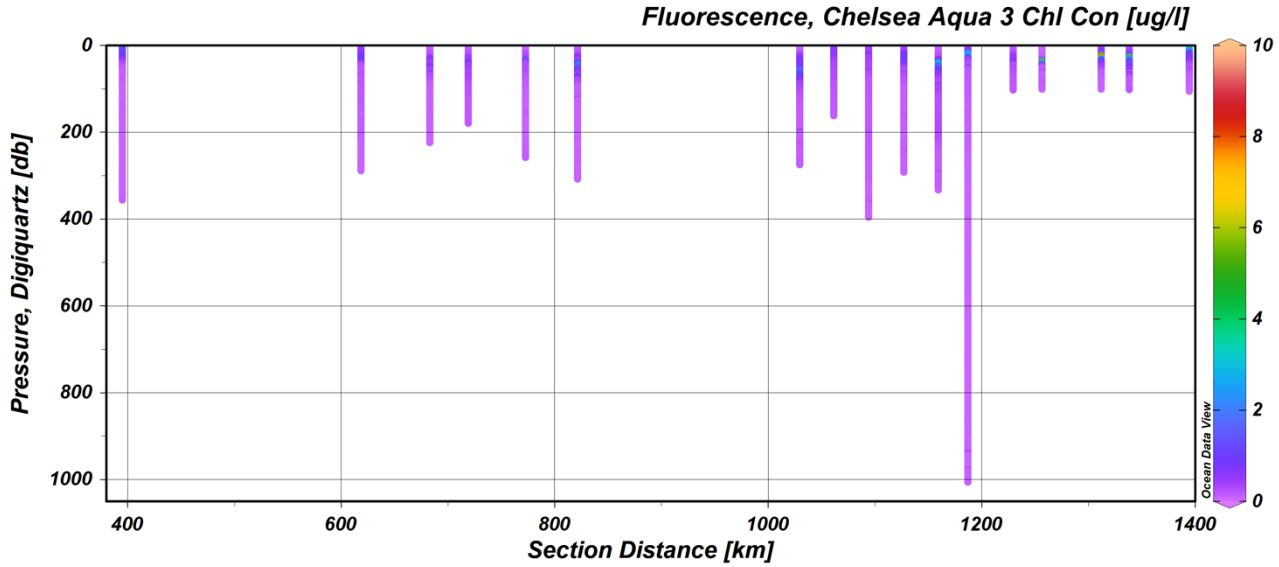
Temperature profiles for JR17007 CTD section



Salinity profiles for JR17007 CTD section

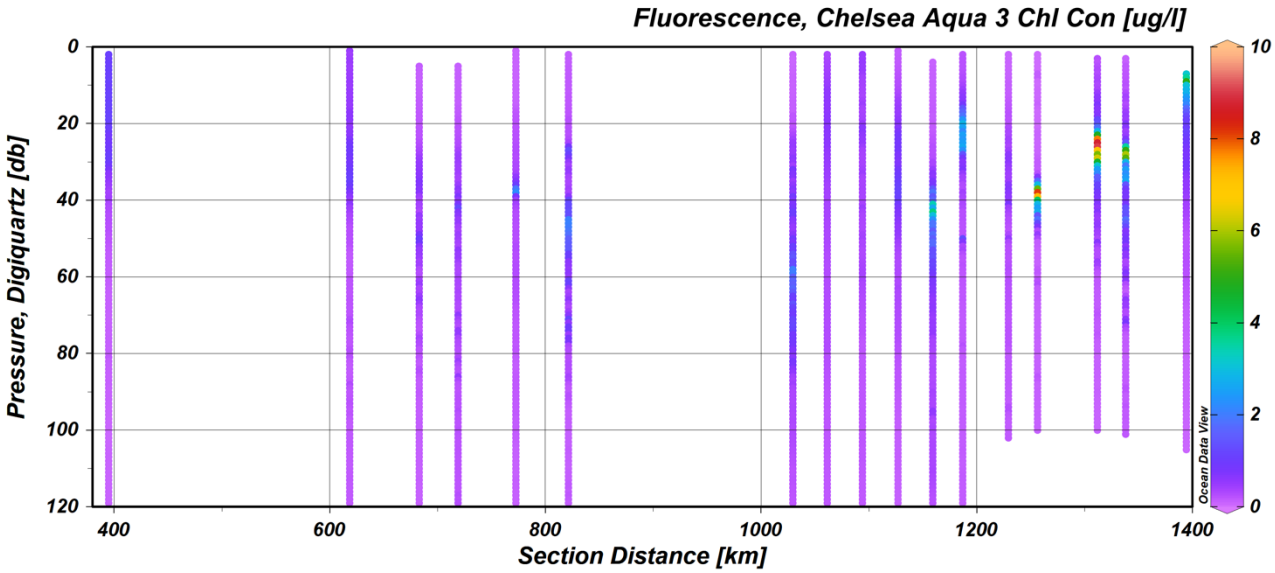


Oxygen concentration profiles for JR17007 CTD section



Fluorescence profiles for JR17007 CTD section

A detailed view of the top 120 m is also included as it allows for easier identification of the chlorophyll maximum at the various CTD stations.



Top 120 m of the Fluorescence profiles for JR17007 CTD section

2.2 Nutrient cycling in sedimentary porewaters and the water column: megacoring and CTD sampling

[1]Sian Henley (University of Edinburgh)
[1] *Author*

Objectives

Nutrient chemical cycling within sediment porewaters and the overlying water column is central to the objectives of Module 3 of the ChAOS project and will provide a key dataset for interpretation of biological and chemical data collected across the project and CAO program. Cruise JR17007 is the second of three summer cruises occurring over three years of the ChAOS project. Measurements of inorganic macronutrient concentrations and isotopic signatures will inform our understanding of the processes by which nutrients are recycled in sedimentary systems, their fluxes across the sediment-water interface, and their role in benthic-pelagic coupling.

Water column sample collection: CTD

Water samples were collected during CTD casts at 13 stations during the cruise (see event log for details). Full details on CTD procedures are included in the AME section of this report. Samples were taken from 20 L niskin bottles mounted on the ship's CTD rosette for a suite of biological, chemical and physical measurements, as summarised in Table 1:

Measurements	**Scientist(s) responsible**
Concentration and isotopic composition of methane (CH4)	Caroline Jacques, Université libre de Bruxelles
Inorganic macronutrient (nitrate, nitrite, phosphate, silicate, ammonium) concentrations	Sian Henley, University of Edinburgh
Stable nitrogen and oxygen isotope ($\delta^{15}N_{NO3}$ and $\delta^{18}O_{NO3}$) composition of nitrate	Sian Henley, University of Edinburgh
Silicon isotope composition of silicic acid	Stephanie Bates, University of Bristol
Barium concentration and isotopic signatures	Stephanie Bates, University of Bristol and Allyson Tessin, University of Leeds
Dissolved organic carbon concentration	Mark Stevenson, Newcastle University
Radiocarbon signature of dissolved inorganic carbon (DIC)	Mark Stevenson, Newcastle University (for Robert Hilton, Durham University)
Primary production and bacterial production	Patrick Downes, Plymouth Marine Laboratory
Concentration of methane*** and nitrous oxide	Patrick Downes, Plymouth Marine Laboratory (for Andy Rees, Plymouth Marine Laboratory)
Particulate organic matter (POM)	Louisa Norman, University of Liverpool [Collaboration with ARISE project]
Oxygen isotope composition of seawater	Stephanie Bates, University of Bristol
Bottom water samples taken for incubation experiments	Saskia Rühl and Liz Talbot, Plymouth Marine Laboratory

For calibration of CTD sensors:	
Dissolved oxygen concentration	Stephanie Bates, University of Bristol
Chlorophyll concentration	Sian Henley, University of Edinburgh
Salinity	Stephanie Bates, University of Bristol

Table 1. ****Effort was made to minimise the overlap between this additional sampling and the work carried out by collaborators from ULB. Where there is overlap, the relevant groups have agreed to collaborate in any resulting publications.*

Sampling order was according to sampling requirements for each parameter with samples for dissolved oxygen, methane and nitrous oxide concentrations taken first to minimise exchange with atmosphere. This was followed by samples for nutrient concentrations, nitrate and silicic acid isotopes, barium, dissolved organic carbon, radiocarbon of DIC, and then chlorophyll, POM and primary and bacterial production. Sampling was completed with samples for oxygen isotopes of seawater and salinity. Bottom water samples for incubation experiments were taken from dedicated bottles.

Nutrient concentration and nitrate isotope samples

Samples for nutrient analysis were prefiltered directly from the niskin bottle using clean nylon mesh of pore size 200 µm to exclude zooplankton. Samples for nitrate isotope analysis were filtered within four hours of collection using sterile acrodisc supor 0.2 µm pore size filters with a membrane prefilter and acid-clean plastic syringes. All sample storage bottles were acid-clean HDPE. Nitrate isotope samples were snap-frozen at -80 °C for ~12 hours and stored at -20 °C for transport to the home laboratory. Inorganic nutrient samples were taken over the full water column depth at stations B3, B13, B14, B15, B16, B17, Z, E, B, R, A and X-south, and nitrate isotope samples were taken between the seafloor and the core of the overlying water mass. Seawater samples collected for inorganic nutrient analysis for the CAO integration dataset are detailed in Table 2.

Chlorophyll samples were taken from the chlorophyll maximum of each CTD cast to calibrate the fluorometer on the CTD package. Samples were collected in duplicate on precombusted (450 °C for 4 hours) GF/F filters of nominal pore size 0.7 µm. Samples were frozen at -20 °C for subsequent analysis at the Scottish Association for Marine Science (SAMS) as part of the NERC CAO program integration work.

Table 2. Seawater nutrient samples taken for the CAO integration dataset.

Station	Event	CTD	Latitude	Longitude	Date	Niskin	Depth
B3	001	001	72.6333	19.2518	11/7/18	4	357
						5	347
						6	245
						7	140
						8	75
						10	54
						12	41
						14	23
						17	17
						19	8
						23	4
B13	041	002	74.5001	30.0003	14/7/18	4	350
						5	340

						6	280
						7	180
						8	75
						10	54
						12	41
						14	22
						17	16
						19	8
						21	3
B15	077	003	78.2517	30.0002	16/7/18	4	303
						5	299
						6	270
						7	190
						9	140
						10	100
						11	70
						12	51
						13	45
						15	39
						17	21
						19	15
						22	8
						23	2
B17	110	004	81.2816	29.3269	18/7/18	4	328
						5	318
						7	170
						9	110
						10	70
						12	53
						14	40
						17	30
						18	21
						20	11
						22	3.5
Z	156	005	83.0462	27.6543	19/7/18	1	993
						3	830
						5	580
						7	350
						9	150
						11	70
						13	50
						15	35
						17	20
						19	10
						21	2.5
A	158	007	81.5264	29.4644	20/7/18	2	100

						3	52
						6	25
						12	10
						20	2.5
R	159	008	81.8	27.7927	21/7/18	2	100
						4	50
						6	28
						10	15
						12	10
						14	1
B	160	009	82.0445	27.275	21/7/18	2	99
						4	50
						8	38
						12	25
						16	10
						20	0.3
E	161	010	82.5439	27.1718	21/7/18	2	100
						4	51
						6	38
						8	25
						10	10
						12	3
B16	165	014	80.1167	30.0683	22/7/18	4	272
						5	262
						7	170
						9	105
						10	60
						13	48
						15	36
						18	14
						21	0.7
B14	218	017	76.5	30.5003	25/7/18	4	285
						6	275
						7	175
						9	110
						10	80
						12	42
						13	34
						17	17
						21	2
Xsouth	253	018	77.0333	29.3335	26/7/18	4	220
						5	210
						7	175
						8	100
						10	70
						14	50

						16	35
						19	19
						21	9
						24	3

Sediment porewater sample collection: megacoring

Porewater samples were taken from sediment cores collected using the NMF megacorer using rhizone syringe filters over the upper 30 cm of sediment (see megacore section for full details). Porewater samples from three separate cores from each megacore deployment were combined, homogenised and split for analysis of various parameters, with splits for nitrate isotope analysis being snap frozen at -80 °C and stored at -20 °C in the same way as water column samples. Samples for nutrient analysis were stored in the fridge and analysed at room temperature within 24 hours of collection.

Sample analysis: nutrient concentrations

Samples were analysed onboard for the concentration of nitrate+nitrite, nitrite, phosphate, silicate and ammonium using a Lachat Quikchem 8500 flow injection analyser standardised using international certified reference materials for nutrients in seawater (KANSO Limited, Japan, batch CD). Nutrient analysis was conducted on samples from the water column, sediment porewaters and incubation experiments for bioturbation (University of Southampton) and resuspension (Plymouth Marine Laboratory). Water column and incubation samples were analysed against standard solutions made up in a low-nutrient seawater (OSIL batch 26) standard matrix. Porewater samples for analysis of nitrate+nitrite, phosphate, silicate and ammonium were diluted in a 2:6 ratio of sample to milli-Q water (18.2 MΩ) – a 4x dilution, and analysed against standard solutions made up in a matrix of 2 parts low-nutrient seawater to 6 parts milli-Q water to match the analyte matrix. Porewater samples for nitrite analysis were undiluted and analysed against standard solutions made up in low-nutrient seawater. Megacore interface waters were analysed undiluted for nitrate+nitrite, nitrite, phosphate, silicate and ammonium.

Sample analysis: stable isotope composition of nitrate

Nitrate isotope samples will be analysed at the University of Edinburgh using the denitrifier method and gas chromatography isotope ratio mass spectrometry (Henley et al., 2018; Sigman et al., 2001; Casciotti et al., 2002).

Recommendations

The use of mercuric chloride as a fixative should always be carried out in one of the ship's exhausting fume hoods, which are located in the main laboratory and prep laboratory, not around the CTD rosette.

If possible, the galley vent into the CTD bottle annex should be closed or inactivated when water samples are being taken for analysis of dissolved gases. Whilst it is not expected that this would have caused contamination problems with the work carried out during this cruise, other types of gas sampling could be compromised by the galley fumes.

2.3 Dissolved oxygen titrations

[1]Stephanie Bates (University of Bristol)
[1] *Author*, *Data set PI*

Samples for dissolved oxygen analysis (measured using the Winkler method) were collected from the majority of CTD casts to calibrate the CTD oxygen sensor. Samples were not taken at stations within the sea ice due to time limitations nor at physics-only CTD casts where no water samples were taken. In each case water samples were taken in triplicate from three depths: at the oxygen maximum, the oxygen minimum and the mid-point between those in terms of oxygen concentration.

Water samples were collected into volume-calibrated 110 ml glass bottles using techniques to exclude bubbles (bubbles removed from tubing before sampling, tubing put to base of bottle to float bubbles out when filling, water flow used to remove any bubbles seen within the bottle during filling and water flow removed slowly when finished sampling). Each bottle was rinsed three times with the seawater before filling and was over-filled for 30 seconds, both as an extra bottle rinse and to bring the bottle down to temperature, which was found to significantly improve reproducibility. Immediately after water filling, water temperatures were taken using a temperature probe. 1 ml each of the Winkler reagents A and B (manganese chloride tetrahydrate and sodium iodide-sodium hydroxide mixture) were then added via pipette, placing the end of the pipette tip just below the water surface whilst dispensing. Samples were then stoppered, mixed by inverting a few times and stored at room temperature.

Dissolved oxygen concentrations were measured onboard using a Metrohm Titrino 848 automatic titrator with a double-wire platinum electrode. A magnetic stir bar and 1 ml of sulphuric acid were first added to each sample. Samples were then pre-mixed on a separate stirring plate to dissolve all the precipitate before analysis. Titrations were then carried out using a potassium thiosulphate titrant and sample titre volumes recorded. The burette, electrode and magnetic stir bar were rinsed with Milli-Q water between each sample to avoid cross-contamination.

Titrations were standardised against SAMS in-house potassium iodate standard with molarity of 0.00310174 M. Standardisations were carried out near the beginning and end of the cruise. Each time the standard titre was measured several times until stable within 0.005 and the average of these values taken as the standard titre volume to use in calculations. The blank was also measured during the cruise by taking the difference between standard titre measurement (which contains all reagents in addition to the potassium iodate standard) and a standard-only titre. Again, measurements were taken until stable within 0.005 and the average of these taken as the blank.

Dissolved oxygen concentrations measured onboard.

Station	Event	CTD	Niskin	Depth (m)	O_2 (µmol/l)	Average	SD	RSD (%)
B3	001	001	6	245	302.248	296.524	8.166	2.8
			6	245	287.173			
			6	245	300.150			
			8	75	299.636	306.250	10.82	3.5
			8	75	300.378			
			8	75	318.736			
			12	41	392.093	392.093	N/A	N/A
			12	41	No EP *			
			12	41	No EP *			
B13	041	002	4	350	317.910	318.439	0.619	0.2
			4	350	319.120			
			4	350	318.288			
			7	180	303.563	294.993	15.263	5.2
			7	180	304.044			
			7	180	277.371			
			17	16	322.676	322.350	0.573	0.2
			17	16	322.686			
			17	16	321.688			
B15	077	003	6	270	314.756	314.195	0.495	0.2
			6	270	313.817			
			6	270	314.013			
			11	70	336.835	336.161	0.584	0.2
			11	70	335.813			
			11	70	335.835			
			21	8	365.234	365.457	0.319	0.1
			21	8	365.315			
			21	8	365.823			
B17	110	004	5	318	326.904	326.044	1.313	0.4
			5	318	324.533			
			5	318	326.695			
			7	170	333.974	333.364	0.729	0.2
			7	170	333.561			
			7	170	332.556			
			20	11	365.646	365.329	0.407	0.1
			20	11	364.870			
			20	11	365.471			
B16	165	014	5	262	329.147	329.250	0.147	0.0
			5	262	329.418			
			5	262	329.186			
			7	170	327.556	326.099	1.324	0.4

			7	170	324.969			
			7	170	325.772			
			13	48	374.162	374.756	0.53	0.1
			13	48	374.923			
			13	48	375.182			
B14	218	017	5	275	316.319	315.479	0.745	0.2
			5	275	314.900			
			5	275	315.218			
			10	80	312.575	311.828	0.763	0.2
			10	80	311.860			
			10	80	311.050			
			13	34	343.060	343.639	0.716	0.2
			13	34	343.418			
			13	34	344.439			
X South	253	018	5	210	312.341	311.329	0.994	0.3
			5	210	311.290			
			5	210	310.355			
			7	175	320.347	320.025	0.566	0.2
			7	175	319.372			
			7	175	320.357			
			21	9	336.050	336.464	0.428	0.1
			21	9	336.437			
			21	9	336.905			

* No endpoint was reached during the titration. Possible problem with electrode or insufficient mixing. Problem did not recur throughout the remainder of the cruise.

Blank and standardisation data for dissolved oxygen titrations.

Standard titre (ml) for CTD 001 to 014	**Standard titre (ml) for CTD 017 to 018**	**Blank titre (ml) for the cruise**
0.9295	0.9260	0.0015
0.9295	0.9255	0.0035
0.9295	0.9240	0.0015
	0.9270	
Average:		
0.9295	0.9256	0.002

2.4 Oxygen isotope ratios

[1] Stephanie Bates, [2] Kate Hendry (University of Bristol)
[1] *Author*, [2] *Data set PI*

Oxygen isotope ratio ($\delta^{18}O$) water samples were collected from whichever water depths necessary to characterise all water masses present at the sampling site, with 10% of the samples duplicated. Water samples were also collected from melted sea ice to determine the oxygen isotope composition of this end-member. Samples were collected in 30 ml wide-neck HDPE bottles, which were rinsed three times before filling. The water samples were then stored at room temperature.

Oxygen isotope ratios will be analysed by the NERC Isotope Geosciences Laboratory (NIGL) using a VG SIRA isotope ratio mass spectrometer with Isoprep-18 system.

List of all oxygen isotope ratio ($\delta^{18}O$) samples collected.

Station	Event type	Event	CTD	Niskin	Depth (m)
B3	CTD	001	001	5A	347
B3	CTD	001	001	5B	347
B3	CTD	001	001	7	140
B3	CTD	001	001	12	41
B3	CTD	001	001	14	23
B3	CTD	001	001	23	4
B13	CTD	041	002	5A	340
B13	CTD	041	002	5B	340
B13	CTD	041	002	7	180
B13	CTD	041	002	8	75
B13	CTD	041	002	12	41
B13	CTD	041	002	14	22
B13	CTD	041	002	19	8
B15	CTD	077	003	4A	303
B15	CTD	077	003	4B	303
B15	CTD	077	003	5	299
B15	CTD	077	003	6	270
B15	CTD	077	003	7	190
B15	CTD	077	003	9	140
B15	CTD	077	003	10	100
B15	CTD	077	003	11	70
B15	CTD	077	003	13	45
B15	CTD	077	003	17	21
B15	CTD	077	003	22	8
B15	CTD	077	003	23	2
B17	CTD	110	004	4A	328
B17	CTD	110	004	4B	328
B17	CTD	110	004	5	318
B17	CTD	110	004	7	170

B17	CTD	110	004	9	110
B17	CTD	110	004	10	70
B17	CTD	110	004	12	53
B17	CTD	110	004	14	40
B17	CTD	110	004	17	30
B17	CTD	110	004	18	21
B17	CTD	110	004	20	11
B17	CTD	110	004	22	3.5
Ice Station Test	CTD	157	006	3A	42
Ice Station Test	CTD	157	006	3B	42
Ice Station Test	CTD	157	006	5	32
Ice Station Test	CTD	157	006	7	26
Ice Station Test	CTD	157	006	9	17
Ice Station Test	CTD	157	006	11	13
Ice Station Test	CTD	157	006	13	6
Ice Station Test	CTD	157	006	15	2
Ice Station A	CTD	158	007	2A	100
Ice Station A	CTD	158	007	2B	100
Ice Station A	CTD	158	007	3	52
Ice Station A	CTD	158	007	6	25
Ice Station A	CTD	158	007	12	10
Ice Station A	CTD	158	007	20	2.5
Ice Station A	Sea ice	158-ICE	N/A	N/A	N/A
Ice Station A	Sea ice	158-ICE	N/A	N/A	N/A
Ice Station R	CTD	159	008	6	28
Ice Station R	CTD	159	008	12	10
Ice Station R	CTD	159	008	14	1
Ice Station R	Sea ice	159-ICE	N/A	N/A	N/A
Ice Station B	CTD	160	009	2	99
Ice Station B	CTD	160	009	8	38
Ice Station B	CTD	160	009	20	0.3
Ice Station B	Sea ice	160-ICE	N/A	N/A	N/A
Ice Station E	CTD	161	010	2	100
Ice Station E	CTD	161	010	8	25
Ice Station E	CTD	161	010	12	3

B16	CTD	165	014	5	262
B16	CTD	165	014	7	170
B16	CTD	165	014	15	36
B16	CTD	165	014	18	14
B16	CTD	165	014	21	0.7
B14	CTD	218	017	5A	275
B14	CTD	218	017	5B	275
B14	CTD	218	017	7	175
B14	CTD	218	017	10	80
B14	CTD	218	017	13	34
B14	CTD	218	017	17	17
B14	CTD	218	017	21	2
X South	CTD	253	018	5	210
X South	CTD	253	018	8	100
X South	CTD	253	018	11	62
X South	CTD	253	018	14	50
X South	CTD	253	018	16	35
X South	CTD	253	018	19	19
X South	CTD	253	018	21	21
X South	CTD	253	018	24	24

‘A’ and ‘B’ samples are duplicates from the same Niskin bottle.

2.5 Silicon isotope ratios

[1] Stephanie Bates, [2] Kate Hendry (University of Bristol)
[1] *Author*, [2] *Data set PI*

Silicon isotope ratio ($\delta^{30}Si$) water samples were collected from the full range of water depths sampled at each site. Samples were initially collected in acid-clean 1 litre Nalgene PP bottles (which were rinsed three times before filling) then stored under refrigeration (4 °C) until they were filtered, which was within 12 hours of collection. Filtration was via 32 mm diameter Pall Acrodisc syringe filters with 0.2 µm Supor membrane and 0.8 µm prefilter. Acid-clean 50 ml BD Plastipak syringes were rinsed 3 times and filters rinsed with 40 ml of seawater before use. Filters were not used for more than one sample to avoid cross-contamination. Seawater was filtered directly into acid-clean 500 ml narrow-mouth LDPE bottles, which were rinsed three times with filtered seawater before filling. Samples were stored under refrigeration (4 °C). Acid-cleaning of 1 litre bottles and syringes between stations consisted of: tap-water rinsing three times; soaking in 10 % reagent-grade hydrochloric acid; then rinsing with Milli-Q water three times.

Silicon isotope ratios will be measured via multicollector inductively coupled plasma mass spectrometry (MC-ICP-MS) using a Thermo Fisher Neptune mass spectrometer at the School of Earth Sciences, University of Bristol.

List of all CTD silicon isotope ratio ($\delta^{30}Si$) samples collected.

Station	Event	CTD	Niskin	Depth (m)
B3	001	001	4	357
B3	001	001	5	347
B3	001	001	6	245
B3	001	001	7	140
B3	001	001	8	75
B3	001	001	10	54
B3	001	001	12	41
B3	001	001	14	23
B3	001	001	17	17
B3	001	001	19	8
B3	001	001	23	4
B13	041	002	4	350
B13	041	002	5	340
B13	041	002	6	280
B13	041	002	7A *	180
B13	041	002	7B *	180
B13	041	002	8	75
B13	041	002	10	54
B13	041	002	12	41
B13	041	002	14	22
B13	041	002	17	16
B13	041	002	19	8
B13	041	002	21	3
B15	077	003	4	303
B15	077	003	5	299

B15	077	003	6	270
B15	077	003	7	190
B15	077	003	9	140
B15	077	003	10	100
B15	077	003	11	70
B15	077	003	13	45
B15	077	003	17	21
B15	077	003	22	8
B15	077	003	23	2
B17	110	004	4	328
B17	110	004	5	318
B17	110	004	7	170
B17	110	004	9	110
B17	110	004	10	70
B17	110	004	12	53
B17	110	004	14	40
B17	110	004	17	30
B17	110	004	18	21
B17	110	004	20	11
B17	110	004	22	3.5
B16	165	014	4	272
B16	165	014	5	262
B16	165	014	7	170
B16	165	014	9	105
B16	165	014	10	60
B16	165	014	13	48
B16	165	014	15	36
B16	165	014	18	14
B16	165	014	21	0.7
B14	218	017	4	285
B14	218	017	6	275
B14	218	017	7	175
B14	218	017	9	110
B14	218	017	10	80
B14	218	017	12	42
B14	218	017	13	34
B14	218	017	17	17
B14	218	017	21	2
X South	253	018	4	220
X South	253	018	5	210
X South	253	018	7	175
X South	253	018	8	100
X South	253	018	10	70
X South	253	018	14	50

X South	253	018	16	35
X South	253	018	19	19
X South	253	018	21	9
X South	253	018	24	3

* A small amount (approximately 1 – 2 ml) of unfiltered seawater from the same sample was added to an almost full bottle of filtered seawater by mistake (sample 7A). Because the level of contamination was very low the sample was kept, but the remaining available water was filtered into an additional clean bottle to provide an alternative sample of pure filtered water (sample 7B).

2.6 Barium isotope ratios

[1] Stephanie Bates (University of Bristol), [2] Tristan Horner (Woods Hole Oceanographic Institution)
[1] *Author*, [2] *Data set PI*

Barium isotope ratio ($\delta^{138}Ba$) water samples were collected were collected from the full range of water depths sampled at each site, except for later in the cruise, when bottle numbers became more limited – here only bottom water samples were taken to pair with sediment porewater $\delta^{138}Ba$ profiles.

$\delta^{138}Ba$ water samples were collected in the same way as $\delta^{30}Si$ samples, by initially collecting water in a 1 litre transfer bottle and then later filtering into the sample bottle via syringe filter (see the $\delta^{30}Si$ section for details). 20 ml acid-clean sample bottles were used and were rinsed three times with filtered seawater before filling. Samples were acidified on board 10 approximately pH 2 by adding 20 µl of Romil UpA hydrochloric acid to each 20 ml sample.

The samples will be analysed at Woods Hole Oceanographic Institution using a Thermo Fisher Neptune MC-ICP-MS (multicollector inductively coupled plasma mass spectrometer).

List of all CTD and sea ice barium isotope ratio ($\delta^{138}Ba$) samples collected.

Station	Event type	Event	CTD	Niskin	Depth (m)
B3	CTD	001	001	4	357
B3	CTD	001	001	5	347
B3	CTD	001	001	6	245
B3	CTD	001	001	7	140
B3	CTD	001	001	8	75
B3	CTD	001	001	10	54
B3	CTD	001	001	12	41
B3	CTD	001	001	14	23
B3	CTD	001	001	17	17
B3	CTD	001	001	19	8
B3	CTD	001	001	23	4
B13	CTD	041	002	4	350
B13	CTD	041	002	5	340
B13	CTD	041	002	6	280
B13	CTD	041	002	7	180
B13	CTD	041	002	8	75
B13	CTD	041	002	10	54
B13	CTD	041	002	12	41
B13	CTD	041	002	14	22
B13	CTD	041	002	17	16
B13	CTD	041	002	19	8
B13	CTD	041	002	21	3
B15	CTD	077	003	4	303
B15	CTD	077	003	5	299
B15	CTD	077	003	6	270
B15	CTD	077	003	7	190

B15	CTD	077	003	9	140
B15	CTD	077	003	10	100
B15	CTD	077	003	11	70
B15	CTD	077	003	13	45
B15	CTD	077	003	17	21
B15	CTD	077	003	22	8
B15	CTD	077	003	23	2
B17	CTD	110	004	4	328
B17	CTD	110	004	5	318
B17	CTD	110	004	7	170
B17	CTD	110	004	9	110
B17	CTD	110	004	10	70
B17	CTD	110	004	12	53
B17	CTD	110	004	14	40
B17	CTD	110	004	17	30
B17	CTD	110	004	18	21
B17	CTD	110	004	20	11
B17	CTD	110	004	22	3.5
Ice Station Test	CTD	157	006	3	42
Ice Station Test	CTD	157	006	5	32
Ice Station Test	CTD	157	006	7	26
Ice Station Test	CTD	157	006	9	17
Ice Station Test	CTD	157	006	11	13
Ice Station Test	CTD	157	006	13	6
Ice Station Test	CTD	157	006	15	2
Ice Station A	CTD	158	007	2	100
Ice Station A	CTD	158	007	3	52
Ice Station A	CTD	158	007	6	25
Ice Station A	CTD	158	007	12	10
Ice Station A	CTD	158	007	20	2.5
Ice Station A	Sea ice	158-ICE	N/A	N/A	N/A
Ice Station R	CTD	159	008	2	100
Ice Station R	CTD	159	008	4	50
Ice Station R	CTD	159	008	6	28
Ice Station R	CTD	159	008	10	15
Ice Station R	CTD	159	008	12	10
Ice Station R	CTD	159	008	14	1
Ice Station R	Sea ice	159-ICE	N/A	N/A	N/A

Ice Station B	CTD	160	009	2	99
Ice Station B	CTD	160	009	4	50
Ice Station B	CTD	160	009	8	38
Ice Station B	CTD	160	009	12	25
Ice Station B	CTD	160	009	16	10
Ice Station B	CTD	160	009	20	0.3
Ice Station B	Sea ice	160-ICE	N/A	N/A	N/A
Ice Station E	CTD	161	010	2	100
Ice Station E	CTD	161	010	4	51
Ice Station E	CTD	161	010	6	38
Ice Station E	CTD	161	010	8	25
Ice Station E	CTD	161	010	10	10
Ice Station E	CTD	161	010	12	3
B16	CTD	165	014	4	272
B14	CTD	218	017	4	285
X South	CTD	253	018	4	220

2.7 Salinity

Stephanie Bates (University of Bristol)

During CTD sampling, 29 salinity water samples were collected for calibrating the CTD conductivity sensor. 46 underway samples were also collected approximately every 6 hours during 11/07/2018 to 29/07/2018 (from the beginning to the end of sampling), except for when the ship was in sea ice where the underway system is switched off. Samples were collected in OSIL 200 ml glass salinity bottles with compatible OSIL caps and inserts. The bottles were rinsed three times before filling to the shoulder of the bottle and bottle caps and inserts were also rinsed. After capping, the samples were stored in the salinometer laboratory inside OSIL salinity bottle storage crates to allow them to equilibrate to room temperature before measurement.

Samples were analysed on board using a Guildine Autosal 8400B salinometer and standardised against IAPSO Standard Seawater.

List of all CTD salinity samples collected.

Station	Event	CTD	Niskin	Depth (m)
B3	001	001	5	347
B3	001	001	12	41
B3	001	001	18	16.7
B13	041	002	7	180
B13	041	002	9	75
B13	041	002	19	8
B15	077	003	5	299
B15	077	003	9	140
B15	077	003	22	8
B17	110	004	8	170
B17	110	004	11	70
B17	110	004	21	11
Ice Station A	158	007	1	100
Ice Station A	158	007	5	34
Ice Station A	158	007	15	8
Ice Station B	160	009	2	99
Ice Station B	160	009	8	38
Ice Station B	160	009	20	0.3
Ice Station E	161	010	2	100
Ice Station E	161	010	8	25
Ice Station E	161	010	12	3
B16	165	014	5	262

B16	165	014	9	105
B16	165	014	23	0.7
B14	218	017	7	175
B14	218	017	21	2
X South	253	018	5	210
X South	253	018	8	100
X South	253	018	21	9

2.8 CTD Radiocarbon

[1,2]Mark Stevenson (Newcastle), [1]Sian Henley (Edinburgh) and [2]Bob Hilton (Durham)
[1]Author, [2]Dataset PI

The CTD was sampled at selected surface and bottom depths for radiocarbon (^{14}C) on DIC (dissolved inorganic carbon) to assess the age and estimate the residence time of the seawater inorganic carbon source. In the context of the ChAOS project these ^{14}C ages will be compared with dates on sedimentary TOC to provide reference to diagenesis processes which may vary between stations and by depth through the sediment.

Methods

For 6 samples 100 ml of water was pipetted directly (using 60 ml syringes) from the CTD Niskin (type GPWP) bottle to avoid contact with the atmosphere, through Millipore 0.22 µm 47 mm PES filters and tygon tubing directly into foil bags (capacity 1 L). For the additional 4 samples the same filters were used to filter 100 ml of seawater but storage was in 250 ml Nalgene bottles (previously acid washed in HCL and rinsed 3 times in MilliQ water). Filter papers were replaced between samples using stainless steel forceps and the unit was rinsed with ~60 ml of the respective seawater. All water samples were frozen after filtering at −20 °C. Samples from Ice Station A (E158) and B14 (E218) re-used filter papers, from previous analyses after a rinse through with at least 60 ml of MilliQ water.

Analysis

CO_2 from the samples will be used for graphitization using the Fe/Zn reduction method at the NERC RF facility in East Kilbride and ^{14}C will be analysed by AMS at the SUERC Laboratory. Additional analysis of $\delta^{13}C$ will be made to help characterise the source of the seawater DIC using a dual-inlet stable isotope mass spectrometer.

Sample list

Station	Event	Type of sample	Storage type	Time	Date	Lat	Long
B03	E1	Surface 4 m	Nalgene bottle	03:23:00	11/07/2018	72.63331	19.25181
B03	E1	Depth 357 m	Nalgene bottle	03:23:00	11/07/2018	72.63331	19.25181
B13	E41	Surface 3 m	Foil bag	07:52:00	14/07/2018	74.50007	30.00027
B13	E41	Depth 350 m	Foil bag	07:52:00	14/07/2018	74.50007	30.00027
B15	E77	Surface – 2 m	Foil bag	11:37:00	16/07/2018	78.25166	29.99992
B17	E110	Surface – 3.5 m	Foil bag	06:50:00	18/07/2018	81.28161	29.32690
B17	E110	Depth – 328 m	Foil bag	06:50:00	18/07/2018	81.28161	29.32690
Ice Station A	E158	Ice melt	Nalgene bottle	22:31:00	20/07/2018	83.04621	27.65430
B16	E165	Surface – 0.7 m	Foil bag	07:57:00	22/07/2018	80.40784	29.89152
B14	E218	Surface – 2 m	Nalgene bottle	02:04:00	25/07/2018	76.50002	30.50026

2.9 Particulate organic matter, δ13C-DIC, and nifH gene sampling

Louisa Norman (University of Liverpool), Claire Mahaffey (University of Liverpool) and Robyn Tuerena (University of Edinburgh)

Background and objectives.

Particulate organic matter and $\delta 13^C$-DIC

Samples were taken for analysis of the concentration and isotopic composition of particulate organic matter (POM) and $\delta 13^C$-DIC at six CTD stations, five of which had been occupied during cruise JR16006. One of the objectives of the ARISE project, which is also part of the NERC CAO programme, is to produce a pan-Arctic isoscape which represents the water masses present (i.e. Atlantic and Arctic waters) and their end members. The measurements taken during this cruise, JR17007, will enhance those from JR16006 and provide a more detailed dataset.

nifH gene

Nitrogen fixation is the biological fixation of dinitrogen gas. Until recently, nitrogen fixation was thought to be confined to warm subtropical ocean gyres. However, nitrogen fixation has now been detected in shallow coastal regions, upwelling regions and most surprisingly, the Arctic Ocean (Blais et al 2012, Diez et al 2012, Fernandez-Mendez et al 2016, Sipler et al 2017, Fong et al 2018, Harding et al 2018,). In the Chukchi and Beaufort Seas, rates of nitrogen fixation are comparable to those found in the low latitude subtropical ocean and the detection of the nifH gene provides further evidence for the presence of active marine nitrogen fixers that are typically found in the lower latitude warm water ocean (Sipler et al 2017, Harding et al 2018). There have been very few studies on nitrogen fixation in the Arctic, particularly around the Barents Sea. Thus, we took the opportunity to collect samples for quantification and identification for the gene that encodes for nitrogen fixation, nitrogenase, or nifH.

Sampling and methods.

Sampling for POM and δ13C-DIC occurred at stations B3, B13, B14, B15, B16, B17 and station Z. Samples were collected from the surface only (between 1 and 3.5 m). All other POM samples were collected from the underway system (see later). The reason for using the CTD for these locations was to allow for a corresponding δ13C-DIC sample to be taken which could not be done using the underway system.

Particulate organic matter

Samples for the analysis of δ15N and δ13C of POM were taken from the CTD rosette at the surface depths only. Samples were collected directly from the Niskin bottles in acid-clean 10 L carboys pre-rinsed with seawater from the underway system. After collection, the samples were placed in the dark and taken to the laboratory for filtering. The seawater was filtered under low vacuum through a 25 mm GF/F filter until a good colour was evident at which point the filtration was stopped and the volume of water filtered recorded. The filters were placed in petri dishes lined with combusted foil and stored at -80°C freezer. Samples will be analysed at the University of Liverpool.

δ13C-DIC

δ13C-DIC samples were taken to correspond with the POM samples. Samples were collected directly from the Niskin bottle using acid clean tubing into 30 mL amber soda-lime glass bottles. The bottles were allowed to overflow by two volumes to rinse before filling. After collection the samples were placed in a fume hood where 100 µL of seawater was removed to provide headspace. The samples were preserved with 50 µL of 5 % $HgCl_2$ and the bottles sealed with screw caps and parafilm. Samples were stored at 4°C and will be stored at a stable temperature prior to analysis at the University of Edinburgh.

nifH gene

nifH gene sampling was conducted primarily from the underway system (section 8?). However, when the ship is in the ice the underway system is turned off to prevent blockages and so the CTD was used for sample collection at three locations north of the ice edge. Samples were collected into an acid-cleaned 10 L carboy and filtered immediately using a Masterflex peristaltic pump. The particles were collected on 0.2 mm Sterivex cartridge filters. To avoid degradation of genetic material filtration time was set at 1 h and the volume of seawater that had passed through the filter was measured after this time. Analysis will be performed using standard molecular techniques.

Data quality notes/problems.

No issues were encountered.

Samples taken

POM and δ13C-DIC - *CTD.*

CTD No.	Event No.	Station	Lat	Lon	Date	Depth
001	001	B3	72.63333	19.25179	11/07/2018	Surface (4 m)
002	041	B13	74.50002	30.0003	14/07/2018	Surface (3 m)
003	077	B15	78.25166	29.99992	16/07/2018	Surface (2 m)
004	110	B17	81.28163	29.32675	18/07/2018	Surface (3.5 m)
005	156	Z	81.52603	29.46549	19/07/2018	Surface (2.5 m)
014	165	B16	80.1167	30.06826	22/07/2018	Surface (0.7 m)
017	218	B14	76.50003	30.50024	25/07/2018	Surface (2 m)

nifH gene – CTD

CTD No.	Event No.	Station	Lat	Lon	Date	Depth
007	158	A	83.04647	27.65231	20/07/2018	Surface (2.5 m)*
009	160	R	82.54386	27.1717	21/07/2018	Surface (0.3 m)*
010	161	B	82.04443	27.2773	21/07/2018	Surface (3 m)*

*N.B. Samples from ice melt were also taken at these locations

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2.10 Megacore: sediment and pore water geochemistry

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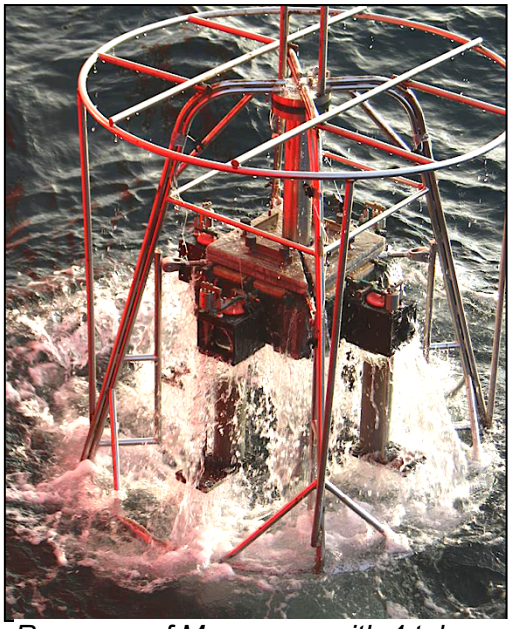
Sampling strategy and procedure

Background and objectives

Samples for sediment and pore water geochemistry were taken to study the amounts and types of organic material at the seafloor of the Barents Sea, the availability of electron acceptors (e.g., nitrate, Fe and Mn oxides, sulphate) for organic matter degradation, the recycling versus burial of nutrients released by organic matter degradation, and the interactions of sediment and pore water geochemistry with biological processes (e.g., bioturbation, microbial community structures).

Sampling strategy/instrument description

Sampling sites for the ChAOS project were collected at benthic stations from the JR16006 cruise in 2017. These sites were initially selected based on available sediment distribution maps of the Barents Sea, with the aim to sample settings with mainly muddy sediment for optimal recovery. In the Barents Sea, muddy sediments are prevalent within the deeper (~300-500 m) troughs carved by ice streams of the Eurasian ice sheet following the Last Glacial Maximum, while the shallower banks are often covered by coarse-grained material due to stronger currents.



Recovery of Megacorer with 4 tubes

Sampling for sediment and pore water geochemistry was conducted with the Megacorer (a multicoring device with up to 12 core tubes) (Fig. 1), which is the most appropriate instrument to sample the top ~30-40 cm of sediment with the overlying bottom water and an intact sediment-water interface (Figs. 2, 3). The Megacorer and accessories (110 mm wide Perspex tubes, rubber bungs, core extruder etc) were provided by National Marine Facilities.

Prior to deployment, the Megacorer was set up with 8 tubes at each station and was deployed at least 3 times at each station, with ~20 m distance between individual deployments to account for spatial variability. The actual number of deployments at each station was dependent on the recovery of intact sediment cores. At each deployment location, 3-4 intact cores were required for pore water sampling and 3-4 intact cores were required for sediment sampling. If less than seven intact cores were not collected at a single deployment, a second deployment was done without moving the ship.



Intact sediment-water interface with benthic fauna in a Megacorer tube.



Sediment-filled tubes after successful Megacorer deployment.

Following deployment, the Megacorer was lowered onto the deck, in some cases preceded by manual closing of the bottom shutters (usually without significant loss of sediment). The recovered tubes were labelled by event number and position within the Megacorer. Individual tubes were removed from the Megacorer by 1-2 ChAOS team members and transferred into a rack to be carried to the wet lab for further processing.

Methods/Processing/Calibrations

Once cores were transferred to the wet lab, bottom water was removed from the core tubes using a plastic tube. The core tubes were then transferred onto a core extruder (on the back deck for inorganic geochemistry, in the wet lab for organic geochemistry), carefully removing the rubber bung to avoid sediment loss. The sediment was manually pushed up on the extruder, and sampling intervals were defined by the core extruder which was cranked at set intervals (one full turn for 0.5 cm). Organic geochemistry samples were taken with stainless steel plates (wearing nitrile gloves to avoid contamination), transferred into aluminium foil wrapped in plastic bags, and stored at -80°C. DNA samples were taken from the same sediment slices as organic geochemistry samples, but using either sterile or ethanol-washed plastic spatulas to transfer the sediment into sterile plastic vials. To avoid contamination the work area was regularly sprayed with ethanol and nitrile gloves were worn. DNA samples were transferred to the -80°C freezer as quickly as possible after sampling (usually 10 minutes in the wet lab at around 10°C). Pigment samples were taken with aluminium plates, wrapped in aluminium foil, stored in plastic bags, and transferred into the -80°C freezer. At stations B14-B17, pH measurements were taken as the organic geochemistry cores were being sliced by placing a pH probe on the sediment surface between slicing. The pH probe was carefully rinsed between samples to avoid cross contamination or addition of KCl to the sediment surface. The pH probe was calibrated using three calibration solution (pH 4, 7 and 10) prior to pH measurements at each station.

Inorganic geochemistry samples for Leeds and plastics samples for PML were taken with Perspex plates, transferred into plastic bags, and stored at -20°C. An anaerobically sampled core was processed from one deployment per station. The core was sliced either on deck or in the CTD annex in an anoxic glove bag that had been purged with N_2 gas. Sediment was transferred into 50 mL centrifuge tubes and parafilmed. Samples were then centrifuged outside the glove bag at 6000 rpm for 20 minutes before being transferred to a second anoxic glove bag within the main lab. Pore waters were then decanted from samples and syringe filtered (22 μm, PES) into vials for ICP analysis (University of Leeds), REEs (GEOMAR, Helmholtz Centre for Ocean Research Kiel), and Re geochemistry (Central Michigan University). When available, one core was also sampled per station for pore water centrifugation. This core was sliced at 1 cm resolution and sediment was transferred to 50 mL centrifuge tubes. After centrifugation, samples were split for onboard nutrient analysis (12 mL), DOC (Newcastle University; 12 mL), and bacterial incubations (PML; remaining volume).



Sectioning of sediment in the wet lab for organic geochemistry samples.



Sediment sectioning on deck for inorganic geochemistry samples.

Sampling resolution for the different sample sets was as follows:
Pore waters – bottom water, 0.5 cm, 1.5 cm, 2.5 cm; 2 cm resolution down to 20.5 cm; 25.5 cm, 30.5 cm.
Pigments: Top 0.5 cm only.
Organic geochemistry and DNA and inorganic geochemistry: 0.5 cm resolution from 0 to 2 cm; 1 cm resolution below 2 cm.

For pore water sampling, pre-drilled cores were transferred into the sinks in the wet lab and fixed with bungee cords. Pore water samples were taken with Rhizone samplers attached to 30 mL plastic syringes with spacers to create a vacuum. At the appropriate depths, the tape was perforated using a pipette tip, and Rhizones were inserted quickly and carefully. If

Rhizones could not be inserted into certain sediment horizons without force (due to the occurrence of rocks), these intervals were not sampled. Syringes were rested onto lab drying racks in the sinks to keep them roughly horizontal. The pore water sampling order was as follows: Bottom water samples were extracted first (~500 mL). While bottom water was being extracted, the Cellotape was perforated at the appropriate depths from the deepest horizon to 4.5 cm depth, Rhizones were inserted, and syringes were attached. Once sufficient bottom water had been sampled, the remaining overlying water was drained by perforating the holes right above the sediment-water interface. Then the holes at 2.5, 1.5 and 0.5 cm depth were opened, and Rhizones were inserted very quickly to avoid the loss of pore water from the very water-rich uppermost sediment horizons. Rhizones were left in the core tubes for up to ~2 hours, depending on the efficiency of pore water extraction (very fast in the top layers, much slower in deeper layers). Pore water volumes ranged from 5 to 50 mL per syringe. Following sampling, pore water samples from the two to three core tubes from each Megacorer deployment were combined into acid-washed and MilliQ-rinsed vials to reach maximum pore water volumes for individual sediment layers. From these combined pore water samples, splits were taken for the following analyses: Nutrient analysis (Henley) – 12 mL; dissolved metal analysis (Faust, März, Tessin) – 3 mL; and cation/anion analysis (Faust, März, Tessin) – 3-4 mL. At one deployment per station, additional samples were taken for isotope analysis as follows: Si isotope analysis (Hendry) – 5 mL; Ba isotope analysis (Tessin, Horner) – 5 mL; N and O isotope analysis of nitrate (Henley) – 20-25 mL (if available). Samples for dissolved metal and Ba isotope analysis were acidified with 20 µL of ultrapure concentrated HCl and stored at 4°C. Samples for nutrient analysis were stored untreated for 1 day (3 days in one case) at 4°C prior to shipboard analysis (silicate, phosphate, nitrite, nitrate+nitrite, ammonium). Samples for cation analysis were acidified with HCl and stored together with untreated samples for anion analysis at 4°C. Samples for nitrate isotope analysis were flash-frozen untreated at -80°C, then transferred to -20°C for storage within ~ 24 hours. Equivalent splits were also taken from bottom water samples and treated and stored in the same way as for pore waters.



Pore water extraction with Rhizone samplers and 50 mL syringes in the sink of the wet lab.



Pore water samples ready for further analysis.

Data quality notes/ problems

Instrument and material problems: The pre-drilled tubes for pore water sampling had to be modified by members of the ChAOS team onboard, as the holes to insert the Rhizone

samplers into the tubes were too small. The pre-drilled tubes were therefore drilled again using a manual drill with a 3.5 mm steel bit. The pre-drilled tubes from JR16006 also caused problems due to holes drilled on the rings. These holes often leaked or caused issues when the tubes were installed on the Megacorer.

The new core extruders were slightly tight when cores were inserted. This problem was remedied by removing an o-ring on the core extruder.

Data resolution and quality: The pore water sampling strategy was in a few instances compromised by sandy/gravelly layers (up to 5 cm thick) in the core tubes. Rhizones could not be inserted into these horizons, leading to gaps in the pore water sample sets.

Similar to samples collected during JR16006 in 2017, at Station B17, brownish precipitates were noticed in the pore water samples below 4.5 cm depth, most likely due to precipitation of dissolved iron as iron (oxyhydr)oxides. These precipitates could have scavenged phosphate from the pore waters, compromising the data quality. This issue will be checked and resolved following analysis of acidified sample splits for total phosphorus at the University of Leeds.

Due to failed syringes and/or sediment characteristics, the amounts of pore water were not uniform, and in some intervals were not sufficient to provide sufficient volume for all planned analyses. This is particularly the case for pore water splits for nitrite concentration and nitrate isotope analyses. As during the JR16006 cruise in 2017 about two weeks before the end of the cruise all Nutella on the ship was consumed which caused serious Nutella under saturation issues.

Samples collected:

Station	Event	Latitude	Longitude	Water depth (m)
B3	E3	72.63328°N	19.25196°E	364
Tube #	**Samples taken**			
6	Sediment samples (20 cm; n=22) for inorganic geochemistry for C. März (Leeds)			
2, 4, 5, 8	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) Barium isotope samples (~5 mL) for T. Horner (WHOI)			
1	Sediment samples (23 cm; n=25) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-23 cm; n=13) for I.Head/N.Gray (Newcastle).			
3	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			

Station	Event	Latitude	Longitude	Water depth (m)
B3	E4 and E5	72.63348°N	19.25136°E	374
Tube #	**Samples taken**			
E5: 6	Sediment samples (38 cm; n=40) for inorganic geochemistry for C. März (Leeds)			
E4: 2, 6, 8 E5: 8	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) Barium isotope samples (~5 mL) for T. Horner (WHOI)			
E4: 4	Sediment samples (35 cm; n=37) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-35 cm; n=25) for I.Head/N.Gray (Newcastle).			
E5: 4	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			

Station	Event	Latitude	Longitude	Water depth (m)
B3	E6 and E7	72.6332°N	19.25227°E	375
Tube #	**Samples taken**			
E7: 1	Sediment samples (38 cm; n=40) for inorganic geochemistry for C. März (Leeds)			
E6: 1, 3, 4, 7	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) Barium isotope samples (~5 mL) for T. Horner (WHOI)			
E7: 4	Sediment samples (29 cm; n=31) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-31 cm; n=21) for I.Head/N.Gray (Newcastle).			
E6: 5	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			

Station	Event	Latitude	Longitude	Water depth (m)
B13	E42	74.29999°N	30.00026°E	356
Tube #	**Samples taken**			
6	Sediment samples (33 cm; n=35) for inorganic geochemistry for C. März (Leeds)			
2, 4, 5, 7	Pore water samples (n=15) 6. Nutrient samples (~12 mL)- analyzed shipboard 7. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 8. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 9. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 10. Silica isotope samples (~5 mL) for K. Hendry (Bristol) Barium isotope samples (~5 mL) for T. Horner (WHOI)			
3	Sediment samples (36 cm; n=38) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-38 cm; n=28) for I.Head/N.Gray (Newcastle).			
8	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			

Station	Event	Latitude	Longitude	Water depth (m)
B13	E43	74.30007°N	29.59982°E	357
Tube #	**Samples taken**			
6	Sediment samples (40 cm; n=42) for inorganic geochemistry for C. März (Leeds)			
2, 5, 7	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
4	Sediment samples (39 cm; n=41) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-39 cm; n=29) for I.Head/N.Gray (Newcastle).			
8	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			
10	Centrifuged porewaters for DOC analysis for M. Stevenson (Newcastle) and bacterial incubations for P. Downes (PML)			

Station	Event	Latitude	Longitude	Water depth (m)
B13	E44	74.29994°N	30.00040°E	356
Tube #	**Samples taken**			
7	Sediment samples (34 cm; n=36) for inorganic geochemistry for C. März (Leeds)			
3, 5, 6	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
10	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			
2	Anaerobic sediments and pore waters (n=11) for REEs (E. Hathorne and K. Crocket), ICP-OES (J. Faust), and trace metals (A. Dickson and A. Chappaz).			
4	Sediment samples (31 cm; n=33) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-33 cm; n=23) for I.Head/N.Gray (Newcastle).			

Station	Event	Latitude	Longitude	Water depth (m)
B14	E244	76.49999°N	30.50029°E	299
Tube #	**Samples taken**			
2, 3, 6, 8	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
4	Sediment samples (40 cm; n=42) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-42 cm; n=32) for I.Head/N.Gray (Newcastle).			
7	Sediment samples (44 cm; n=46) for inorganic geochemistry for J. Faust (Leeds)			
5	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			

Station	Event	Latitude	Longitude	Water depth (m)
B14	E245	76.50014°N	30.49954°E	299
Tube #	**Samples taken**			
1, 6, 7, 8	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
3	Sediment samples (34 cm; n=36) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-36 cm; n=26) for I.Head/N.Gray (Newcastle).			
2	Sediment samples (38 cm; n=40) for inorganic geochemistry for J. Faust (Leeds)			
5	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			
4	Anaerobic sediments and pore waters (n=11) for REEs (E. Hathorne and K. Crocket), ICP-OES (J. Faust), and trace metals (A. Dickson and A. Chappaz).			

Station	Event	Latitude	Longitude	Water depth (m)
B14	E246	76.49986°N	30.50064°E	299
Tube #	**Samples taken**			
2, 7, 8	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
3	Sediment samples (37 cm; n=39) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-39 cm; n=29) for I.Head/N.Gray (Newcastle).			
4	Sediment samples (39 cm; n=41) for inorganic geochemistry for J. Faust (Leeds)			
5	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML			

Station	Event	Latitude	Longitude	Water depth (m)
B15	E101	78.15100°N	30.00005°E	314
Tube #	**Samples taken**			
2	Sediment samples (41 cm; n=43) for inorganic geochemistry for C. März (Leeds)			
3, 4, 8	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
5	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			
6	Sediment samples (40 cm; n=42) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-42 cm; n=32) for I.Head/N.Gray (Newcastle).			

Station	Event	Latitude	Longitude	Water depth (m)
B15	E102	78.15104°N	29.59955°E	317
Tube #	**Samples taken**			
7	Sediment samples (40 cm; n=42) for inorganic geochemistry for C. März (Leeds)			
3, 4, 6, 8	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
2	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			
10	Sediment samples (40 cm; n=42) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-42 cm; n=32) for I.Head/N.Gray (Newcastle).			
5	Centrifuged porewaters for DOC analysis for M. Stevenson (Newcastle) and bacterial incubations for P. Downes (PML)			

Station	Event	Latitude	Longitude	Water depth (m)
B15	E103	78.15089°N	30.00032°E	314
Tube #	**Samples taken**			
7	Sediment samples (40 cm; n=42) for inorganic geochemistry for C. März (Leeds)			
3, 5, 8, 10	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
2	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			
6	Sediment samples (37 cm; n=39) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-39 cm; n=29) for I.Head/N.Gray (Newcastle).			
4	Anaerobic sediments and pore waters (n=11) for REEs (E. Hathorne and K. Crocket), ICP-OES (J. Faust), and trace metals (A. Dickson and A. Chappaz).			

Station	Event	Latitude	Longitude	Water depth (m)
B16	E196	80.11678°N	30.06764°E	279
Tube #	**Samples taken**			
2, 4, 5	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
1	Sediment samples (38 cm; n=40) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-40 cm; n=30) for I.Head/N.Gray (Newcastle).			
7	Sediment samples (35 cm; n=37) for inorganic geochemistry for J. Faust (Leeds)			
6	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML			
3	Centrifuged porewaters for DOC analysis for M. Stevenson (Newcastle) and bacterial incubations for P. Downes (PML)			

Station	Event	Latitude	Longitude	Water depth (m)
B16	E197	80.11684°N	30.06767°E	278
Tube #	**Samples taken**			
2, 3, 4, 5	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
6	Sediment samples (34 cm; n=36) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-36 cm; n=26) for I.Head/N.Gray (Newcastle).			
1	Sediment samples (33 cm; n=35) for inorganic geochemistry for J. Faust (Leeds)			
7	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML			

Station	Event	Latitude	Longitude	Water depth (m)
B16	E198	80.11662°N	30.06899°E	278
Tube #	**Samples taken**			
2, 5, 6, 7	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
3	Sediment samples (32 cm; n=34) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-32 cm; n=22) for I.Head/N.Gray (Newcastle).			
4	Sediment samples (35 cm; n=37) for inorganic geochemistry for J. Faust (Leeds)			
8	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML			
1	Anaerobic sediments and pore waters (n=11) for REEs (E. Hathorne and K. Crocket), ICP-OES (J. Faust), and trace metals (A. Dickson and A. Chappaz).			

Station	Event	Latitude	Longitude	Water depth (m)
B17	E141	81.28163°N	29.3272°E	335
Tube #	**Samples taken**			
4, 8, 10	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
3	Sediment samples (41 cm; n=43) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-41 cm; n=31) for I.Head/N.Gray (Newcastle).			
7	Sediment samples (45 cm; n=47) for inorganic geochemistry for J. Faust (Leeds)			
5	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			

Station	Event	Latitude	Longitude	Water depth (m)
B17	E142	81.28175°N	29.32601°E	335
Tube #	**Samples taken**			
2, 4, 6, 7	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
5	Sediment samples (41 cm; n=43) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-43 cm; n=33) for I.Head/N.Gray (Newcastle).			
3	Sediment samples (43 cm; n=45) for inorganic geochemistry for J. Faust (Leeds)			
8	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			

Station	Event	Latitude	Longitude	Water depth (m)
B17	E143	81.28146°N	29.32788°E	334
Tube #	**Samples taken**			
4, 6, 8	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
2	Sediment samples (42 cm; n=44) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-42 cm; n=32) for I.Head/N.Gray (Newcastle).			
5	Sediment samples (42 cm; n=44) for inorganic geochemistry for J. Faust (Leeds)			
7	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML			

Station	Event	Latitude	Longitude	Water depth (m)
B17	E144	81.28157°N	29.32778°E	336
Tube #	**Samples taken**			
5	Centrifuged porewaters for DOC analysis for M. Stevenson (Newcastle) and bacterial incubations for P. Downes (PML)			
7	Anaerobic sediments and pore waters (n=11) for REEs (E. Hathorne and K. Crocket), ICP-OES (J. Faust), and trace metals (A. Dickson and A. Chappaz).			

Station	Event	Latitude	Longitude	Water depth
BX-S	E277	77.03331°N	29.33371°E	236
Tube #	Samples taken			
1, 4, 6	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
5	Sediment samples (34 cm; n=36) for inorganic geochemistry for C. März (Leeds)			
3	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			
7	Sediment samples (37 cm; n=39) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-37 cm; n=27) for I.Head/N.Gray (Newcastle).			

Station	Event	Latitude	Longitude	Water depth
BY	E294	73.88666°N	26.33525°E	450
Tube #	Samples taken			
2, 3, 5, 8	Pore water samples (n=15) 1. Nutrient samples (~12 mL)- analyzed shipboard 2. Acidified split for elemental analysis (~3 mL) for J. Faust (Leeds) 3. Unacidified split for major ion analysis (~1-2 mL) for C. März (Leeds) 4. Nitrate isotope samples (~20 mL) for S. Henley (Edinburgh) 5. Silica isotope samples (~5 mL) for K. Hendry (Bristol) 6. Barium isotope samples (~5 mL) for T. Horner (WHOI)			
4	Sediment samples (34 cm; n=36) for inorganic geochemistry for C. März (Leeds)			
7	Sediment samples (top 0-0.5 cm) for pigment analysis for R. Airs (PML)			
1	Sediment samples (33 cm; n=35) for organic geochemistry for M. Stevenson, G. Abbott (Newcastle). Sediment samples for DNA (0-10 cm; n=12) for K.Tait (PML) & (10-33 cm; n=23) for I.Head/N.Gray (Newcastle).			
6	Anaerobic sediments and pore waters (n=11) for REEs (E. Hathorne and K. Crocket), ICP-OES (J. Faust), and trace metals (A. Dickson and A. Chappaz).			

2.11. Faunal analysis

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Sampling methodology/instrument description

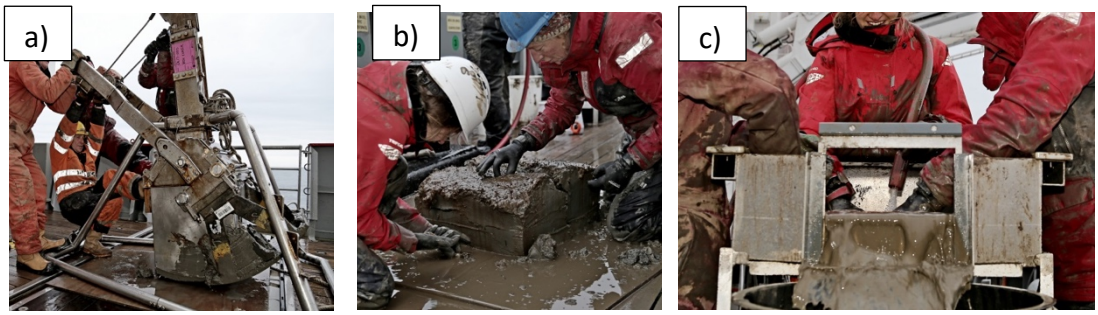
To collect organisms across the full range of benthic invertebrates, a range of sampling equipment was deployed at each of the 7 full ChAOS benthic stations (B3, B13, B14, X-South, B15, B16, B17). Sampling was replicated from the previous cruise, JR16006, as follows. Four specific animal groups were sampled. The smallest organism group collected was the ***meiofauna***. These organisms are defined as those animals that live within the interstices between the sediment grains and are generally retained on a 63µm mesh. Larger than the meiofauna are the ***macrofauna*** and these organisms are large enough to move sediment particles and construct sediment features, such as tubes and burrows. This group is defined as those organisms large enough to be retained on a 0.5mm mesh. The next group is the ***mega-infauna*** and these are the large bodied, sparsely distributed organisms living within the sediment and are retained on a 1cm mesh. Finally, there are the large bodied organisms that live on or near the sediment surface known as the ***epifauna***. These were collected using a trawl. Depending on the size of sample required for each of specific organism groups, two types of boxcorer were deployed; the USNL corer (surface area 0.1m^2) and the larger SMBA corer (surface area 0.5m^2). Samples for meiofauna and macrofauna were collected using the UNSL corer, whilst samples for mega-infauna were collected from the SMBA corer. In addition to the faunal samples, sediment samples were collected for sediment particle size analysis (PSA) to characterize the sediment type at each station.

2.11.1 SMBA Large box-corer

Megafauna: At all full ChAOS benthic stations, 5 replicate 0.5m^2 sediment cores were collected using the SMBA box corer. The top, loose section of each sample was sieved through a 1cm mesh and the bottom, clay-like sediment was manually inspected for any infaunal organisms >1cm. All sieved residue and clay dwelling organisms were placed into a 0.5L pot and preserved with 10% formaldehyde solution.

Samples taken to collect megafauna and describe benthic community abundance, diversity and structure.

Station	Location	Date	Depth	Event No's.
B3	72.63N 19.25E	11/7/2018	366m	008,009,010,011,012
B13	74.50N 30.00E	14/7/2018	363m	046,047,048,049,050
B14	76.50N 30.50E	25/7/2018	295m	247,248,249,250,252
X-South	77.03N 29.33E	27/7/2018	235m	276,277,278,279,281
B15	78.25N 29.99E	17/7/2018	317m	104,105,106,107,108
B16	80.12N 30.07E	23/7/2018	278m	199,200,201,202,203
B17	81.28N 29.32E	19/7/2018	334m	145,146,147,148,149



Images depicting a) SMBA box corer being recovered with sample, b) sample from box corer showing top soft layer and clay bottom layer and c) sieving sample through 1cm sieve.

Results

The sample residue will be returned to PML where the mega-infauna (organisms >1cm) will be extracted, identified and biomass obtained.

Data quality notes/ problems

There were no significant sample collection or data quality issues to note. However, it should be noted that site B17 had lots of rocks, one of the SMBA box corer buckets got damaged when it closed on a large rock.



2.11.2 UNSL Small box-corer

Meiofauna and ***Macrofauna:*** At all full ChAOS benthic stations, 5 replicate 0.1m^2 sediment cores were collected using the UNSL box-corer. The overlying water was drained off to reveal the sediment surface. In each core, three 50ml syringe corers were then pushed into the sediment to a depth of approximately 8 cm. The sediment from these 3 x 50ml cores was pooled into a pot and preserved with 10% formaldehyde solution. The remaining sediment in the core was sieved over a 0.5mm sieve and the residues placed into a pot and preserved with 10% formaldehyde solution.

Station	Location	Date	Depth	Event No.
B3	72.63N 19.25E	13/7/2018	371m	029,030,031,032,034
B13	74.49N 29.99E	15/7/3018	361m	063,064,065,067,068
B14	76.50N 30.50E	25/7/2018	292m	227,228,229,230,231
X-South	77.03N 29.33E	27/7/2018	227m	260,261,262,263,264
B15	78.25N 29.99E	16/7/2018	320m	084,085,086,087,088
B16	80.12N 30.07E	23/7/2018	278m	175,176,177,178,179
B17	81.28N 29.32E	18/7/2018	337m	123,124,125,126,127

Samples taken to collect meiofauna and macrofauna to describe benthic community abundance, diversity and structure.

Results

These samples will be returned to Plymouth Marine Laboratory (PML) where the meiofauna (organisms <63µm) and macrofauna (organisms >0.5mm) will be extracted, identified, measured and their biomass calculated.

Data quality notes/ problems
There were no significant sample collection or data quality issues to note. However, it should be noted that at site B13, one of the UNSL box corer buckets got damaged by a rock.

Particle Size Analysis: At each of the ChAOS benthic stations, 5 USNL cores were subsampled for Particle Size Analysis (PSA). In each core, three 50ml syringe corers were pushed into the sediment to a depth of approximately 8 cm. The sediment from these 3 x 50ml cores was pooled and placed into a Ziploc plastic bag, sealed and then placed into a 4ºC refrigerator, before being transferred into a -20 ºC freezer. These samples will be returned to PML and analysed.

Samples taken to characterise sediment at each station

Station	Location	Date	Depth	Event No.
B3	72.63N 19.25E	12/7/2018	373m	015,016,017,018,019
B13	74.49N 29.99E	14/7/2018	362m	051,052,053,054,060
B14	76.50N 30.50E	25/7/2018	294m	237,238,239,240,242
X-South	77.03N 29.33E	27/7/2019	230m	270,271,272,273,274
B15	78.25N 29.99E	17/7/2018	310m	092,096,097,098,099
B16	80.12N 30.07E	23/7/2018	282m	189,190,192,193,194
B17	81.28N 29.32E	19/7/2018	337m	134,135,136,137,138

2.12 Nitrogen cycling

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[1] Author, [2] Dataset PI
ChAOS

Background and objectives

Nitrogen isotopes (δ15N) will be used to assess processes of N immobilisation and microbial processes at each of the ChAOS benthic stations in order to understand the effects of differing organic matter (OM) supply, due to various states of ice cover, on the dominant pathways of nitrogen transformation.

Sampling strategy/instrument description

To determine rate measurements for important N-cycling sediment processes (***nitrification, denitrification*** and ***anammox***) bottled sediment samples and sediment cores spiked with ^{15}N were collected and incubated for at least 24 hours. Incubations were conducted at each of the ChAOS benthic stations (B03, B13, B14, B15, B16, B17) and one additional station (X south) with all N-cycling cores being collected from the USNL corer.

Methods/Processing/Calibrations

Nitrification rates: At each ChAOS benthic station, 12 replicate samples of surface sediment were collected in pre-weighed, 14 mL glass vials (using a 50mL syringe to take up the surface layer down to 0.5 cm depth). Approximately 4-5 mL of sediment was collected in each vial and filled with bottom water to create a slurry. Subsets of the slurries were amended with 0.1 mL of 1M zinc chloride ($ZnCl_2$; n=3), 0.1 mL of 1M allylthiourea (ATU; n=3) and 0.1 mL of 1M sodium chlorate ($NaClO_3$; n=3) and incubated in the CT-room at bottom temperature for ca. 24 hours. A parallel incubation without sediment (bottom water + treatments, n = 3 per treatment) was conducted at the same time. At the end of the incubation period, 0.5 mL of 1M $ZnCl_2$ was added to all the bottles for preservation. Ammonium oxidation rates will be measured as rates of nitrite accumulation in the $NaClO_3$-treated samples compared to the ATU-treated samples. The initial $ZnCl_2$ treatment acts as the starting point. Sediment rates will be corrected for ammonium oxidation in bottom water.

Denitrification and Anammox rates: At each ChAOS benthic station, 12 replicate cores were collected (i.d. 7 cm) from 3 separate USNL cores. Each core-tube had approximately 15-20 cm of sediment and 10-15 cm of overlying water. Overlying water was discarded from each core and replaced with bottom water amended with $^{15}NO_3$- (Three treatments: +0 µM, +50 µM, +200 µM $^{15}NO_3$-). The +0 treatment was homogenized with a power tool and the slurry decanted into x2 50mL glass bottles. 1 mL of 1M $ZnCl_2$ was added for preservation and the bottles were sealed with Teflon-lined rubber septa and Al-crimps. The remaining two treatments were incubated in the CT-room, at bottom water temperature for ca. 24 hours. Magnetic fleas were suspended in the core tubes and agitated by an external electromagnetic circuit. After the incubation period, the cores were homogenized and preserved as above. Denitrification and Anammox rates will be determined post-cruise by membrane inlet mass spectrometry.

Data quality notes/ problems

There were no significant sample collection or data quality issues to note. However, at the extra station (X south) there were not enough 50mL glass bottles remaining to collect the homogenized slurry from all 12 core tubes. Samples from this station were therefore collected in 4 25 mL plastic vials, and preserved with 0.5mL of 1M $ZnCl_2$.

Sampling details for nitrification and denitrification incubations.

Station	Location	Date	Depth (m)	Bottom water (T°C)	Cool Room (T°C)	Event
B03	**72.63N 19.25E**	**12.07.18**	**365**	**4.5**	**2**	**13, 14, 16**
B13	**74.49N 29.99E**	**15.07.18**	**359**	**1.34**	**2**	**60, 61, 62**
B14	**76.49N 30.50E**	**25.07.18**	**292**	**1.54**	**0**	**241, 242, 243**
B15	**78.25N 30.00E**	**17.07.18**	**313**	**-0.58**	**0**	**98, 99, 100**
B16	**80.11N 30.06E**	**23.07.18**	**280**	**0.39**	**0**	**193, 194, 195**
B17	**81.28N 29.32E**	**19.07.18**	**334**	**0.98**	**0**	**138, 139, 140**
X south	**77.03N 29.33E**	**27.07.18**	**228**	**1.45**	**1**	**274, 275, 276**

Results

All the samples will be analysed once returned to Plymouth Marine Laboratory. Consequently, there are no preliminary data available for this section.

2.13 Sediment erodibility and exchange processes at the benthic/pelagic boundary

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Background

The overarching objective was to measure factors impacting benthic/pelagic exchange processes along an environmental gradient of water mass distribution and typical seasonal sea ice cover levels, in order to understand differences between areas and how a shift of the polar front and climate-related changes in sea ice cover may affect local exchange processes.

In order to do this, critical sediment shear stresses as well as biologically important compounds typically affected by benthic-pelagic exchange processes were quantified. A measure of bioirrigative and advective water transport across the benthic/pelagic boundary was included as well.

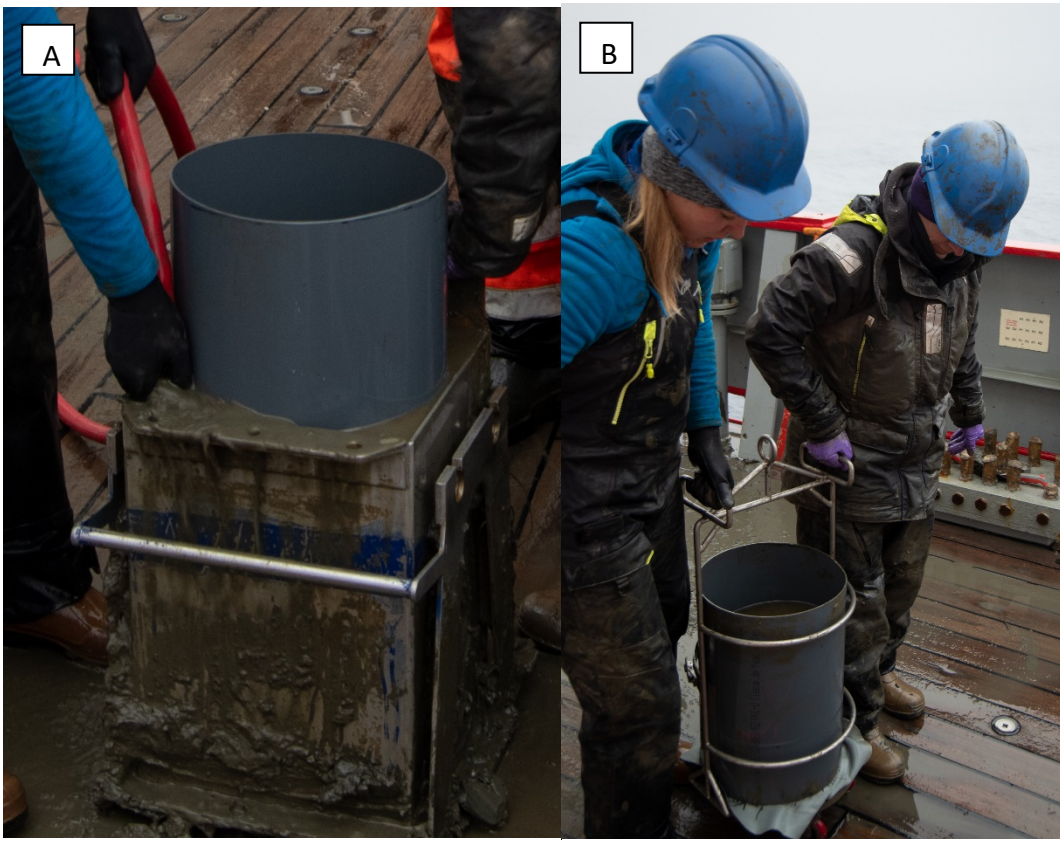
This data could in future analyses be combined with information on local macrofauna abundance and biomass to quantify the extent of biologically mediated exchange processes. Additionally, by combining the benthic/pelagic boundary data with measurements of nutrients, organic carbon and pigment presence throughout the water column, sources and sinks of each of them may be identified. Granulometry data from each of the stations will provide additional information on the properties of the sediment at the sites.

Work achieved in this workpackage will contribute to a Ph.D thesis (Ruhl), supervised by Charlie Thompson (University of Southampton) and Steve Widdicombe and Ana Querios (PML).

Methods

The centre of each station during the JR17007 cruise was determined by averaging the locations of sampling from the previous year's cruise (JR16006). Sediment samples were taken from stations B3, B13, B14, B15, B16, B17 and X-south with a 30 x 30 cm USNL box corer by selecting a series of spots within a 200 m^2 box surrounding the station centre and travelling 20m within the box in a randomized direction between each sampling point. Re-sampling of any single point was avoided.

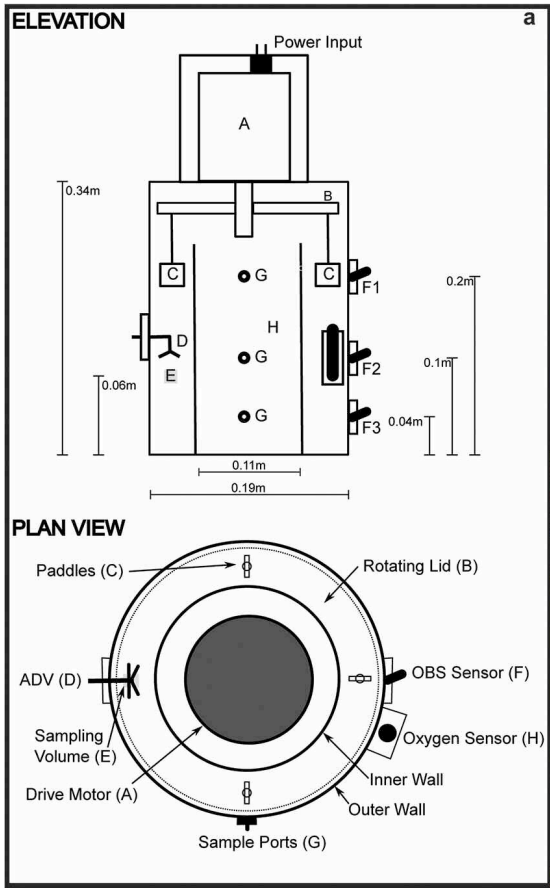
From each box corer box, five replicate 30 cm diameter sub-cores were used to extract an intact sediment core and the overlying water (see figure A), and sealed on the bottom using a marine plywood base and neoprene seal. Cores were then transported into a temperature controlled lab that was kept at the current bottom temperature of each station as determined by the CTD drop preceding the sediment sampling. Disruption of the sediment matrix and accidental resuspension during core transport where avoided as far as possible by using a carrying frame and rolling platform (see figure B).



Extraction of sediment core from USNL box corer (A) and transport of core from deck to the lab (B).

Where the water level upon taking the sub-cores was of insufficient height, bottom water from the CTD was used to top it up using bubble wrap and airline tubing as described by Widdows *et al*. (1998). Each core was given a 24 hour period between sampling and processing to settle, during which the water was aerated gently near its surface using air stones. Non-airtight neoprene lids were used to protect the cores from light. Weather conditions during the cruise were calm, thereby eliminating accidental resuspension due to wave action during the settling period.

Sample processing methods were based on the Core Mini Flume (CMF) methods described in Thompson *et al.* (2013, see figure 2 for diagram of flume used).



Schematic of CMF, as published in Thompson et al. (2013). Acoustic Doppler Velocimeter (ADV) and oxygen sensor were not included in the measurements taken during this cruise. ADV values will be back-calibrated at a later time using sediment collected from each of the stations.

In addition to the Optical Back Scatter Sensor (OBS) and Suspended Particulate Matter (SPM) measurements undertaken to monitor the erosion, resuspension and settling processes during the flume run, the overlying water was sampled for nutrients. Nutrient samples were collected at the same intervals as SPM samples and filtered through 0.2µm membrane filters. They were stored in a dark refrigerated environment and analysed within 48 hours using the methods described within this report.

To calculate rates of bioirrigative and advective transport, Sodium Bromide (NaBr) was added to flumes at a concentration of 10 uM prior to each run, sampled 15 minutes after the initial addition, after four hours of incubation, immediately prior to running the flume, and immediately after the end of the experiment. *In-situ* samples of the bottom water collected in the CTD at each station were also collected to provide a local base line bromide concentration to which samples taken during a flume run could be compared. All samples were filtered using 25 µm GF/F and stored in the dark and frozen at -20°C prior to analysis. Bromide concentration will be determined from the samples *via* High Performance Liquid Chromatography (HPLC), using an Agilent 1100 system (Agilent Technologies, Cheadle, UK). Elution will be carried out using an IonPac AG14 RFIC (Thermo Scientific DIONEX) and Bromide levels will be detected at 210 nm from six 10 µl replicate sub-samples of each sample in 1:10 dilution.

In addition to the water samples detailed above, sediment properties measurements were undertaken before and after application of the flume by syringe-coring areas of the sediment core from within the flume channel and other areas which had remained untouched by the simulated resuspension (see figure below).



Illustration of resuspension affected (the ring-shaped flume channel) and unaffected sediment areas (the circle of sediment covered by clear water in the middle of the flume) prior to syringe coring.

Wet bulk density, water content and organic content loss on ignition will be determined from the syringe cores by separating them into depth sections corresponding to 0-1, 1-2, 2-3, and 3-5 cm depth from the sediment surface, then weighing each section wet, dry (after 60 °C for 24 hours) and ashed (after 450 °C for 24 hours). Additional syringe cores collected in the same manner will be analysed for pore water bromide content prior to and after flume runs and pigment composition. The former will be carried out using the HPLC methods mentioned above and the latter will be executed using the methods detailed in Tait *et al.* (2015).

References

Tait, K., Airs, R.L., Widicombe, C.E., Tarran, G.A., Jones, M.R., Widdicombe, S. (2015). Dynamic responses of the benthic bacterial community at the Western English Channel observatory site L4 are driven by deposition of fresh phytodetritus. *Progress in Oceanography*, 137, 546-558.

Thompson, C.E.L., Couceiro, F., Fones, G.R., Amos, C.L. (2013). Shipboard measurements of sediment stability using a small annular flume – Core Mini Flume (CMF), *Limnology and Oceanography*, 11, 604-615.

Widdows, J., Brinsley, M., Elliott, M. (1998). Use of *in situ* flume to quantify particle flux. *In: Black, K.S., Paterson, D.M., Cramp, A.* (eds) *Sedimentary Processes in the Intertidal Zone.* Geological Society, London, Special Publications, 139, 85-97.

2.14 Faunal bioturbation experiments

Ellie Ward, Laura Grange & Martin Solan (University of Southampton)

Bioturbation

Background and objectives

The functional role of epi- and infauna is critical to understanding biogeochemical cycling at the sediment water interface, and the potential for organic matter to be recycled, or stored, in ocean floor sediments. Bioturbation and bioirrigation enhance exchange fluxes, driving a feed-back loop for nutrient cycling, and exerting a strong influence on the rate and degree of organic matter degradation. Mixing enhances the availability of terminal electron acceptors (TEAs), prevents metabolic inhibitor accumulation, and encourages the drawn down of surface material into deeper sediment layers, which all in turn increase the rate of degradation. Bioirrigation additionally prevents the re-oxidation of reduced chemical species into the sediment by recycling them back into the water column. Understanding the potential for changes in organic matter cycling under future climate scenarios requires a detailed understanding of benthic ecosystem function and how this might itself be influenced by a changing Arctic ocean.

Sampling strategy/instrument description

To quantify *in situ* rates of bioturbation and bioirrigation, intact benthic communities were subsampled from the USNL box corer at sites B13, B14, B15, B16, B17 and Xs. Fluorescent tracer particles were added to the surface of each core and incubated for 12-days at 1.5˚± 0.5˚C and the redistribution of particles quantified using fluorescent sediment profile imagery. Net changes in bioirrgation were measured by recording the changes in sodium bromide in each core over an 8 hour period. In addition, two dominant macrofaunal species were collected from Agassiz trawls at stations B16 and B17 in order to explore the effect of future climate conditions on species trait expression and behaviour. The sediment for these cores was retrieved from station B17 by an SMBA corer, and the cores were maintained at ambient conditions in an on board tank system. The controlled climate experiments will be performed on return to the National Oceanography Centre, Southampton.

Methods/Processing/Calibrations

Bioturbation and bioirrigation:

At each of the stations (B13, B14, B15, B16, B17, Xs), 4 replicate sediment cores were collected from four separate 0.1m^2 USNL cores. A small amount of sediment was first removed from the edge of the core and stored in -18˚C for granulometry and organic carbon sampling. Each intact core was subsampled using a (LWH) 20 x 20cm x 10cm insert and placed in a transparent aquaria (internal LWH: 20 x 20 x 34 cm, wall thickness: 0.5cm) before being overlaid with uncontaminated surface seawater (~5 to 6 L) and left to settle for 24 hours. All aquaria were maintained in a water tank at 1˚C and continually aerated. After 24 hours, each aquaria received a small amount of fish food which was allowed a few hours to settle before the overlying water was replaced with uncontaminated surface seawater. In order to carry out nutrient analysis (NO_2, NO_3, NH_3/NH_4, PO_4), 14 ml of water were removed from each replicate core before the addition of luminophores (green colour, size class: <250 µm, mean particle size ~100 µm, pending particle size analysis) to the sediment surface. The cores were incubated for 12 days after which an



Subsampling intact faunal communities from the USNL corer. Photo Credit: Phillip Richardson.

additional 14ml of water was removed for nutrient analysis and 2.84g of sodium bromide was added. The net change in bromide (Br-) concentration over an 8 hour period was used to quantify the rate of benthic bioirrigation. The rate of bioturbation in each replicate core was analysed using fluorescent sediment profile imaging (f-SPI). The four sides of each core were photographed under UV light and processed using standard image analysis techniques. In order to identify what macrofaunal species were dominant in the cores, the sediment from each was sieved at 500 µm, retained and preserved for identification at the University of Southampton.

Climate experiments:

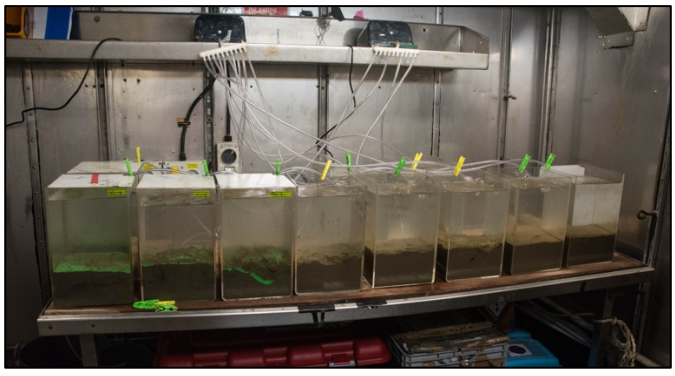
At station B17, surficial sediment (i.e. top 10 cm) was retrieved using 5 replicate SMBA deployments and sieved at 500µm in shallow water. The sediment was left to settle for 48 hours, the overlying water removed, and the sediment distributed (~15cm) between 30 small aquaria (internal LWH: 12 x 12 x 33cm, wall thickness: 0.5cm) and 6 large aquaria (internal LWH: 20 x 20 x 34 cm, wall thickness: 0.5cm). From this station, and from station B16, individuals of two target species (*Ctenodiscus crispatus* and an Unidentified bivalve sp.) were retrieved from a total of one 5 minute and 9 replicate 15 minute Agassiz trawls (see later section of report). Any additional individuals of the target species recovered in the SMBA cores were also retained and maintained with continual aeration in an onboard cold room at 1 ± 1 ˚C. The individuals were separated between the small cores as follows: Bivalve sp. – 10 replicate cores of 6 individuals, small *C. crispatus* – 10 replicate cores of 4 individuals, and large *C. crispatus* – 10 replicate cores of 2 individuals. At this point a small amount of aquarium fish food was added to each core and aeration turned on. These cores were maintained at ambient bottom water temperatures and the overlying water exchanged for uncontaminated surface seawater after 7 days. Fish food was provided 1-2 times per week. Controlled climate experiments under present and future (year 2050) environmental conditions will be undertaken for a period of 6 months once the cores are returned to the National Oceanography Centre, Southampton.



Onboard experimental tank set up in the rough lab.

Molpadia borealis

Due to its presence in the trawls, the opportunity also presented itself to establish what *Molpadia borealis* does functionally in its environment. A total of 6 individuals were collected across the same trawls as for the climate experiments, and were distributed individually into the 6 large aquaria containing sediment collected from the SMBA at station B17. These aquaria were then maintained with continual aeration in the onboard cold room (1˚C), and will be moved to the National Oceanography Centre, Southampton for incubations to determine *in situ* rates of bioturbation.



Cores containing individuals of Molpadia borealis maintained at 1˚C in the onboard the cold room.

Data quality notes/ problems

For the incubation cores, there were no significant concerns with sample collection, however there were some issues regarding the maintenance of the cores at bottom water temperature. Cores collected from the first two benthic station (B13 and B15) were placed into temperature controlled tanks maintained by a chiller system (independent from ship services). However, an incorrect installation (user error) led to fluctuating (± ~2.5˚C) temperatures. The running of the chiller was corrected before reaching the next station and reliably held 1±0.5˚C. Due to sufficient time being available and concern about maintaining representative temperatures, the effected aquaria were terminated, B13 and B15 were revisited and the cores were resampled.

There were no significant sample collection or data quality issues to note with the collection of the climate experiment cores or *M. borealis.*

Samples collected

Sampling details for the collection of cores (USNL corer) for the bioturbation incubations.

Station	Event #	Date	Latitude	Longitude	Time	Depth (m)
B13	289	28th July, 2018	74.5001	29.99813	06:40	358
	291	28th July, 2018	74.50028	29.99748	07:40	359
	292	28th July, 2018	74.50008	29.99748	08:08	360
	293	28th July, 2018	74.4999	29.99755	08:38	359
B14	237	25th July, 2018	76.49917	30.49924	15:48	293
	238	25th July, 2018	76.49923	30.49987	16:13	294
	239	25th July, 2018	76.49925	30.50065	16:40	294
	240	25th July, 2018	76.4994	30.50113	17:06	296
B15	205	24th July, 2018	78.25151	30.00001	08:04	317
	206	24th July, 2018	78.25149	29.99928	08:32	318
	207	24th July, 2018	78.25161	29.99843	09:01	318
	208	24th July, 2018	78.25142	29.99809	09:32	319
B16	189	23rd July, 2018	80.11620	30.06719	09:13	283
	190	23rd July, 2018	80.11618	30.06817	09:39	285
	191	23rd July, 2018	80.11634	30.06881	10:04	279
	192	23rd July, 2018	80.11642	30.06969	10:35	280
B17	134	19th July, 2018	81.28105	29.32781	04:45h	337
	135	19th July, 2018	81.28124	29.32828	05:15h	337

	136	19th July, 2018	81.28133	29.32941	05:43h	337
	137	19th July, 2018	81.28136	29.32802	06:13h	345
X_s	270	27th July, 2018	77.03279	29.33267	05:04	228
	271	27th July, 2018	77.03288	29.33338	05:27	229
	272	27th July, 2018	77.0329	29.33407	05:50	230
	273	27th July, 2018	77.03305	29.33449	06:13	235

Sampling details for the collection of sediment from the SMBA corer for the climate incubations.

Station	Event #	Date	Latitude	Longitude	Time	Depth (m)
B17	150	19th July, 2018	81.28176	29.32551	16:50h	334
	151	19th July, 2018	81.28176	29.32601	17:24h	334
	152	19th July, 2018	81.28169	29.32593	17:55h	335
	153	19th July, 2018	81.2816	29.32590	18:26h	339
	154	19th July, 2018	81.28153	29.32597	18:54h	339

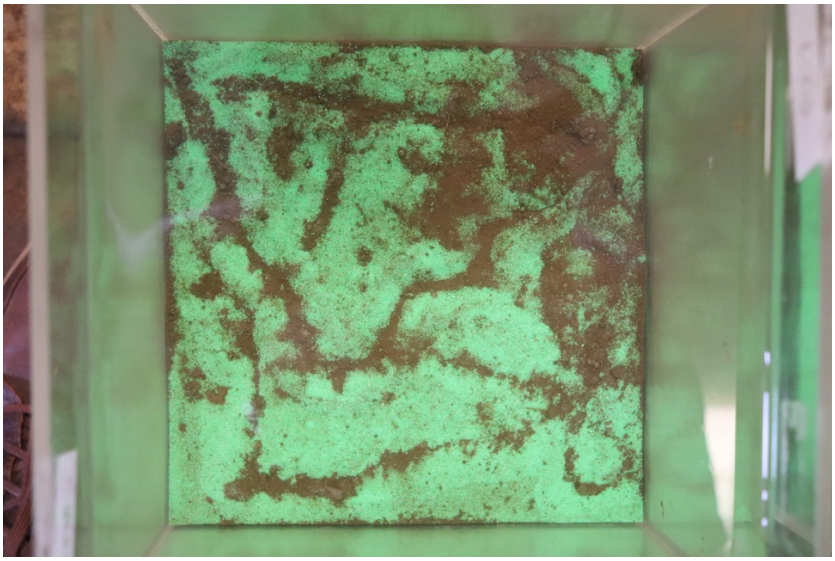
Sampling details for the collection of organisms from the Agassiz trawl for the climate incubations.

Station	Event	Date	Latitude			Longitude			Start time	Bottom time	End time	Trawl time (mins)	Depth (m)
			Start	Bottom	End	Start	Bottom	End					
B17	113	18th July, 2018	81.27922	81.27922	81.27979	29.34515	29.3446	29.26345	10:12h	10:13h	11:21h	5	340
	117	18th July, 2018	81.28334	81.28324	81.28277	29.35586	29.34905	29.31516	15:16h	15:26h	15:49h	15	339
	119	18th July, 2018	81.28378	81.28366	81.28322	29.34869	29.34070	29.30639	17:22h	17:33h	17:58h	15	340
	120	18th July, 2018	81.28397	81.28388	81.28342	29.34701	29.34098	29.30313	18:26h	18:36h	19:05h	15	354
	121	18th July, 2018	81.28394	81.28310	81.27740	29.34459	29.34406	29.34019	19:36h	19:46h	20:14h	15	350
	122	18th July, 2018	81.28475	81.28415	81.27814	29.33391	29.33843	29.38193	20:45h	20:56h	21:33h	25	350
B16	172	22nd July, 2018	80.11647	80.11562	80.10993	30.04722	30.05017	30.06896	17:39h	17:48h	18:27h	15	282
	173	22nd July, 2018	80.11593	80.11504	80.10932	30.04600	30.04885	30.06622	18:47h	18:57h	19:41h	15	292
	174	22nd July, 2018	80.11518	80.11409	80.10897	30.04508	30.04837	30.06422	19:56h	20:06h	20:48h	15	292

Preliminary results

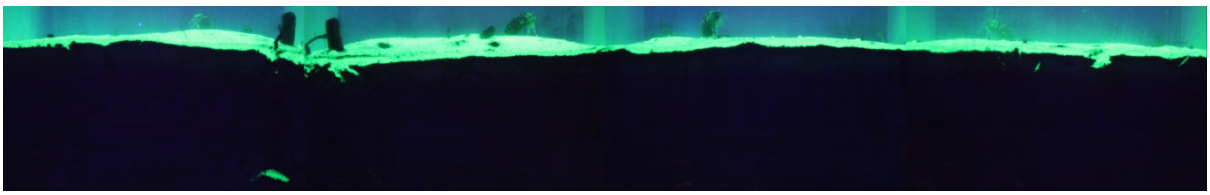
The bioturbation cores were sampled on day 0 and day 12 of the incubations in order to quantify the exchange rates of nutrients (NO_2, NO_3, NH_3/NH_4 and PO_4) in the top waters. The day 0 samples were analysed onboard (Sian Henley, University of Edinburgh). The day 12 samples have been frozen (-18˚C) and will be sent to SAMS in Oban for analysis within a month of return. Water samples retrieved for determining the concentration of bromide will be analysed at the University of Aberdeen in order to determine net rates of bioirrigation. Due to an earlier arrival in Southampton than scheduled, the majority of bioturbation incubations were still outstanding, and hence f-SPI of the cores, and the identification of dominant macrofauna from the sieved cores will be carried out after return to the UK. The climate mesocosm experiments will be performed in a controlled temperature and CO_2 laboratory in the NOC where organisms will be exposed to ambient and future conditions for a period of 6 months. Hence, it is not possible to present preliminary data for this section other than an initial example of (i) a sediment surface and (ii) a sediment profile image:

(i)



Example core from B17 after 12 days incubation. The green particles are luminophore tracers (fluorescent dyed particles). Surficial reworking of the sediment surface was common at B17. Aquaria dimensions 20 x 20 cm.

(ii)



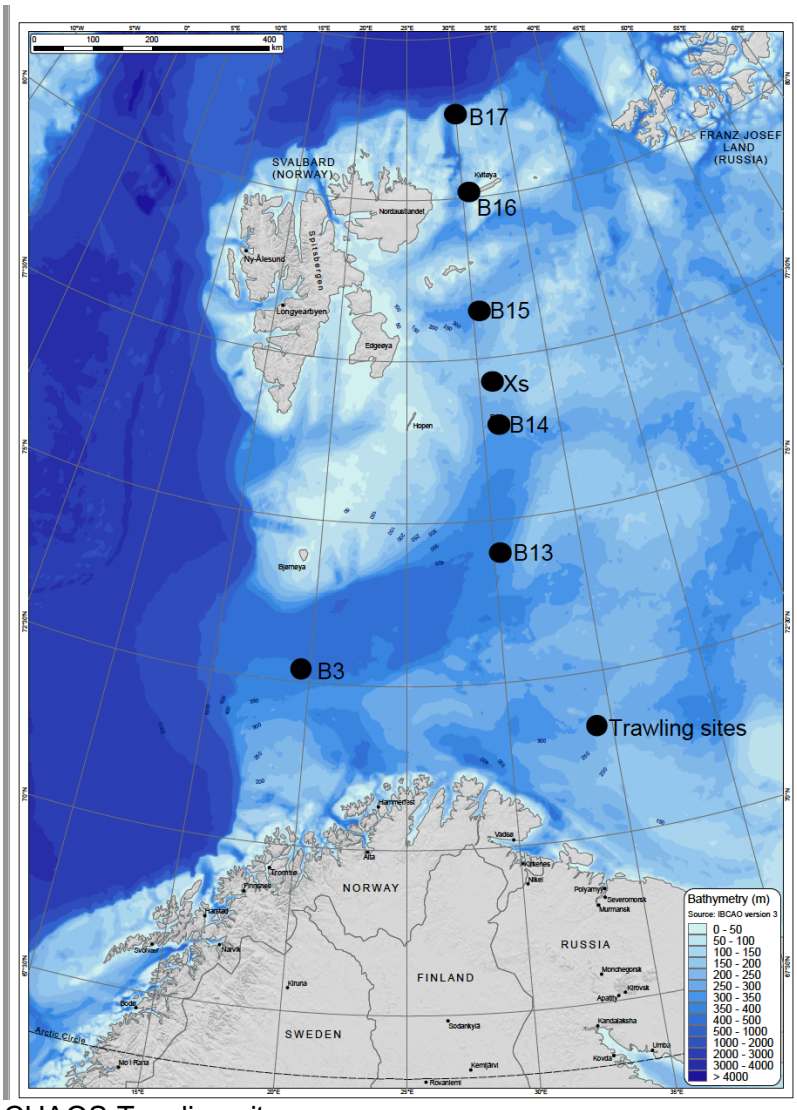
Example stitched (4 sides of aquaria, ~80cm (perimeter of aquaria) sediment profile image from B17. The green particles are luminophore tracers (fluorescent dyed particles). Lack of any significant deep mixing was typical of B17.

2.15 Agassiz Trawl (AGT)

Terri Souster (British Antarctic Survey)
Laura Grange (Southampton University)
Louisa Norman (Liverpool University)
Rachel Coppock (Plymouth Marine Laboratory)
Johan Faust (University of Leeds)

Rates of warming in the high northern latitudes are amongst the highest globally. One of the most obvious manifestations is the dramatic reduction in summer sea ice extent and thickness over the past few decades. Reduction in Arctic Ocean sea ice leads to increased light on the water column and therefore greater phytoplankton blooms in both magnitude and duration. Arctic benthic marine invertebrates could therefore feed for longer periods of time, increasing carbon draw down.

Benthic assemblage composition, organism activity and standing stock are likely to differ considerably along the continuum of sea ice-covered to open water, with inevitable effects on the key ecosystem functions provided by benthic organisms. To begin to understand the importance of sea ice conditions on the structure, function and diversity of benthic communities inhabiting shelf sediment habitats, a transect of 6 Stations (B3, B13, B14, B15, B16 and B17) was sampled in 2017 that ran from ice free NE Atlantic dominated communities in the south (B3) to predominately ice covered Arctic dominated communities in the north (B17), and in 2018 an extra station (Xs) between B14 and B15 was added to include sampling at the polar front (Figure 5.1).



CHAOS Trawling sites

Sampling strategy/instrument description

Pre sampling checks

Outer and inner nets – attached and in good condition i.e. no holes

Knot - which ever knot chosen, just be confident in the knot used to tie the cod end as it sustains friction when trawling and also needs to be easy enough to remove with the weight of the contents once back on deck (see images below for knot used in JR17007). A knot is tied around both the inner and outer nets separately.



Knot used for cod end on AGT

Weather – Maximum sea state, force 7 – 8 (wind, 30 – 40 knots) depending on swell

The Agassiz trawl dimensions are: 125 cm in length, 41 cm in width and height of 85 cm. The Agassiz trawl was deployed by paying out cable at a rate of approximately 30 m/min whilst the ship was sailing at 0.3 knots. At 50 m from the bottom, the ship's velocity was increased to 1 knot, until the trawl reached the seabed, where the ship's speed was reduced to 0.5 knots until all the cable was veered. The length of cable for each trawl equaled 1.5 times the water depth. Once the length of cable was deemed acceptable for each site, the trawl started with the ship sailing at 1 knot for 5 to 15 minutes. After this time recovery started with the ship's speed decreasing to 0.3 knots and a cable haul speed of approximately 30 m/min until it cleared the seabed, after which the speed was increased to 45 m/min until close to the surface. The trawl was then recovered on deck and the samples collected into containers for sieving.

The first 3 trawl tows were conducted for 5 minutes. The sediment collected from these trawls was sieved over a stacked 1 cm then 1 mm mesh. The residue was then picked and the fauna allocated to Class. The fauna are then preserved in 96% ethanol and returned to the British Antarctic Survey where the different groups (Class) will be dispersed to taxonomic experts across the World where they will be identified to species level (where possible). In addition, genetic studies will be run on target species and carbon content (inorganic and organic) of these organisms will also be calculated.

The second 3 trawl tows were conducted for 15 minutes. On recovery the sediment from the trawl cod end was sieved over a 1 cm then 1 mm mesh. The fauna recovered were catalogued, photographed and placed in a 5-litre bucket, and preserved with 10% buffered formal saline solution. Relevant data are not included here as the faunal returns need to undergo formal taxonomic identification. These fauna will be returned to Plymouth Marine Laboratory where they will be identified to species (where possible) and weighed (blotted wet weight and decalcified wet weight). These data will be used to quantify the community structure and biomass of large epifaunal organisms at each of the seven benthic stations. This material will then be supplied to Dr Laura Grange (University of Southampton) for reproductive analysis. Selected target species, determined by species abundance and dominance, will be measured to establish individual size and wet weight, dissected to remove discrete reproductive tissues and processed through standard wax histology

techniques (dehydration, clearing, impregnation and embedding in molten wax, and sectioned at 7µm using a rotary microtome). Following sectioning, glass slides of thin tissue sections will be stained using a standard hematoxylin and eosin protocol, and viewed under a compound microscope. Reproductive metrics including oocyte size and maturity, and spermatogenic maturity stage will then be quantified and described.

There were no notable issues experienced with sample collection or data quality. However, the trawl was redeployed if the net was recovered twisted or open. The latter was only observed on a handful of occasions (Event 71, 113, 221 and 224, however animals where taken from Event 221 for University of Southampton climate change experiments).

- Total of 54 trawling events
- Trawl Events 119,120, 121, 122, 172, 173 and 174 where carried out to collect species for the climate change experiments, see separate section (Martin Solan, University of Southampton)
- 5 different species per station where taken from the 5 min trawls for Newcastle University to look at C_{13} and N_{15} content
- Trawled a distance of 9.66 nautical miles (17.90km) and covered an area of seabed equal to an area of 26,854m^2
- Rubber sheets on the AGT where changed for new ones after B15 and prior to B17 sampling
- Two *Gorgonocephalus arcticus* recovered at B15 (see Figure 5.3)



The Ophiuroid Gorgonocephalus arcticus

- 15 different classes of benthic fauna recovered across the 5-minute trawls
- Bivalvia where the most abundant class of fauna across all sample sites (391 individuals) followed by Ophiuroidea (338 Individuals) and then Asteroidea (338 Individuals) (see Table 5.1)

Event Log (N.B. The blue text identifies the 5-minute AGT trawls used undertaken for samples collected by the British Antarctic Survey, whereas the black text identifies the 15-minute trawls used for samples collected collaboratively by the Plymouth Marine Laboratory and University of Southampton.

Event	Station	Date	Latitude			Longitude			Start time	Bottom time	End time	Trawl time (mins)	Depth (m)
			Start	Bottom	End	Start	Bottom	End					
35	B3	13th July, 2018	72.63232	72.63231	72.63231	19.25735	19.25262	19.24055	07:33 h	07:48 h	08:19 h	5	370
36	B3	13th July, 2018	72.63204	72.63204	72.63203	19.2517	19.24804	19.2354	08:35 h	08:47 h	09:20 h	5	370
37	B3	13th July, 2018	72.63188	72.63185	72.63173	19.25963	19.25596	19.24444	09:36 h	09:48 h	10:14 h	5	370
38	B3	13th July, 2018	72.63154	72.63144	72.63101	19.26316	19.25943	19.24371	10:30 h	10:41 h	11:19 h	15	370
39	B3	13th July, 2018	72.63115	72.63104	72.63058	19.26396	19.25984	19.24535	11:32 h	11:44 h	12:25 h	15	370
40	B3	13th July, 2018	72.63047	72.63039	72.63008	19.26599	19.26181	19.2452	12:37 h	12:48 h	13:28 h	15	370
69	B13	15th July, 2018	74.49952	74.49888	74.49633	30.00697	30.00172	29.98116	03:40 h	03:57 h	04:42 h	5	360
70	B13	15th July, 2018	74.49931	74.49882	74.49627	30.01046	30.00661	29.98598	04:59 h	05:12 h	06:04 h	5	360
Event 71 B13 Failed Trawl													
72	B13	15th July, 2018	74.49904	74.4985	74.49524	30.00965	30.00965	29.98936	07:32 h	07:42 h	08:24 h	5	360
73	B13	15th July, 2018	74.50281	74.50217	74.49783	30.00295	30.0003	29.98235	08:48 h	08:58 h	09:40 h	15	324
74	B13	15th July, 2018	74.50365	74.50295	74.49823	30.00714	30.00419	29.98735	09:55 h	10:06 h	10:44 h	15	360
75	B13	15th July, 2018	74.50407	74.50333	74.49876	30.00267	29.99987	29.98302	11:08 h	11:19 h	11:56 h	15	365
78	B15	16th July, 2018	78.25065	78.25001	78.24635	30.00463	30.00109	29.9796	12:43 h	12:52 h	13:24 h	5	315
79	B15	16th July, 2018	78.25061	78.25018	78.24686	30.00321	30.0004	29.97761	13:43 h	13:51 h	14:30 h	5	316
80	B15	16th July, 2018	78.25082	78.25032	78.24779	30.00442	29.99983	29.97596	14:42 h	14:52 h	15:27 h	5	317
81	B15	16th July, 2018	78.25077	78.2506	78.24954	30.00108	29.99624	29.96685	15:40 h	15:50 h	16:30 h	15	318

Event	Station	Date	Latitude			Longitude			Start time	Bottom time	End time	Trawl time (mins)	Depth (m)
			Start	Bottom	End	Start	Bottom	End					
82	B15	16th July, 2018	78.25046	78.25131	78.25763	29.98937	29.98939	29.99027	16:44 h	16:53 h	17:35 h	15	316
83	B15	16th July, 2018	78.25045	78.25151	78.25865	29.99142	29.9914	29.99139	17:47 h	17:57 h	18:41 h	15	317
111	B17	18th July, 2018	81.28007	81.28014	81.28084	29.34901	29.3435	29.28688	07:50 h	08:00 h	08:48 h	5	324
112	B17	18th July, 2018	81.27941	81.2796	81.28076	29.34432	29.33682	29.28519	09:03 h	09:13 h	09:57 h	5	349
Event 113 B17 Failed Trawl													
114	B17	18th July, 2018	81.2802	81.28022	81.28088	29.35526	29.34901	29.29652	11:45 h	11:54 h	12:37 h	5	337
115	B17	18th July, 2018	81.27939	81.27938	81.27885	29.33728	29.33635	29.2882	12:58 h	13:00 h	13:46 h	15	344
116	B17	18th July, 2018	81.27882	81.27876	81.27847	29.28686	29.2797	29.24346	14:05 h	14:15 h	14:42 h	15	339
118	B17	18th July, 2018	81.28354	81.28332	81.28297	29.35273	29.33683	29.30954	16:15 h	16:32 h	16:51 h	15	339
166	B16	22nd July, 2018	80.11751	80.11674	80.11071	30.07503	30.07768	30.09771	11:16 h	11:24 h	12:00 h	5	283
167	B16	22nd July, 2018	80.11735	80.1165	80.11202	30.07433	30.07665	30.08818	12:27 h	12:36 h	13:04 h	5	288
168	B16	22nd July, 2018	80.11735	80.11624	80.11158	30.0743	30.07492	30.07791	13:25 h	13:35 h	14:09 h	5	282
169	B16	22nd July, 2018	80.11578	80.1147	80.10913	30.07398	30.07459	30.07787	14:26 h	14:36 h	15:12 h	15	289
170	B16	22nd July, 2018	80.11569	80.1146	80.10903	30.07218	30.07288	30.0762	15:30 h	15:40 h	16:14 h	15	288
171	B16	22nd July, 2018	80.11552	80.11469	80.10910	30.06882	30.06933	30.0726	16:36 h	16:44 h	17:17 h	15	286
219	B14	25th July, 2018	76.4995	76.49888	76.49635	30.50671	30.50347	30.49061	02:58 h	03:08 h	03:41 h	5	306
220	B14	25th July, 2018	76.49966	76.49892	76.49642	30.50671	30.50347	30.49061	03:53 h	04:04 h	04:33 h	5	307

Event	Station	Date	Latitude			Longitude			Start time	Bottom time	End time	Trawl time (mins)	Depth (m)
			Start	Bottom	End	Start	Bottom	End					
221	B14	25th July, 2018	76.49959	76.49882	76.49575	30.50872	30.50576	30.49435	04:51 h	05:01 h	05:28 h	5	307
222	B14	25th July, 2018	76.49949	76.49869	76.49492	30.50938	30.50655	30.4933	05:41 h	05:51 h	06:23 h	5	306
223	B14	25th July, 2018	76.49872	76.49809	76.49352	30.50939	30.50697	30.49	06:39 h	06:48 h	07:27 h	15	310
Event 224 B14 Trawl failed													
225	B14	25th July, 2018	76.49936	76.49806	76.49226	30.50926	30.50918	30.50887	08:45 h	08:56 h	09:28 h	15	309
226	B14	25th July, 2018	76.49867	76.49787	76.49218	30.50861	30.51013	30.52146	09:42 h	09:51 h	10:25 h	15	306
254	Xs	26th July, 2018	77.03247	77.0322	77.03081	29.34055	29.33696	29.31781	17:43 h	17:51 h	18:21 h	5	228
255	Xs	26th July, 2018	77.03215	77.03179	77.03071	29.34291	29.33734	29.32	18:38 h	18:49 h	19:18 h	5	229
256	Xs	26th July, 2018	77.03203	77.03164	77.03025	29.34076	29.33596	29.31844	19:33 h	19:42 h	20:10 h	5	220
257	Xs	26th July, 2018	77.03209	77.03176	77.02914	29.33968	29.33695	29.31514	20:26 h	20:33 h	21:08 h	15	221
258	Xs	26th July, 2018	77.03193	77.03143	77.02925	29.33961	29.33615	29.3203	21:20 h	21:29 h	22:04 h	15	227
259	Xs	26th July, 2018	77.03218	77.03155	77.02753	29.34007	29.33699	29.31635	22:23 h	22:31 h	23:03 h	15	229

	Sites																				
	B3	B3	B3	B13	B13	B13	B14	B14	B14	B15	B15	B15	B16	B16	B16	B17	B17	B17	XS	XS	XS
	Abundance (not density) in 5 min Trawls																				
Bivalvia	1	3	3	69	30	54	6	1	1	1	8	6	52	66	39	21	14	16	13	6	3
Gastropoda				2										3	1				1		3
Scaphopoda				15	26	26	15	4	11		2	2	1	1			1	3	43	34	27
Articulata	1																1				
Ophiuroidea	4	3		12	7	9	7	5	4	15	4	46	47	83	39	5	16	32	15	68	43
Echinoidea																			1	2	
Asteroidea	1	1		31	10	28	42	42	34	1	2		41	37	19	15	7	4	39	29	19
Holothuroidea	1					1	1	3	1				5	2	1			3	4		2
Crinoidea																		1			
Pycnogonida													1							2	
Malacostraca	1	2	1	6	6	15	24	9	29			2	2	7	7	2			17	26	13
Polycheata	2	6	6	32	28	15	17	8	20	3	2		7	7	9	27	18	7	21	7	32
Nemertea													7	3	11		1		1	6	
Turbellaria														2							
Anthazoa												1	11								
Gymnoleamata	1								1	1		1	1	5							
Demospongiae		1															3	5			
Pisces												2									
Cnidaria	2							1					29	27	15						1
Sipuncula	1																				

Abundance of faunal classes at all trawled sites catalogued from the 5-minute trawls

Benthic communities from the 15-minute trawls at each site





B3

B13





B15



B17



B16



B14

Xs

2.16 Phytoplankton and microbial production

Patrick Downes, Plymouth Marine Laboratory

Background and Objectives: Drastic changes in sea ice cover are predicted to impact the quality and quantity of dissolved organic matter (DOM). As well as changing the relative proportions of DOM sources; marine, sea-ice and terrestrial, which will in turn impact carbon cycling in the water column and sediment. The supply of organic carbon influences the activity of heterotrophic bacteria which utilise this carbon pool, recycling the DOM within the water column. Carbon entering this microbial loop is diverted away from higher trophic levels and export to the sea floor. Heterotrophic bacteria further compete with phytoplankton for inorganic nutrients consequently impacting phytoplankton community composition and rates of primary production. We aim to assess the dynamics between primary production and microbial production with emphasis on the utilisation of dissolved organic matter.

Sampling: Sampling depths were selected based on the PAR irradiance readings from the CTD at the surface of the water (approx. 2m) after being initially stabilised at 10m and bought back to the surface. Six set percentages of light 100%, 50%, 25%, 15%, 3% and 1% were calculated from the surface PAR(log) and the depths chosen accordingly. Once sampled from the CTD, the water was briefly stored in incubators at in-situ temperature before subsampling for the below methods. Samples collected:

Event number	CTD number	Station	Date	Lat	Long	Bottles sampled
1	001	B3	11.07.18	72.633273	19.25157	22, 20, 18, 15, 13, 11, 4
40	002	B13	13.07.18	74.500002	30.00043	22, 20, 18, 15, 13, 11, 6
77	003	B15	16.07.18	78.25166	29.99992	24, 21, 20, 18, 16, 12, 8
110	004	B17	18.07.18	81.28163	29.32675	23, 21, 19, 15, 13, 11, 8
158	007	A	20.07.18	83.04647	27.65231	19, 16, 10, 8, 5, 4
160	009	B	21.07.18	82.04443	27.2773	19, 15, 13, 11, 6, 3
165	014	B16	22.07.18	80.1167	30.06826	22, 20, 19, 17, 16, 14, 8
218	017	B14	25.07.18	76.50003	30.50024	22, 20, 19, 18, 16, 12, 8
253	018	X-South	26.07.18	77.0333	29.33359	23, 20, 18, 17, 15, 11, 9
295	020	B3	29.07.18	72.63338	19.25128	1, 3, 5, 7, 9, 11

(i) Primary Production

Estimations of summer primary production rates were made using 14C on deck incubations. Accompanied with distinguishing the contribution of three size classes to total production.

Methods

Sea water from each of the 6 PAR depths was dispensed into 70ml acid washed polycarbonate bottles, minimizing headspace. Each depth consisted of three replicates plus

one fully blacked out and one used for a T0 measurement. Each bottle was spiked with 10µCi (370kBq) $NaH^{14}CO^3$. Dispensing and addition of the label was carried out swiftly before bottles were transferred to on-deck incubators, with corresponding light percentage density filters. Incubations were carried out for 24 hours with continuous day light and temperature maintained by a continuous supply of sea water from the non-toxic underway supply. To terminate the incubations, samples were transferred into a dark cool box for processing in the radiochemical lab. Before filtering, a subsample of 5ml from each bottle was aliquoted directly into a pony vial for measuring total organic carbon (TOC). Under low vacuum the samples were then sequentially filtered through 47mm polycarbonate membrane filters (20µm, 2µm, 0.2µm). Filters were then fumed for 2 hours with 37% HCL and desiccated for a minimum of 12 hours. Finally filters were placed in 8ml antistatic pony vials with the addition of ProSafe FC+ scintillation cocktail and stored in the dark for analysis at PML. As the scintillation counter supplied by BAS was not operational for the duration of the cruise.

(ii) Community Composition

To assess the phytoplankton and microbial communities a combination of techniques will be used. Taxonomic identification and enumeration of the phytoplankton assemblages will be coupled with biovolume estimates to support the primary production rates measured. Identification will be aided by photo documentation obtained from net samples. Flow-cytometry will be used to analyse the microbial community abundance of bacteria and nanoflagellates. Molecular samples were taken for next generation sequencing and qPCR to provide information on both microbial and phytoplankton taxonomy and relative abundances. Samples were obtained from each of the 6 PAR depths plus an additional deep sample at the salinity maximum defining the Atlantic bottom water.

Methods

Phytoplankton taxonomy

Lugol's fixation; for each depth a sample was aliquoted into a 500ml amber glass jar containing 5ml acid lugol's iodine solution. Formalin fixation; samples were preserved in neutral formalin buffered with Borax, by adding the sample directly to a 500ml amber glass jar containing 10ml buffered formalin. These samples will be used to analyse the calcifying members of the phytoplankton community. Light microscopy will be used at PML to analyse both the formalin and lugol's samples, for taxonomic identification and enumeration with additional biovolume estimates.

Flow-cytometry

Corresponding to the depths sampled for phytoplankton taxonomy, subsamples were preserved for flow-cytometry. Duplicates were taken for each depth; 1.8µl of sample was aliquoted into 2ml cryovials, prior to the addition of Pluronic F-68, final concentration 0.01% and Glutaraldehyde solution, final concentration 0.25%. cryovials were then kept at 4°C in the dark for 12 hours before storage at -80°C.

Molecular samples

For each depth sampled, 2 litres of sea water was filtered through a 0.22µm sterivex^{TM} filter unit using a peristaltic pump. The filter unit was then immediately stored at -80°C. Duplicate filters were obtained using 0.22µm Millipore GPWP Polyethersulfone hydrophilic membrane filters, using low vacuum 2L was filtered and immediately stored at -80°C.

(iii) Dissolved inorganic phosphorus uptake and dissolved organic release

Bulk community dissolved inorganic phosphorus uptake was quantified using 33P labeled phosphoric acid; incubations were conducted simultaneously to the primary production incubations. These measurements were combined with estimating dissolved organic phosphorus release.

Methods

DIP Uptake

Sea water from each of the 6 PAR depths was dispensed into 70ml acid washed polycarbonate bottles, minimizing headspace. Each depth consisted of three replicates plus one fully blacked out and one used for a T0 measurement. Each bottle was spiked with 2µCi

^{33}P-phosphoric acid. Dispensing and addition of the label was carried out swiftly before bottles were transferred to on-deck incubators, with corresponding light percentage density filters. Incubations were carried out for 24 hours with continuous day light and temperature maintained by a continuous supply of sea water from the non-toxic underway supply. To terminate the incubations, samples were transferred into a dark cool box for processing in the radiochemical lab. Under low vacuum the samples were then filtered through 47mm polycarbonate membrane filters (0.2µm). Prior to use, filters were treated with a lithium chloride phosphate buffer and further rinsed post filtering. Filters were placed in 8ml antistatic pony vials with the addition of ProSafe FC+ scintillation cocktail and stored in the dark for analysis at PML. As the scintillation counter supplied by BAS was not operational for the duration of the cruise.

DOP excretion

Prior to filtering, a 10ml aliquot was filtered through a 0.2µm treated membrane filter using a circular filtration manifold with glass collection vials. the filtrate was transferred to 15ml centrifuge tubes with the addition of 250µl NaOH (1M) to precipitate out the inorganic phosphorus (Björkman et al. 2000). They were shaken vigorously before centrifuging and 3500rpm for 1 hour, 1ml of the supernatant was transferred to a glass scintillation vial for analyses at PML.

Björkman, K.M., Thomson-Bulldis, A.L., Karl, D.M., 2000. Phosphorus dynamics in the North Pacific subtropical gyre. Marine Ecology Progress Series 22, 185-198.

(iv) Microbial Production

Microbial production was estimated by measuring incorporation of radio labelled leucine. To gain a comparison of the relative contribution of archaeal and bacterial production to the whole community production, inhibitors were used in separate incubations.

Methods

Whole community production

Whole community production was measured at all depths sampled see table 1. For each depth triplicates were used with one trichloroacetic acid (TCA) killed control, final concentration 5%. Micro-centrifuge tubes containing 1.7ml sample were used for the incubations. Each was spiked with 3H-leucine at a final concentration of 20nmol L^{-1}. Incubations were conducted at in situ temperatures in the dark for three hours and terminated by the addition of TCA to a final concentration of 5%. The protocol described by Smith & Azam (1983) was used to process the samples. All samples will be analysed at PML.

Bacterial vs Archaeal production

The same protocol was used as stated above with the addition of the following steps. For 1 depth, sample was aliquoted into 12 micro-centrifuge tubes. One set of triplicates were left untreated for total production. The archaeal inhibitor N1-guanyl-1,7-diaminoheptane (GC7) was added to a final concentration of 0.8mM to triplicates to estimate the bacterial contribution. To estimate the archaeal contribution, a set of triplicates was treated with Vancomycin (150µg/ml), Ampicillin(150µg/ml) and Fosfomycin (100µg/ml). All antibiotics plus the archaeal inhibitor GC7 were added to a final set of triplicates to assess resistant groups. Once the inhibitors were added, samples were kept in the dark at in-situ temperature for 24 hours, before the addition of 3H-leucine.

Smith DC, Azam F (1992) A simple, economical method for measuring bacterial protein synthesis rates in seawater using 3H-leucine. Mar Microb Food Webs 6:107–114

(v) Extracellular Enzyme Activity

Heterotrophic bacteria within the planktonic community play a key role in recycling organic matter and remineralising nutrients. The majority of this organic matter is too large for direct uptake, therefore it must be hydrolyzed by extracellular enzymes. The activity of these enzymes reflects the quantity and composition of the organic matter available. Enzyme activity was measured fluorometrically, using substrates which emit fluorescence after hydrolytic cleavage. The substrates and associated enzymes are outlined in the table below.

Methods

Saturating concentrations of the substrates were determined at B3, XSouth and B17, to represent Atlantic and Arctic waters. For each station four depths were used for enzyme assays, three surface plus one deep. Triplicates were used with a blank containing just seawater. The substrate was added to a 5ml cuvette, followed by the addition of 3ml sample. A T0 measurement was recorded directly after sample addition followed by 3-4 measurements over a 24hour period. The assays were kept in the dark at in situ temperatures. Standards for calibration curves were made using 7-amido-4-methylcoumarin and 4-Methylumbelliferone sodium salt dissolved in sterile filtered seawater.

Fluorogenic substrates and associated enzymes.

Substrate	Enzyme
4-methylumbelliferyl phosphate	Alkaline phosphatase
4-methylumbelliferyl N-acetyl-β-D-glucosaminide	Chitobiases
4-methylumbelliferyl β-D-cellobioside	Cellulases
4-methylumbelliferyl β-D-glucopyranoside	ß-Glucosidase
L-Leucine-7-amido-4-methylcoumarin hydrochloride	Leu-aminopeptidase

2.17 Phytoplankton Net

Patrick Downes, Plymouth Marine Laboratory

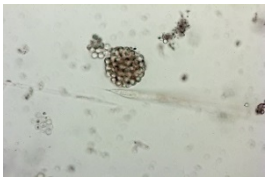
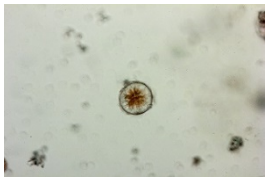
Aims and Objectives

To aid phytoplankton taxonomic identification as discussed in section 1.2, a net was deployed collecting live samples in order to create a photographic index of the present species.

Methods

A bongo net with a 20µm mesh was used at five stations. Each deployment was to 40m and hauled vertically. The sample was analyzed with light microscopy soon after collection.



Sampled Stations

Event number	Net number	Station	Date	Lat	Long
76	001	B13	74.49707	29.97673	30.00043
109	003	B15	17.07.18	78.25166	29.99988
155	002	B17	20.07.18	81.28169	29.32675
204	004	B16	23.07.18	80.11671	30.06839
284	005	X-South	27.07.18	77.03328	29.33273

2.18 Particulate organic matter and nifH gene sampling from underway system

Louisa Norman and Claire Mahaffey (University of Liverpool)

Background and objectives.

Objectives relating to POM and nifH gene sampling are given in section 2.8. This work contributes to the ARISE research grant within the Changing Arctic Ocean research programme.

Sampling and methods.

Samples for both POM and nifH gene were taken from the underway system at intervals along the cruise track between 71 ºN and 81 ºN. In total, nine POM samples and 13 nifH gene samples were collected in addition to those obtained from the CTD. For both parameters, samples were collected directly from the underway system into 10 L acid-cleaned carboys and then processed and stored as detailed in section 1, CTD sampling.

Data quality notes/problems.

No issues were encountered.

Samples collected.

POM - underway

Date	**Time**	**Lat**	**Lon**
13/07/2018	16:47	72.90865	20.76218
16/07/2018	05:55	77.34509	29.99877
17/07/2018	16:50	79.16267	31.46698
22/07/2018	06:59	80.49088	27.83756
27/07/2018	12:26	76.99773	29.22227
27/07/2018	18:44	75.95137	29.63024
28/07/2018	17:54	73.79495	25.79882
29/07/2018	13:06	71.89135	17.38323
29/07/2018	19.44	71.00523	15.23769

nifH gene – underway

Date	Time	Lat	Lon
12/07/2018	09:30	71.50459	20.06965
13/07/2018	18;47	73.12128	21.93656
15/07/2018	15:56	75.01354	29.99894
16/07/2018	08;42	77.80839	29.99966
17/07/2018	15:35	78.95879	31.46228
19/07/2018	17:55	81.28169	29.32593
22/07/2018	06:58	80.49366	29.83592
23/07/2018	18:27	80.1167	30.06762
24/07/2018	08:56	78.25161	29.9984
25/07/2018	23:58	76.50012	30.50022
27/07/2018	12.23	77.00455	29.2166
28/09/2018	04:56	74.49993	29.99958
29/07/2018	10:38	72.22924	18.24594

2.19 Microplastic distribution and abundance from the underway system

Rachel Coppock, Plymouth Marine Laboratory

Background

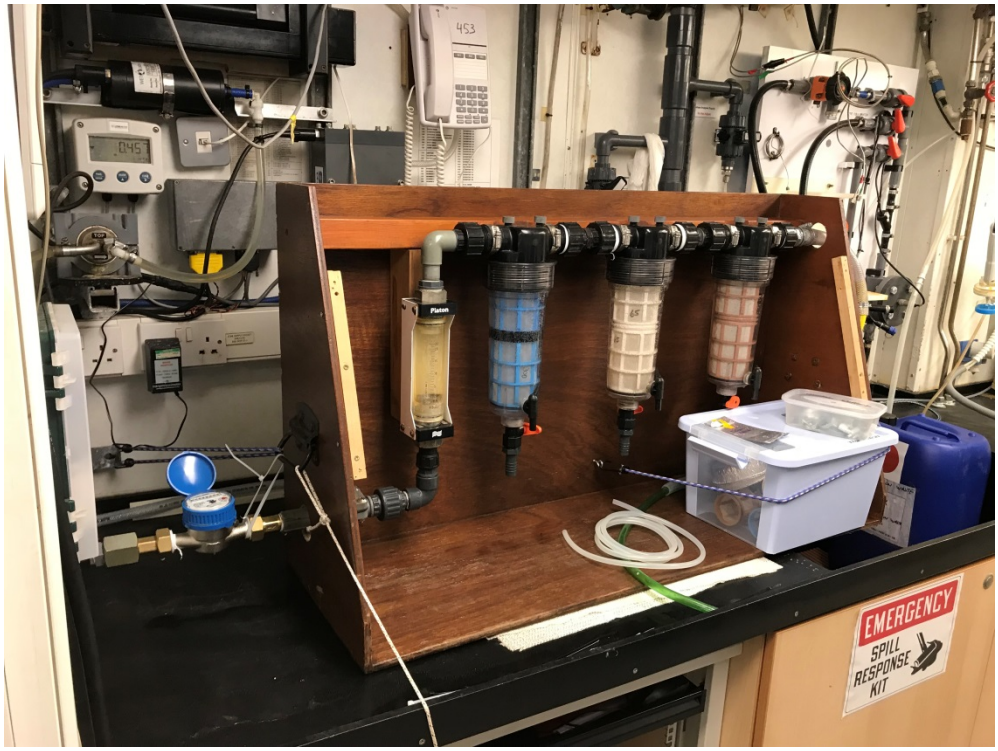
Microplastics (plastic pieces < 5mm in size) are ubiquitous in the marine realm. Now accepted as a pervasive marine pollutant (UN Sustainable Development Goal 14 target 14.1.1, GESAMP 2016), microplastics have been documented in every habitat investigated; in surface waters, Polar regions, the deep sea and shorelines globally. Microplastic particles can be purposefully manufactured, such as those used in cosmetic exfoliates or virgin pre-production pellets or the result of fragmentation from larger items such as fibres from textiles and ropes and the breakdown of single use plastics, degraded over time. Being so small, microplastics can be ingested by a wide range of animals and have been documented in a variety of taxa including zooplankton, fish, turtles, seabirds and marine mammals. Microplastic ingestion can result in adverse health effects, including reduced feeding and fecundity in zooplankton, intestinal damage in fish and reproductive disruption in commercially important oysters. There is very little knowledge about the abundance and distribution of microplastics in the Arctic, however it has been hypothesised that there is a 6th Ocean gyre in the Barents Sea where plastic may accumulate. This study will use the ship's underway system to collect water samples to test this hypothesis and provide currently unknown distribution and abundance data for microplastics in Arctic surface waters.

Methods/equipment

A filter rig was connected to the ship's underway system, which is located on the starboard side of the ship approximately 6m below the surface of the water and was pre-filtered at 6mm. The filtration system progressively filtered surface water over three mesh sizes, starting at 300µm then flowing to 65 µm and finally, 22µm. A water meter was installed to calculate the volume of water passing through the unit and had a 2mm internal filter to prevent clogging. Whilst underway, flow was regulated at between 3 and 10L/min and time, co-ordinates and meter readings were noted at both the beginning and end of each transect. At the end of each transect, the mesh filters were removed from the rig, covered with foil and transferred to a laminar flow cabinet to minimise chance of any external contamination. Each filter was washed thoroughly onto a corresponding sized nylon mesh which was then folded twice and stapled in place, before drying at 50°C for 8 hours in a digital food dehydrator (Callow). Each sample was then wrapped in foil and stored in a -20°C freezer.

Contamination control procedures

All equipment was rinsed thoroughly with filtered water; MilliQ (0.22µm) for the smallest mesh size of 22µm or filtered seawater (FSW 22µm) for the larger mesh sizes. A cotton lab coat was worn at all times and processing of filters was carried out in a laminar flow hood, with a damp GFF filter paper open to the air in a petri dish. The laminar flow hood was wiped clean using blue roll and MilliQ prior to use. Nylon meshes (300µm, 63µm, 20µm) were visually inspected for external contamination prior to washing down filters, using a light microscope (CETI, x20 magnification). Procedural controls were carried out for each transect, following all of the steps used with the samples but using a spare filter (22µm or 65µm).



Filtration rig connected to the ship's underway system, water meter installed at inlet



Processing each filter within the laminar flow hood.

Data collected for each transect undertaken

Date (UTC)	Aprox Transit	Length of time (mins)	Vol water filtered (m^3)	Start Lat/Long	End Lat/Long	Flow Rate (L/min)
11/07/2018	B03 to Tromsø	240.00	2103	N72°04.53' E19°39.41'	N71°11.53' E20°17.42'	10
12/07/2018	Tromsø to B03	288.00	2500	N71°17.77' E20°12.78'	N72°18.99' E19°28.28'	10
13/07/2018	B03 to B13	465.00	3694	N72°41.55' E19°34.47'	N73°29.47' E24°02.63'	10
13/07/2018	B03 to B13	491.00	3537	N73°36.48' E24°42.95'	N74°30.01' E29°59.99'	10
15/07/2018	B13 to B15	1273.00	4258	N74°43.16' E30°00.09'	N78°15.17' E30°00.22'	3
17/07/2018	B15 to B17	431.00	3875	N78°28.20' E30°20.18'	N79°31.40' E30°04.01'	10
19/07/2018	B17 to ice	366.00	2883	N81°19.58' E29°19.72'	N82°08.29' E29°00.66'	10
23/07/2018	B16 to B15	509.00	3674	N79°30.53' E30°07.93'	N78°15.11' E30°00.73'	10
24/07/2018	B15 to B14	196.00	934	N78°12.45' E30°01.78'	N77°26.16' E30°02.00'	3

Results

Samples will be transferred to Plymouth Marine Laboratory for later analysis, where all biological material will be removed via enzymatic digestion and any microplastics extracted, enumerated and chemically identified by Fourier Transform Infrared spectroscopy (FT-Ir).

2.20 Methane

Caroline Jaques
Université Libre de Bruxelles

My goal is to better understand the role of sea ice on the biogeochemical cycle of methane (CH_4). Most of the surface ocean is supersaturated in CH_4 with respect to the atmosphere, and therefore acts as a source (Lamontagne et al., 1973). However, this source is poorly quantified and is, in Polar Regions, further influenced by the sea ice cover. Sea ice was long considered as an inert and impermeable barrier, preventing the efflux of CH_4 to the atmosphere, but some recent studies have highlighted that it might not be that simple. CH_4 excess in surface waters have been measured in the close vicinity of Arctic sea ice (Damm et al., 2015), and high atmospheric CH_4 concentrations were reported above areas with fractional sea ice cover (Kort et al., 2012). Negative CH_4 fluxes were also measured above the ice at some locations in the Arctic (He et al., 2013). Last year, during a winter cruise in Antarctic, a significantly higher CH_4 atmospheric concentration was detected in areas of the Ross Sea known to be "sea ice factories" (C. Sapart, personal communication). These observations show that sea ice is not as inert as first thought and that CH_4 might be produced and/or oxidized in this complex environment.

In order to better understand the processes influencing CH_4 fluxes from sea ice, it is essential to look at both the seawater and the atmosphere. During the JR17007 cruise, I measured dissolved CH_4 in surface water continuously in order to study how it evolves towards the sea ice marginal zone. In parallel, I took discrete water and atmospheric samples for concentration and stable isotope analyses. Most biological, physical and chemical reactions discriminate between heavy and light isotopes. For example, methanotrophic bacteria tend to preferentially consume light CH_4, leaving the remaining pool of methane enriched in heavy isotopes. So, stable isotope signatures ($\delta^{13}C$-CH_4 and δD-CH_4) provide information on the processes responsible for CH_4 formation and removal as they are associated with a characteristic isotopic fractionation. These measurements will help me to unravel the role of sea ice on the CH_4 cycle during the summer season in the Barents Sea.

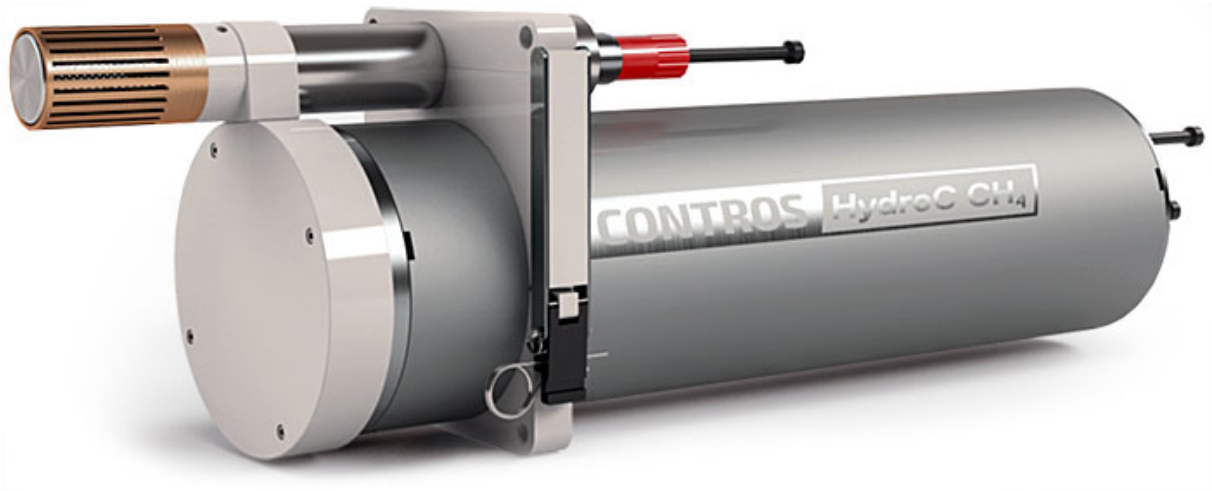
Work achieved here will contribute to a PhD thesis (Jaques, University of Liège), funded outside of the Changing Arctic Ocean research programme.

Dissolved methane

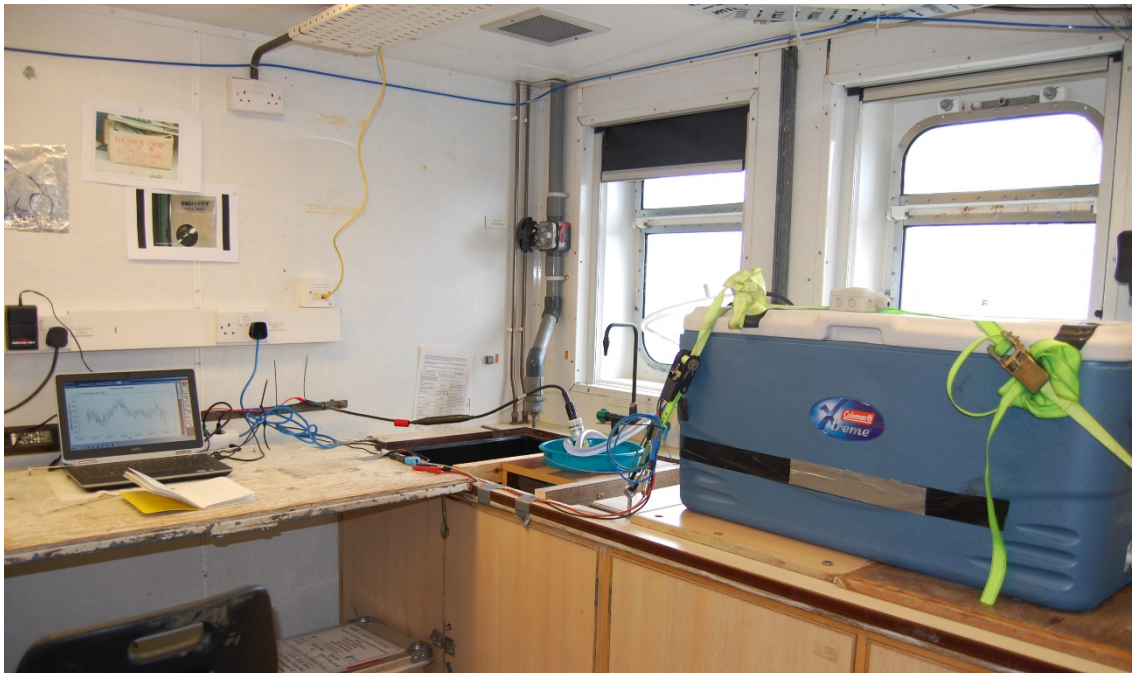
a. Continuous measurements

Methane dissolved in surface water was measured continuously thanks to a Contros HydroC® CH_4 underwater sensor (see figure below). This device consists in a Tunable Diode Laser Absorption Spectroscopy (TDLAS) unit enclosed in a 136x494 mm corrosion-free titanium cylinder. The sensor weighs 12.5 kg and operates at depths down to 1500 m, within a temperature range comprised between -2 and 35°C. Theoretical detection limit and accuracy are <1 µatm and ± 2 µatm respectively.

The sensor is connected to the ship underway non-toxic seawater supply and the flow set to 6 L min^{-1}. It is immersed in a Coleman Xtreme® cooler box to keep the temperature constant (see figure below). Water flowing against the sensor hydrophobic silicone membrane allows dissolved gas to diffuse inside a detector chamber. Light at a wavelength corresponding to the absorption spectrum of CH_4 is emitted through the chamber by a laser. The intensity of the transmitted light is proportional to the pCH_4 in the chamber. The signal is recorded by an internal data logger connected to a computer that displays continuously the output data with the software CONTROS DETECT®.



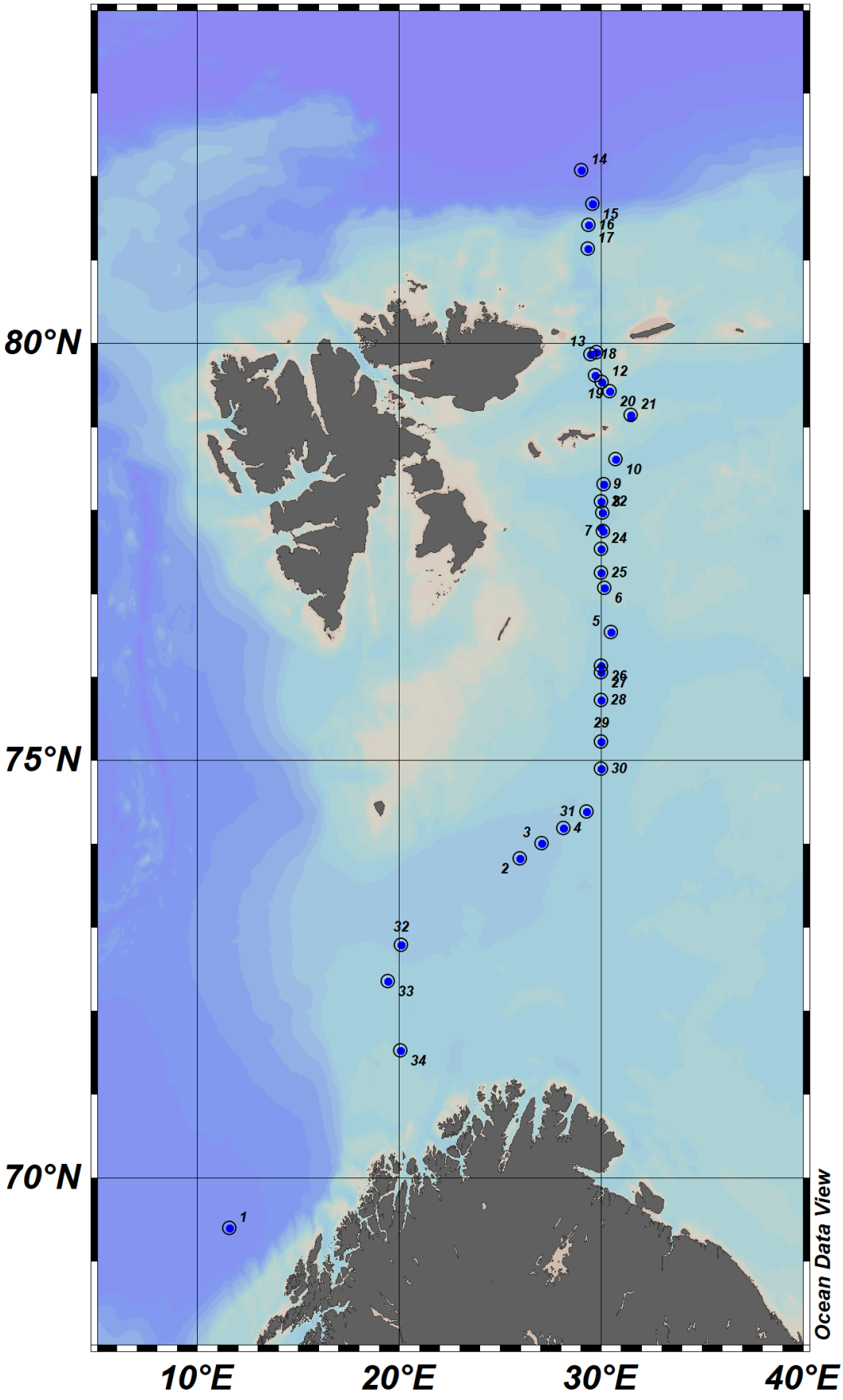
The Contros HydroC® CH4 underwater sensor



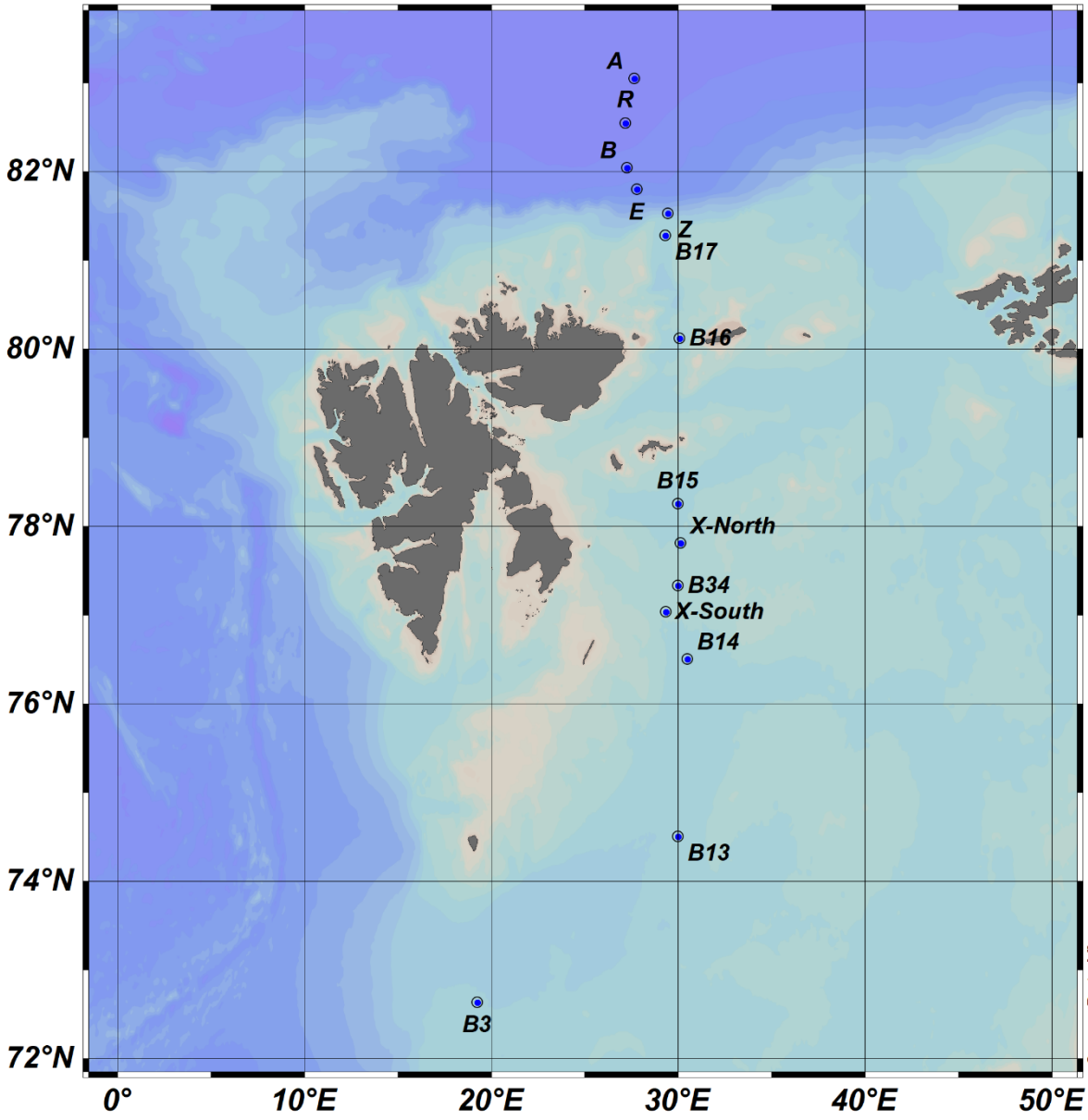
Picture of the continuous dissolved CH_4 measurement set-up, with the sensor in the cooler box, connected to the underway non-toxic seawater supply, and connected to the computer displaying real time values

b. Discrete measurements

Discrete water samples were collected from the ship underway non-toxic seawater supply (see figure below), with great care to avoid trapping air bubbles. At each location, 60 ml were collected for Gas Chromatography (GC) analyses in order to measure dissolved CH_4 concentration and calibrate the sensor, and 2x100 ml for Isotope Ratio Mass Spectrometry (IRMS) analyses to measure $\delta^{13}C\text{-}CH_4$ and $\delta D\text{-}CH_4$. All samples were poisoned with $HgCl_2$ (0.2 $\mu l.ml^{-1}$), closed with a stopper and an aluminium crimp seal and stored at ambient temperature until measurement. Discrete samples were also collected from Niskin bottles at 4 different depths: surface, maximum chlorophyll, under the halocline or 10 m above seabed and at the bottom (see figure below). At each depth, 60 ml were collected for GC analyses and 2x100 ml for IRMS analyses ($\delta^{13}C\text{-}CH_4$ and $\delta D\text{-}CH_4$), and underwent the same treatment as described above.



Discrete water sample locations



CTD stations

The underway non-toxic seawater supply was turned off as we approached the Marginal Ice Zone in order to avoid blocking the pipes. It was therefore not possible anymore to measure dissolved CH_4 continuously, nor taking discrete water samples. However, on the way back from the northern point of the cruise, four CTD were performed during the transition from consolidated sea ice to open ocean, at stations A, R, B and E (see figure above). The Contros HydroC® CH_4 underwater sensor was attached to the rosette during these 4 CTD deployments, to record the evolution of CH_4 with depth (see figure below).



Deployment of the Contros HydroC® CH_4 underwater sensor on the CTD rosette at stations A, R, B and E

2. Lipid biomarkers

Filtrations were performed on surface water and melted sea ice from CTD stations A, R and B. At CTD station E, only water was collected for filtrations as there was no sea ice. Depending on the particulate content, 250 to 2000 ml were filtered, in three replicates. The filters were kept frozen at -80°C. Subsequent lipid biomarker analyses will be performed in order to give an indication on the bacterial communities present both in sea ice and in surface sea water.

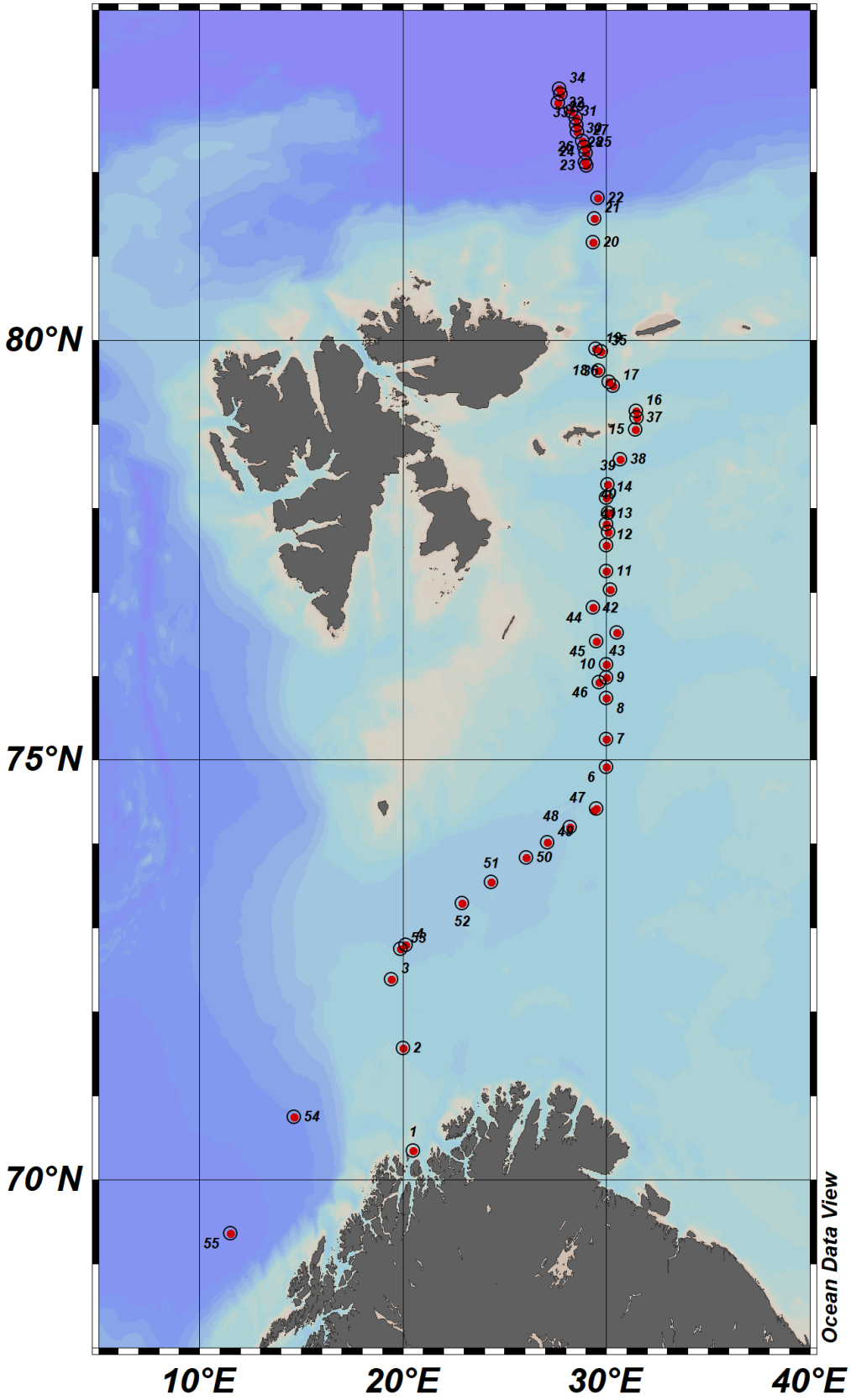
3. Atmospheric methane

a. Continuous measurements

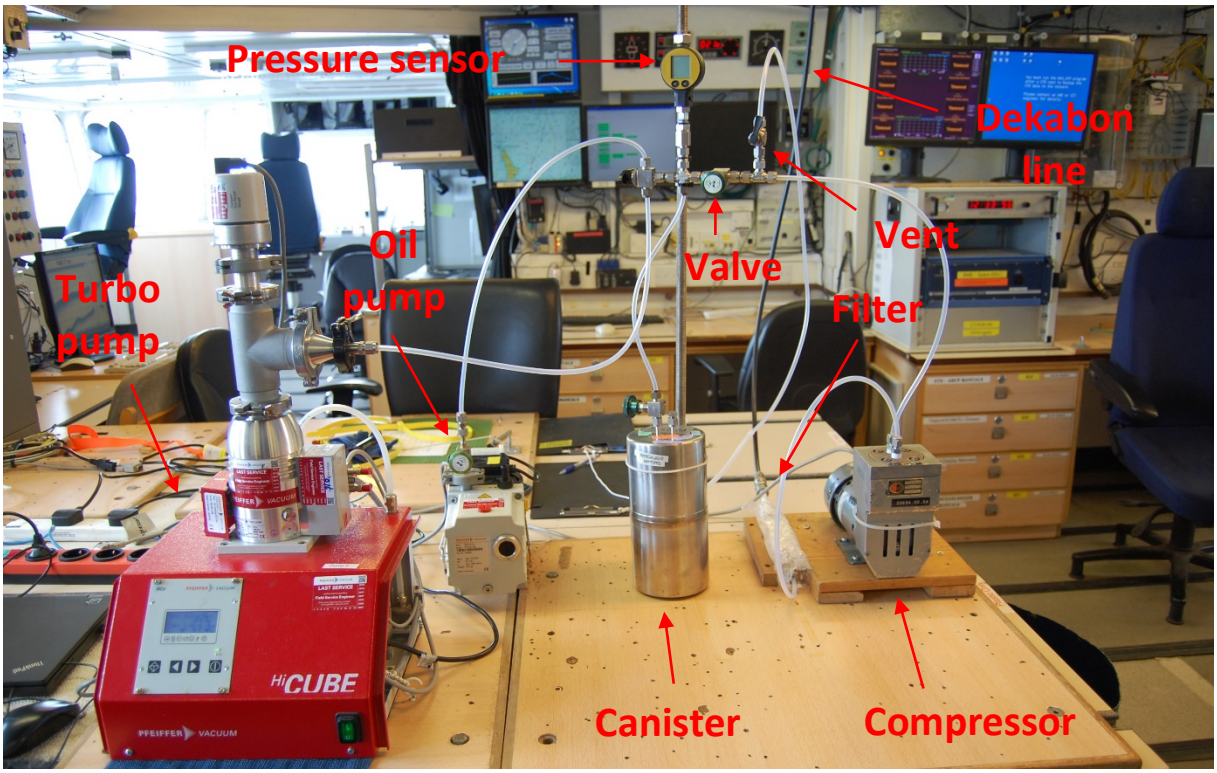
Aboard the RRS James Clark Ross, a Picarro device, operated by Neil Brough from the British Antarctic Survey, measures atmospheric CH_4 and CO_2 concentration continuously. These atmospheric continuous measurements were helpful to decide when taking discrete atmospheric samples, and complemented the water continuous measurements.

b. Discrete measurements

Discrete atmospheric samples were collected at 55 locations (see figure below). An inlet attached in front of the bridge was connected to the sampling unit inside the UIC room by a dekabon line. The sampling unit is described in the figure below. First, the canister is evacuated using the oil pump then the turbo pump. In the meantime, the compressor is switched on and the vent opened to evacuate the dekabon line during a few minutes. Once the canister has been evacuated down to $5x10^{-5}$ mbar, the pump is switched off, the vent is closed and the valve opened, to fill the canister up to 3.5 bars. The filter, located at the end of the dekabon line and before the compressor, is filled with glass wool and magnesium perchlorate, in order to absorb water vapour. These canisters will be brought back in the lab where the CH_4 concentration and stable isotopic composition will be measured.



Discrete atmospheric sample locations



Description of the discrete atmospheric sampling set-up

References

Damm, E., B. Rudels, U. Schauer, S. Mau, and G. Dieckmann (2015), Methane excess in Arctic surface water- triggered by sea ice formation and melting, Sci. Rep., 5, 16179.

He, X., L. Sun, Z. Xie, W. Huang, N. Long, Z. Li, and G. Xing (2013), Sea ice in the Arctic Ocean: Role of shielding and consumption of methane, Atmospheric Environment, 67, 8–13.

Kort, E. A., S. C. Wofsy, B. C. Daube, M. Diao, J. W. Elkins, R. S. Gao, E. J. Hintsa, D. F. Hurst, R. Jimenez, F. L. Moore, J. R. Spackman and M. A. Zondlo (2012), Atmospheric observations of Arctic Ocean methane emissions up to 82◦ north, Nature Geoscience, 5, 318–321.

Lamontagne R. A., J. W. Swinnerton, V. J. Linnenbom and W. D. Smith (1973), Methane concentrations in various marine environments, J. Geophys. Res., 78, 5317-5324.

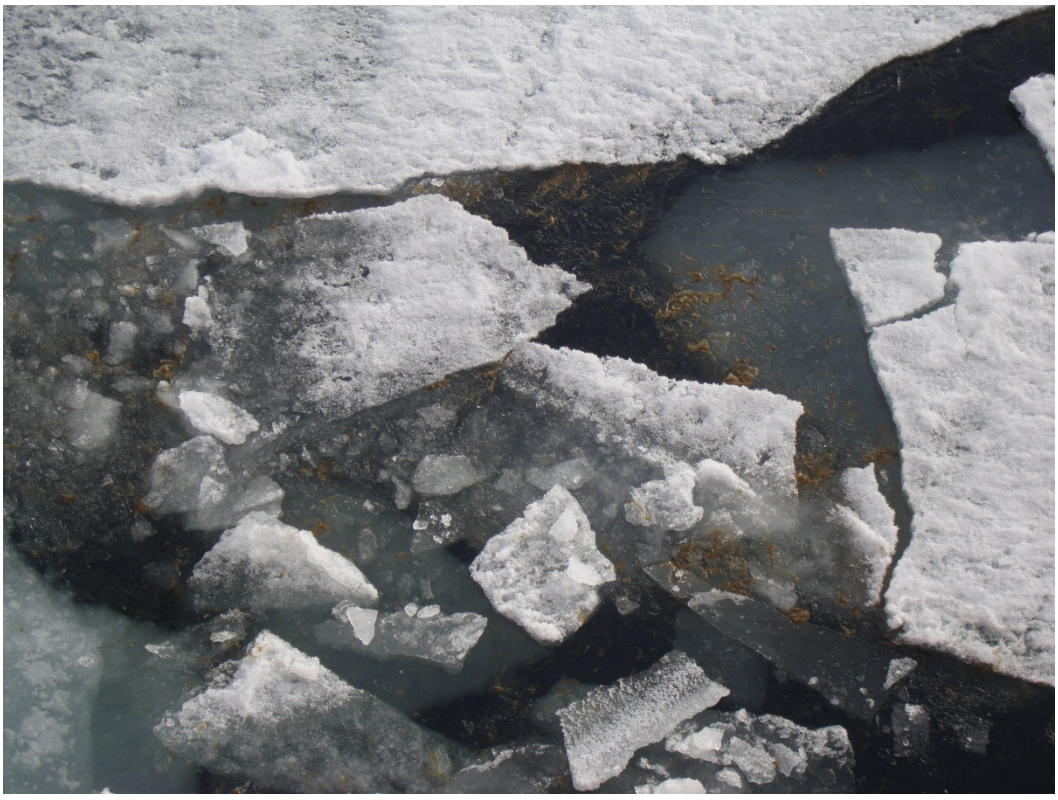
2.21 Arctic Sea Ice and Algal samples

Mark Stevenson (Newcastle), Caroline Jacques (ULB), Allyson Tessin (Leeds), Sian Henley (Edinburgh), Patrick Downes (PML & Bristol), Louisa Norman (Liverpool), Martin Solan (Southampton)

Sea ice and algal samples were collected from three stations (A, R & B) between 83.04 and 82.04 ° N, to enable analysis of nutrients and potential future characterisation of DOC, lipid biomarkers, particulate $\delta^{13}C$/ $\delta^{15}N$ and pigments.

Rationale

Arctic sea ice provides a key ecosystem for algal production, fixing carbon due to the presence of algae attached on, under and within the ice. During the summer melt period warmer temperatures and a variety of habitats (pools, meltwater cracks, under ice) facilitate the growth of diverse algal communities. However, currently our understanding of how algal community composition changes across the ice edge margin in this region is limited. Variations across the ice edge are possible due to the unique sea ice flow patterns north of Svalbard, influenced by weather patterns, ocean current flows and the presence of land.



Sea ice broken during the ships movement, together with visible ice algal mats (Photo M.Stevenson).

Changes in the thickness and extent of sea ice between the ice edge and the inner ice could be distinct, or may instead change gradually along this transect. Key controls on algal community composition include availability of nutrients and presence of particulate/dissolved organic matter on the ice, which is linked to the presence of multi-year ice, atmospheric deposition and the initial source of the transported ice. Algae are predominantly fixers of carbon through primary production. However, when nutrients are limited they may adopt mixotrophic strategies, either directly consuming organic matter or by utilising energy released from bacterial colonies to supplement growth.

Aim

Characterise algal community composition along an Arctic sea ice margin gradient/transect and determine the relative extent of autotrophic and heterotrophic production.

Methods

At each station the ships hydraulic crane attached to a steel mesh shipping basket was used to collect pieces of broken sea ice, after movement through the ice by the JCR. Visible algae was collected using stainless steel forceps and placed into ashed foil, sealed in plastic bags and frozen at −80 °C. Ice chunks were broken from larger pieces of ice using a steel mallet covered in decarbonised previously ashed foil and placed into three 10 litre buckets that had previously been HCL acid washed overnight and rinsed three times. Ice was stored at 4 °C until fully melted prior to filtration for the proposed analyses (see below). Filtration and preparation of samples for specific analyses follow the standard methodology detailed in the relevant sections of this report.

At station R due to the high abundance of algae visible within surface waters buckets were used to collect free floating algal mats and left to settle, prior to filtration through a 100 µm sieve and to facilitate direct collection of sample with stainless steel forceps. Additionally, four algal mat sub-samples from station R were treated with Lugol's iodine to enable phytoplankton and diatom enumeration.

Sample types collected

From water filtrates

Pigment analysis – determine algal community composition.

DOC – quantify the generally more labile 'dissolved' fraction of sea ice.

Nutrient analysis (ammonium, silicate, phosphate, nitrate, nitrite) – to determine if these environments are nutrient limited (Sian 60 ml per station).

Lipid analysis – *n*-alkane/*n*-alkanoic acid analysis could be used to determine if the organic matter present is labile or recalcitrant and also indicate if any is terrestrially sourced. Additional filter papers through collaboration with colleagues at NIOZ are proposed for novel biomarkers of microbial and bacterial activity associated with sea ice algae.

Bulk POM/$\delta^{13}C$ & $\delta^{15}N$ – to help determine the sources of organic matter, its reactivity and position of sea ice algae in the arctic food-web.

Barium – to investigate fluxes of Ba from sea ice to the surface ocean, which is thought to affect the use of Ba as a constant water mass tracer.

From under ice algae 'scrape'

'Scrape' samples for pigment analysis & possible diatom analysis.

For the 'Public Dissemination of Science'

A single piece of sea ice approx. 30 x 50 x 70 cm was collected and stored at −20 °C and will be maintained at NOC-Southampton as a visual cue for presentations and community events of sea ice loss in the Arctic.



Collection of sea ice using shipping basket attached to the JCR's hydraulic crane (Photo M.Solan).

Samples collected

Station	Event	Samples collected	Time	Date	Lat	Long
Ice Station A	E158 – Ice	Pigments, biomarkers x6 (Stevenson). Biomarkers x 3 (Jacques). Algal samples for −80 °C x2 (Stevenson). Nutrient analysis x1 (Henley). DOC x1 (Stevenson). Bulk POM/$\delta^{13}C$ & $\delta^{15}N$ x2 (Henley, Norman). Barium x1 (Tessin/Horner).	23:19:00	20/07/18	83.04907	27.68574
Ice Station R	E159 – Ice	Pigments, biomarkers x6 (Stevenson). Biomarkers x 3 (Jacques). Algal samples preserved with Lugol's x4 (Stevenson, Downes). Algal samples for −80 °C x2 (Stevenson). Algal samples for 4 °C x2 (Stevenson). Nutrient analysis x1 (Henley). DOC x1 (Stevenson). Bulk POM/$\delta^{13}C$ & $\delta^{15}N$ x2 (Henley, Norman). Barium x1 (Tessin/Horner).	09:58:00	21/07/18	82.56536	27.30297
Ice Station B	E160 - Ice	Pigments, biomarkers x3 (Stevenson). Biomarkers x 3 (Jacques) Algal samples for −80 °C x2 (Stevenson). Nutrient analysis x1 (Henley). DOC x1 (Stevenson). Bulk POM/$\delta^{13}C$ & $\delta^{15}N$ x2 (Henley, Norman). Barium x1 (Tessin/Horner).	16:56:00	21/07/18	82.04384	27.25771

Note: *The use of the hydraulic crane with attached mesh basket is not a piece of designated science equipment so a unique event number was not allocated. However, since ice was obtained immediately following CTD casts (E158, E159 & E160) samples have been designated '- Ice', but with time, date and position updated for the specific ice collection.*

2.22 Underway navigation, sea surface hydrography and meterology

[1,2]Joana Beja, BODC
[1,2] Author and Dataset PI

2.22.1 Overview

Continuous measurements of navigation, surface hydrography and meteorology parameters were taken during the cruise. The instruments collecting the data are located in different places on the ship: navigation systems in and above the bridge, bathymetry instruments in the hull; meteorology sensors are all located on the met mast at the front of the ship, with exception of the anemometer, which is on a mast above the bridge and the barometers located inside the ship in the ship's Underway Instrumentation Control room. The surface hydrography instruments are located in the ship's hull and the prep lab.

The data were collected by: GPS systems, gyrocompass, multibeam and echosounder, two barometers, two PAR, two TIR, two air temperature and humidity, one anemometer, two temperature hull sensors, one thermosalinograph, one flow meter one fluorometer and one transmissometer.

Details on the various instruments makes, models, serial numbers and last calibration dates are included in the AME report as an annex to this document.

2.22.2 Data logging

Data was continuously logged to individual ascii files in a .ACO format. These files contain a similar structure, the first four columns relate to date (Year, Day of the year, integer day of the year, decimal day of the year), followed by the data itself. .TPL files are also created during acquisition and describe each file's parameters and units.
Throughout the cruise the non-toxic water supply was switched off at various stages: when sailing through ice or when cleaning the filters due to debris accumulating and preventing a regular flow.

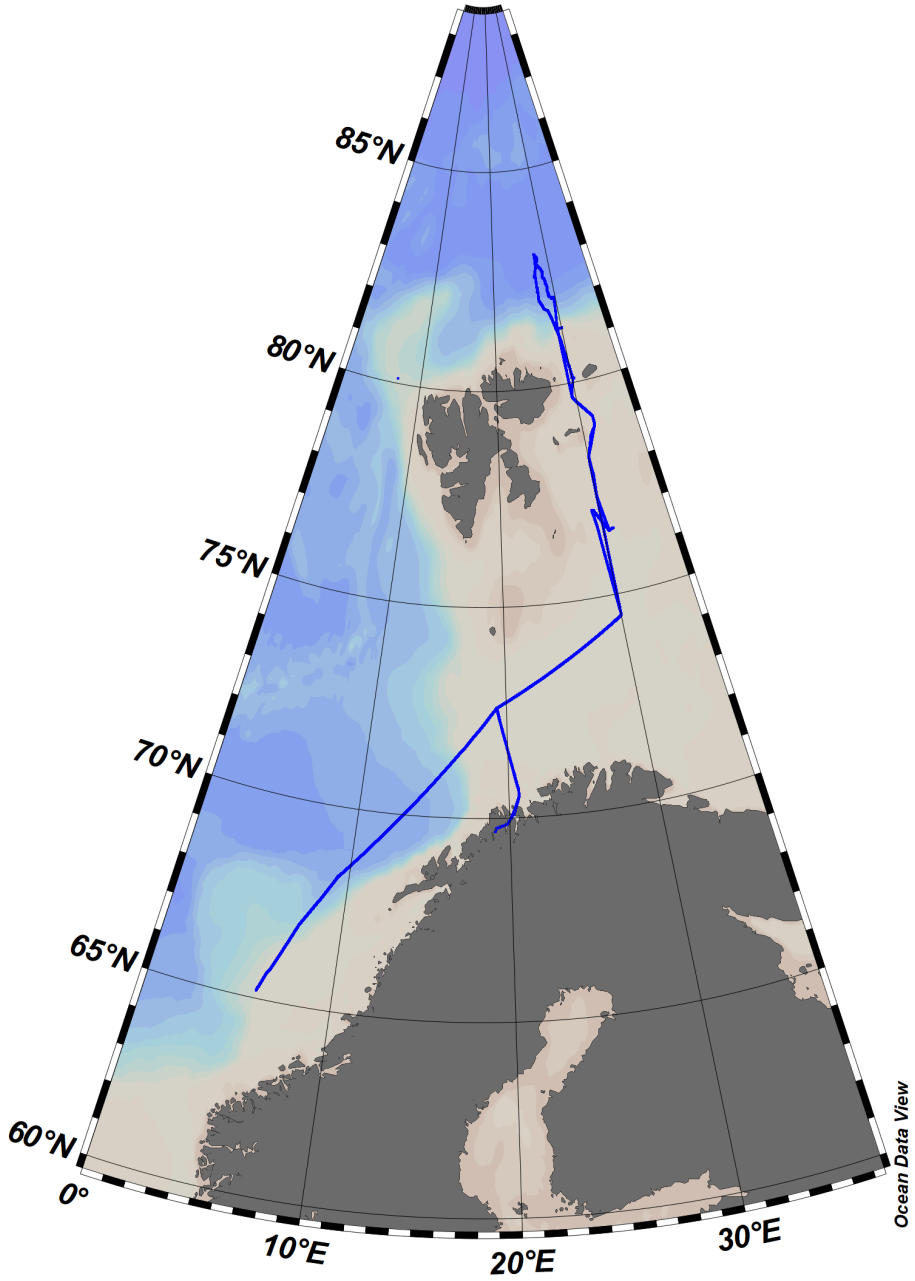
No data were processed or calibrated on board, but salinity samples were taken at regular intervals and analysed on board and will be used to determine a salinity calibration.

2.22.3 Preliminary data

The graphs included in this report refer to raw, uncalibrated data and should be used only as a reference as no quality control has been done on the data.

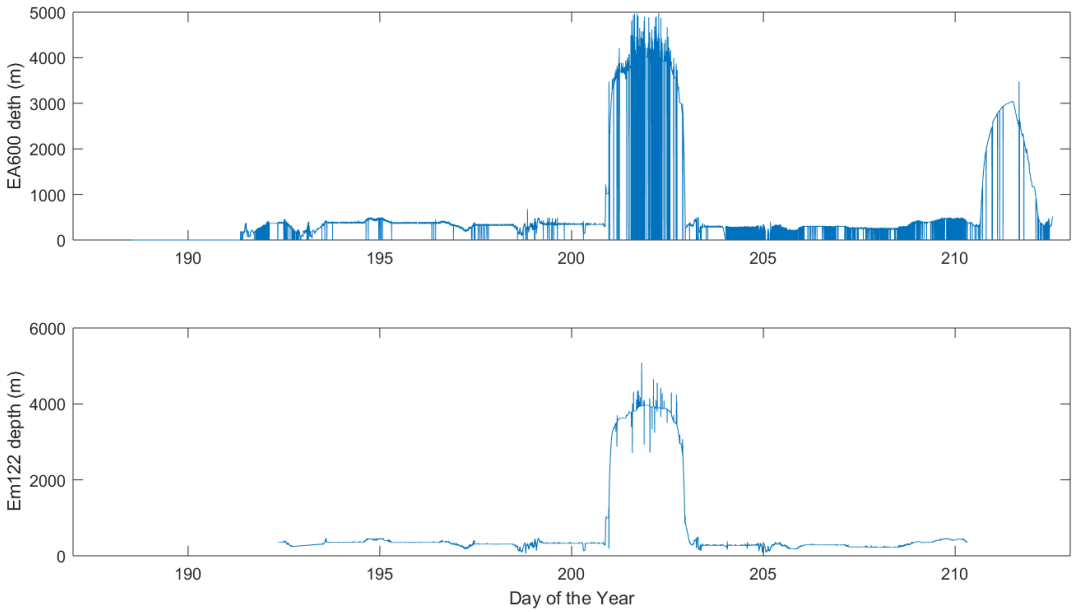
Navigation

There was a power outage during the cruise which affected data logging, more details can be found on the IT document included in this report. The cruise track, using the full resolution data is presented below.



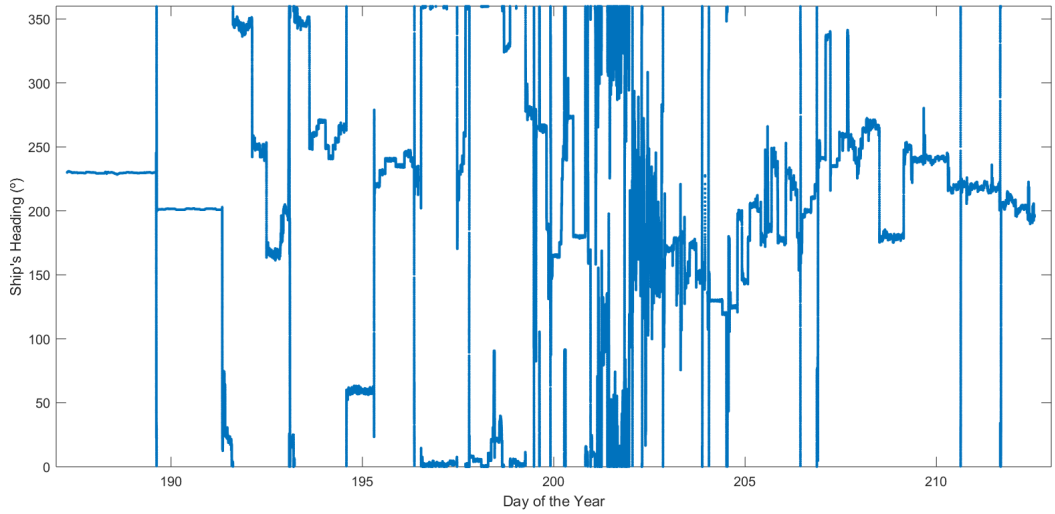
Cruise track during JR17007

Bathymetry data was collected with the EA600 (single beam echosounder) and the EM122 (Multibeam echosounder). The raw data is presented in the graph below. The EM122 collected less data than the EA600 but, for the periods where both instruments were logging data, the latter appears to be cleaner than the former. The EA600 data exhibits several drops to zero and some noisy data which needs to be cleaned to produce a more accurate depiction of the seabed depth. The data presented here should not be used for navigation purposes.



Bathymetry data as collected by the EA600 and EM122 during JR17007

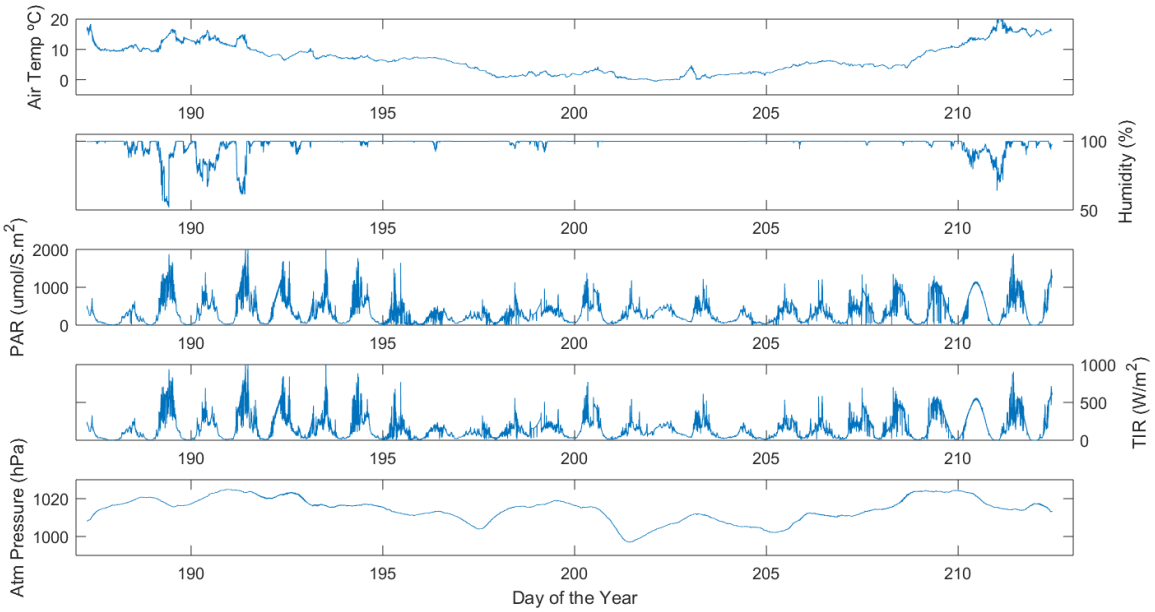
Data from the ship's gyrocompass is presented below. No processing or quality control has been applied to these data, so caution should be used when interpreting the data.



Ship's heading during JR17007

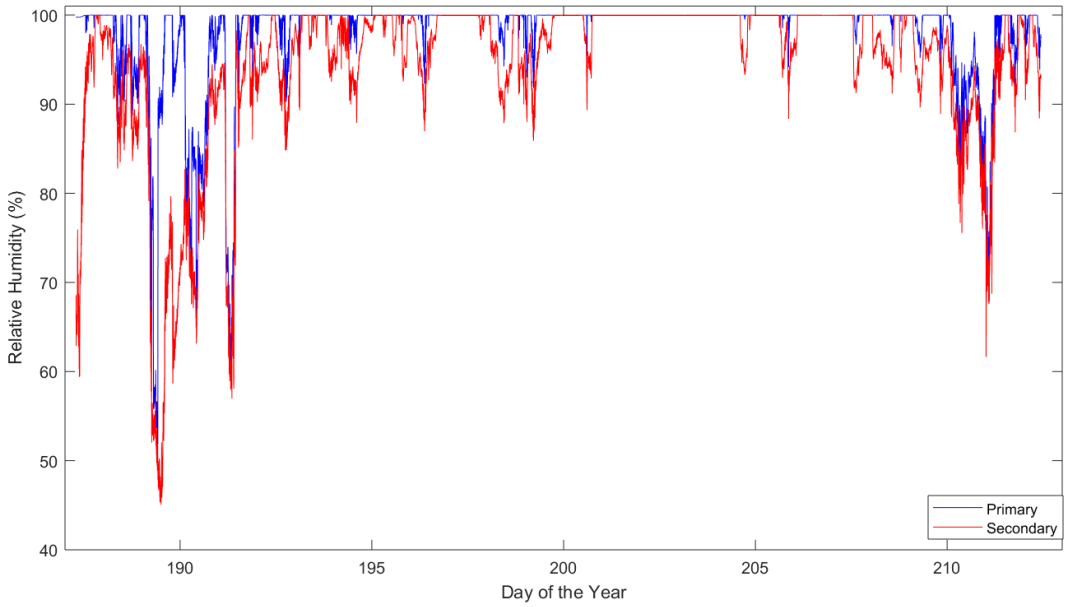
Meteorology

Data from the duplicate sensors was visually checked and for most sensors, there was a good comparison, with minimal differences identified. The graph below includes the primary meteorological data as collected by the ship's sensors. As previously mentioned, these data have not been processed or quality controlled, so caution is advised when interpreting them.



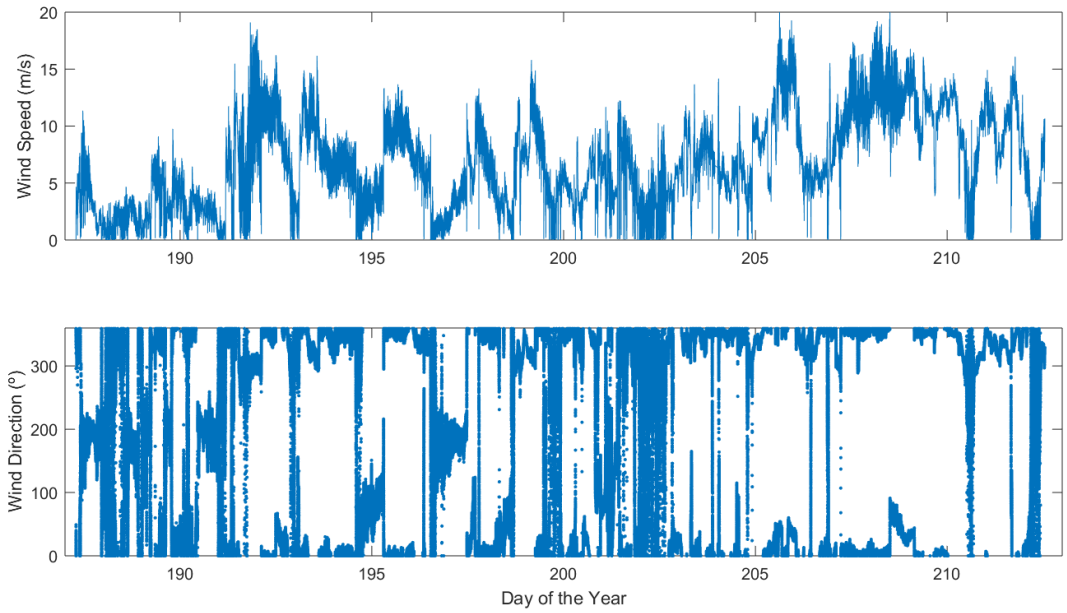
Meteorology parameters during JR17007

The main differences between duplicate sensors were identified in the Relative Humidity data. Further analysis is needed to determine the cause for the differences in the data, but they can be due to condensation, flooding and or freezing of the sensor, etc.



Relative Humidity data from primary and secondary sensors during JR17007

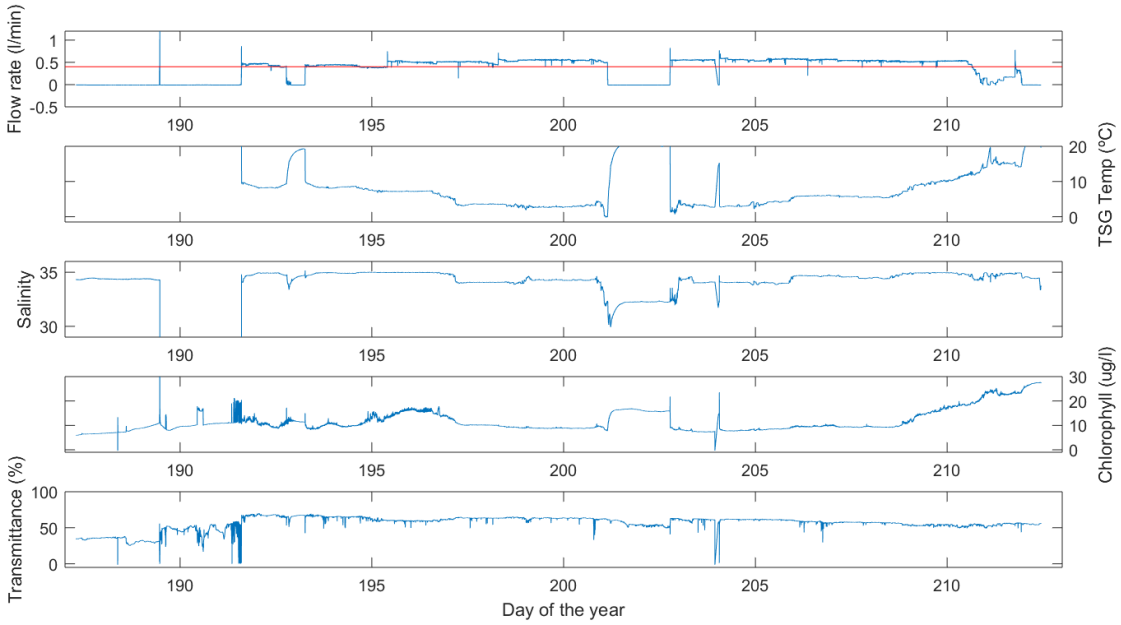
The wind data is included below. As before, these data have not been processed and the wind direction is not relative to the ship as no conversions have been applied.



Wind speed and direction during JR17007

Surface Hydrography

The figure below includes several surface hydrography parameters plotted alongside the flow meter. The flow meter rate varied throughout the cruise and it is possible to identify the periods where it was below the minimum threshold accepted for good quality data (0.4 l/min- represented as a red horizontal line on the first plot). The periods where the flow meter data (in blue) was below the red line should be used as a guide to quality control the remaining parameters. For all those periods, the temperature, chlorophyll, salinity and transmittance data should be used with caution.



Surface hydrography parameters during JR17007

2.23 USNL cores for SAMS

[1,2]Joana Beja (BODC), [2]Bhavani Narayanaswamy (SAMS)
[1,2] Author and Dataset PI

A total of 7 USNL corer deployments were performed on station B34, for biological measurements These corers were deployed on behalf of Bhavani Narayanaswamy from SAMS. Three of these deployments failed and no samples were collected. More details about each deployment can be found on the cruise event log included in the report.

Deployment procedures were the same as used for other USNL activities on board the cruise.

Sampling methodology
Once the corers were on deck, three distinct layers (0 to 5 cm, 5 to 10 cm and 10 to 15 cm) were sampled and sieved through a 0.5 cm mesh. The contents remaining from the clay sieving were then stored in plastic containers and 10% formaldehyde solution. Further analysis will be done at SAMS.

Part III. Support reports

3.1 AME Scientific Ship Systems Cruise Report

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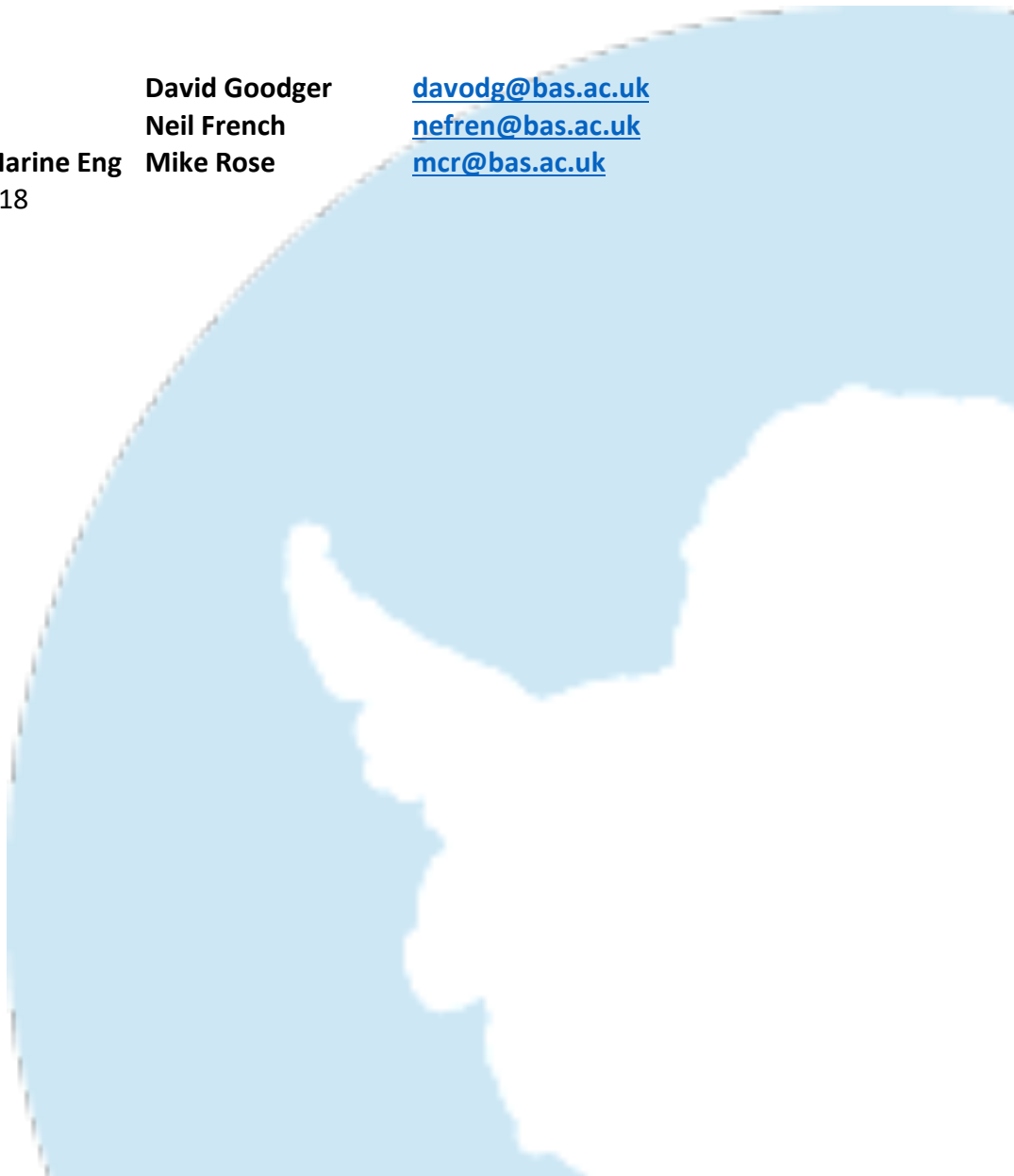
BAS Instrument Contact	**Neil French**	nefren@bas.ac.uk
Head of Antarctic and Marine Eng	**Mike Rose**	mcr@bas.ac.uk

Compiled on: 30 July 2018
For Cruise: JR17007



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Cruise Summary

Cruise	Departure	Arrival	AME Engineer(s)
JR17007	08/07/18 (Norway)	10/08/18 (UK)	David Goodger (davodg@bas.ac.uk)

This Cruise is part of the Chaos Science Program, with A small number of CTS's at 8 stations and a large amount of box coring, some science was carried out on the water from the underway system as well as air chemistry.

This Remit was expanded opportunistically with an additional 3 stations and 8 CTD's, Ice sampling and attaching a methane measurement system to the CTD.

Noteworthy Ship wide events

The ship experienced a full power failure on the 22/07/2018 from 22:40 to 23:36 UTC. This appeared to have no detrimental effect on system and the vast majority restarted automatically. There was a period of data loss on, ocean logger, Swath, and the underway water pumps stopped until they were manually started again. For more detail see the IT report

Instrumentation

Systems used on cruise. All Data sheets were supplied as part of the cruise "legwork" files

Instrument	#SN if Used	Make and Model	Comments
Lab Instruments			
AutoSal	63360	OSIL 8400B	Operated By Science Team, Seen Notes
Scintillation counter	SGTC20150612	PERKINELMER TRI-CARB 2910TR	Failed on JR17006, See Notes
XBT	No		
Acoustic			
ADCP	No		
EM122	Yes	Kongsberg	Operated Opportunistically
TOPAS	No		
EK60/80	No	Kongsberg EK60/80	
K-Sync	Yes	Kongsberg K-Sync	
SSU	No	Kongsberg Sounder-Sync Unit	
USBL	No	Sonardyne Ranger 2	
10kHz IOS Pinger	No		
Benthos 12kHz Pinger	No		
Benthos 14kHz Pinger	No		
Mors 10kHz Transponder	No		
EA600	Yes	Kongsberg EA600	Bridge Equipment but logged
Oceanlogger			
Barometer1	V145002	VAISALA PTB210B1A2B	Inside the UIC
Barometer2	V145003	VAISALA PTB210B1A2B	Inside the UIC
Air humidity & temp1	60743897	Rotronic Hygroclip 2	On Foremast, See Notes
Air humidity & temp2	61698922	Rotronic Hygroclip 2	On Foremast, See Notes
TIR1 sensor (pyranometer)	172882	Kipp & Zonen Sp Lite2	On Foremast
TIR2 sensor (pyranometer)	172883	Kipp & Zonen Sp Lite2	On Foremast
PAR1 sensor	160959	Kipp & Zonen PQS-1	On Foremast
PAR2 sensor	160960	Kipp & Zonen PQS-1	On Foremast
Thermosalinograph	453893-0130	SBE45	PrepLab
Transmissometer	846DR	Wet Labs C-Star	PrepLab
Fluorometer	1498	Wet Labs WSCHL	PrepLab
Flow meter	05/811950	LitreMeter F112-P-HC-AP-OR-PP	PrepLab
Seawater temp 1	3862856-0599	SBE38	Sea Inlet
Seawater temp 2	3862856-0601	SBE38	Sea Inlet

Table 1

Instrument	#SN if Used	Make and Model	Comments
CTD			
Deck unit 1	11P15759-0458	SBE11plus	
Underwater ACD/ Depth	09P15759-0480	SBE9plus	
Temp1	032705	SBE3plus	
Temp2	03P5042	SBE3plus	
Cond1	042222	SBE 4C	
Cond2	042255	SBE 4C	
Pump1	054488	SBE5T	
Pump2	052371	SBE5T	
Standards Thermometer	3527735-0024	SBE35 0024	
Transmissometer	1399DR	Wet Labs C-Star	
Oxygen sensor	432291	SBE43	
PAR sensor	70688	QCP2350	
Fluorometer	088-249	CTG Aqua Tracker MkIII	
Altimeter	10127.244740	Tritech S10127 232	
CTD swivel linkage	961018	Focal Technologies Group	
LADCP Master Down	14897	TeleDyne WHM300	
LADCP Slave Up	15060	TeleDyne WHM300	
Pylon		SBE32	
Other ship's systems (non-AME)			
Anemometer	Yes		Bridge Equipment, logged
Ships Gyro	Yes		Bridge Equipment, logged
System(s) brought by science team (non-AME)			
Dissolved Methane Sensor	Yes	Kongsberg	See CTD Notes

Heading and Course Instruments

Seatex

The ship operates a dual frequency phase detecting GPS system, this emulates a gyroscope and is more accurate that the ships Gyro. It should be used rather than the ships Gyro. It was not affected by the power outage but the data logging was.

Ships Gyro

The ships gyro is the ships primary heading system, but it is currently 10° out of specification. It should not be used for scientific purposes. It was logged throughout the cruise but that logging effected by the power down event in section 1.1.

Lab Instruments

AutoSal

Scintillation Counter

Prior arrival on the ship I had been made aware that the Scintillation Counter was not functional and had instructions to contact a service tech in Norway and make a best effort to fix it. I was put into contact with the system design engineer via the phone. While on the phone, myself,

the Radiation Protection Officer (RPO) (Patrick Downes) and the Deck Eng accessed the system diagnostics software and found the issue. The vial return spring which was stretched (a part on the aging process). We didn't have a spare or the specialist tools needed to remove and reseat the table so the system was deemed to be inoperable. The Captain, the RPO and the none-BAS Science team had not been made aware of the issue before the Cruise. This is a major H+S concern as this is the main safety system to test for radioactive contamination. The ships senior officers, lab manager and PSO should have been notified prior to boarding the vessel.

Notes for Acoustic Systems used

K-Sync

The K-Sync allows multiple acoustic systems to run simultaneously. It functioned throughout the cruise and worked correctly, other than the power down mentioned in at the start of this document

EM122

EM122 was run opportunistically on this cruise with the system logging and providing a more accurate depth. The bridge requested that logging was stopped while on station to "save resources". This should have little to no impact on data although seems unneeded as we have vast amounts of data space.

EA600

EA600 is the bridge depth Echo sounder, but is logged by IT, it had no issues on the cruise bar the power down on the 22nd, see section 1.1

Oceanlogger

Ocean logger collects Humidity, Temperature, Radiation, Sea Temperature, Conductivity, flow rate, Transmittance and fluorimeter values from the foremast, or underway systems and logs them. It functioned throughout the cruise, excluding the power down described in section 2. The humidity sensors where found to be reading high throughout the cruise and had been for some time (over 30 days) on the day where the change appeared to happen the ship went through heavy seas, this could indicate flooding or salt crystals on the sensor. Maintenance of this system was unavailable for the duration of the cruise due to the crane and man-basket not being used at sea. It is noteworthy that this is one of the system which didn't auto-start after the power down but required manual intervention. Excluding the humidity all other systems appeared to function well throughout jr17007. The oceanlogger was stopped on 01/08/2018 at 14:45 for demobilisation.

CTD

Basic Stats			
Number Of Casts	20	Number of Successful Casts	20
Max Depth	1000	Min Depth	94
Cable Removed (m)	10m	Number of Re-terminations (elect.)	0

Table 2

Information about CTD configuration

The Instruments for the CTD can be seen in section 3.1, with no sensors having issues over JR17007. Figures 1, 2 and table 1 shows the systems physical layout and measurements with all bar two bottles removed for visibility. This system was constructed from a range of equipment, with NMF's mechanical elements and BAS's electronic. This was to accommodate the 20l bottles requested by the Science team and was on the ship from the previous two cruises (17005 and 17006). In the case of CTD deployments 006 to 010 a methane sensor was attached to the system. This logged as a standalone system and the data was recovered by the scientist involved.

Name	Purpose	Distance from Base of Frame to bottom of Sensor (mm)
Altimeter	Distance to sea bed (max 100m)	45
LADCP Master	Downward Facing LADCP	110
T1/T2	Temperature at 24Hz	284
Fluorimeter	Measures Florescence	313
9+	Communications and Pressure measurement	358
C1/C2	Conductivity Cells	362
Dissolved Oxygen	Oxygen in the Water	388
Bottles	Water collection (24)	452
Transmissomiter	Measure of light transmitted through water	522
SBE35	Accurate Temperature sensor	800
Par	Radiation Sensor	1299
LADCP Slave	Upwards Facing LADCP	1328

Table 3

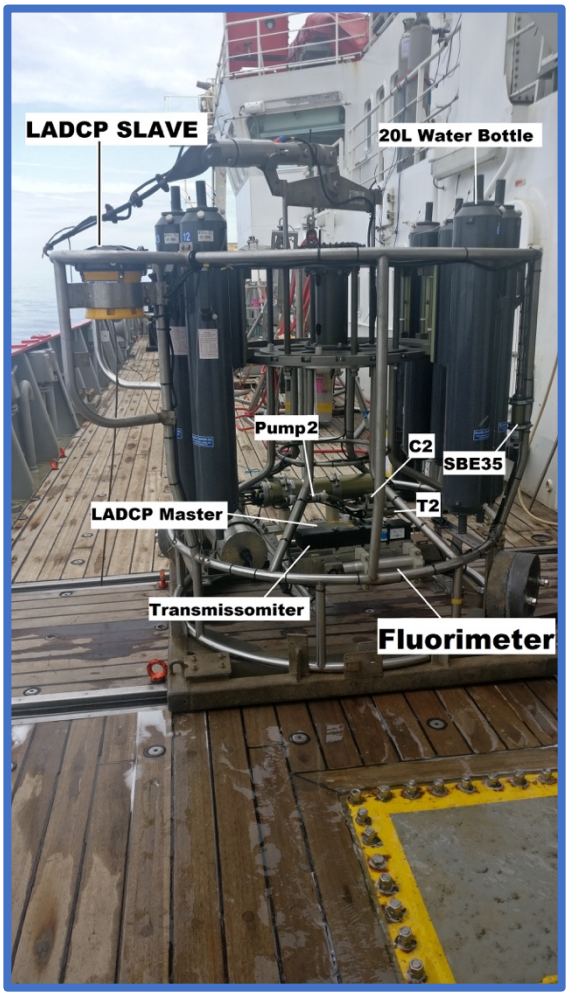

Figure 1

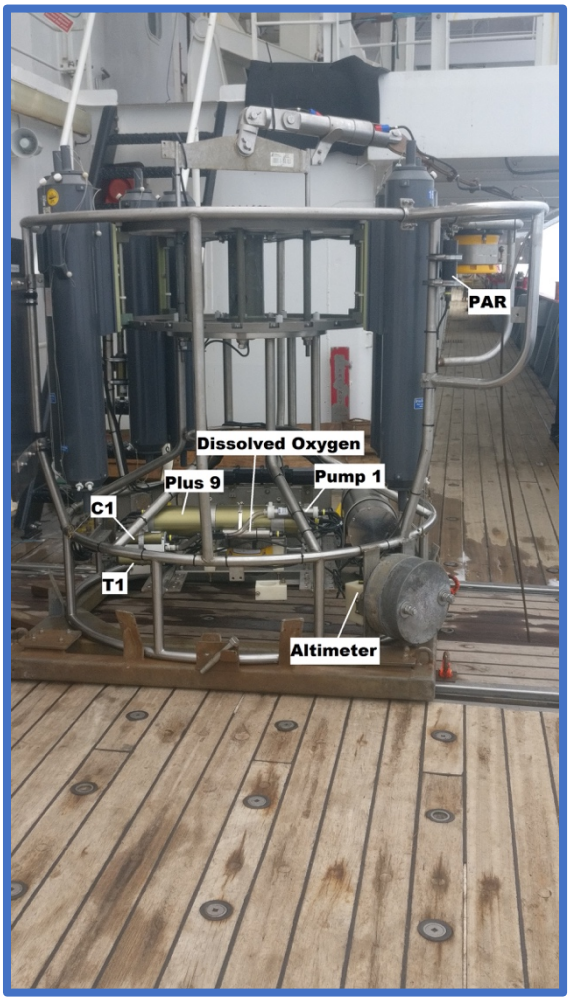

Figure 2

CTD Deployment Procedure

Prior to deployment all bottles are cocked and the deionised water is vented from the T/C sensors. Predeployment technical tests are carried out on the LADCP's and are logged. The LADCP is then activated and starts logging.

Once the Deck crew and winch operator are ready the CTD is lifted into the water and lowered to 10m, where power is started and logging begins. It is held here until the operator sees the difference between T1 and T2 stabilize. This can take some time, especially if the air temperature and sea temperature are far apart. At a minimum the wait is 3 minutes. In some circumstances, mainly turbulent surface waters it can be necessary to lover the CTD to 20m or further where the temperature is more stable, this is at the operator's discretion. Once stable, the CTD is lifted to as near to the surface as the winch op deems safe then is lowered to the bottom depth without stopping. This depth is an approximation from the best echo sounder available, commonly the EM122. Once within 100m of the sea bed the altimeter is used to stop approximately 10m from the sea bed. From here some adjustment can be made to get closer, this is done at the operator's discretion. Once the down cast is complete bottles are fired at requested depths, in order, deepest first. When each bottle is fired 15 seconds are given to ensure that the independent standards thermometer has time to take a reading.
Once on the surface the CTD is returned to the vessel, the C/T sensors are filled with deionised water to avoid damage. All data is backed up as soon as possible.

Additional work completed on cruise

Brussels University Instrument setup

On arrival the scientists from the University of Brussels equipment needed heavy modification to function, this included; construction of DC power supplies, modification of instrument housings, construction of mounting points for equipment, additional waterproof cables, and the installation of an Air Line. The experiment was also reliant on use for the UIC Piccaro, which is not maintained on the ship, but was functioning to the extent needed by the scientist, Data for this instrument is not collated by the ships systems and will need to be requested from Neil Brough (nbro@bas.ac.uk). Part of this experiment was also briefly mounted on the CTD(figure 3).



Figure 3

PML Flume Issues

The processing of some of the sediment was carried out by a flume in the cold room, but the equipment provided was not satisfactory. The experiment lacked a spares package, requiring new fittings to be machined during the cruise. The control computer was a widows 98, Toshiba laptop made in 1999, which had many issues. No copies of the software had been brought so without the tools to build a solution a replacement wasn't an option. It took some time to get the experiment running stably. Better advice or even screening of equipment lists/ bols may help avoid this in the future.

BAS Piccaro Air Sampler (UIC)

Some work was carried out for Neil Brough on the BAS Piccaro in the UIC. The main data collection unit is functioning perfectly but the secondary unit which controls the calibration and gas valves isn't communicating with the control PC. Upon arrival the control PC was switched off. The instrument and data was expected to be used by a Scientist on the cruise.

3.2 IT Engineer's Report
Andrew England and Phill Richardson, both from BAS.

1. Data Logging / SCS

The SCS server and data logging systems worked well throughout the cruise but logging had to be restarted mid-cruise due to a ship wide power outage. The uninterruptible power supply (UPS) for the rack containing the SCS was unable to support the load for the entire outage and lost power after 45 minutes.

Time & Date (GMT)	Event
2018/07/06 06:52	ACQ restarted, newleg run (Leg: 20180706)
2018/07/22 22:40	Power outage stops logging by anemometer, winch, dopperlog, tcount, ea600, em122, emlog-vhw, emlog-vlw, furuno-{gga,gll,rmc,vtg,zda}
2018/07/22 22:55	Power outage stops gyro logging
2018/07/22 23:25	ACQ stopped due to power outage
2018/07/23 00:20	Power restored and ACQ restarted
2018/07/09 xx:xx	ACQ restarted, end of leg

Between 2018/07/22 22:41:21 and 23:25:36 data logged from data from seatex-gga, seatex-gll, seatex-vtg and seatex-zda is intermittently malformed due to the power outage.

2. Other systems

The other systems on board, the JRLB unix fileserver, SABRIS systems and ESX server all worked without any serious issues. The EM122 and EA600 powered down during the outage on the 22nd July and required restarting.

APPENDIX
Ship log

Time	Event	Lat	Lon	Comment
29/07/2018 07:49		72.63282	19.24942	END OF SCIENCE - VESSEL ENROUTE TO SOUTHAMPTON
29/07/2018 07:48		72.6332	19.25118	Vessel off DP
29/07/2018 07:44	295	72.63336	19.25183	CTD recovered to deck
29/07/2018 07:33	295	72.63336	19.25179	CTD stopped at depth 92m
29/07/2018 07:25	295	72.63338	19.25128	CTD deployed
29/07/2018 07:22		72.63338	19.25118	Vessel on DP @ Station B3 for CTD deployment
28/07/2018 16:45		73.88667	26.33526	Vessel off DP. Proceeding to B3
28/07/2018 16:34	294	73.88665	26.33523	Megacorer recovered to deck
28/07/2018 16:22	294	73.88665	26.33523	Commence recovery of Megacorer
28/07/2018 16:18	294	73.88666	26.33525	Megacorer on bottom (cable out 450m)
28/07/2018 16:05	294	73.88677	26.33549	Megacorer deployed
28/07/2018 16:00		73.88695	26.33845	Vessel on DP at station 'Y'
28/07/2018 08:48		74.49927	29.99587	Vessel off DP - enroute to 'Station Y'
28/07/2018 08:38	293	74.49988	29.99746	USNL recovered to deck
28/07/2018 08:27	293	74.49988	29.99756	Commence recovery of USNL
28/07/2018 08:25	293	74.4999	29.99755	USNL on bottom (cable out 359m)
28/07/2018 08:15	293	74.49988	29.99755	USNL deployed
28/07/2018 08:10		74.49994	29.99749	Vessel repositioned 180* x 20m
28/07/2018 08:08	292	74.50004	29.99746	USNL recovered to deck
28/07/2018 07:59	292	74.50009	29.9975	Commence recovery of USNL
28/07/2018 07:57	292	74.50008	29.99748	USNL on bottom (cable out 360m)
28/07/2018 07:46	292	74.5001	29.99745	USNL deployed
28/07/2018 07:42		74.50013	29.99742	Vessel repositioned 180* x 20m
28/07/2018 07:40	291	74.50023	29.99743	USNL recovered to deck
28/07/2018 07:30	291	74.50028	29.99742	Commence recovery of USNL
28/07/2018 07:27	291	74.50028	29.99748	USNL on bottom (cable out 359m)
28/07/2018 07:17	291	74.50029	29.99748	USNL deployed

28/07/2018 07:12		74.50029	29.99747	Vessel repositioned 270* x 20m
28/07/2018 07:11	290	74.50028	29.99769	USNL recovered to deck (fail)
28/07/2018 07:00	290	74.50029	29.99811	Commence recovery of USNL
28/07/2018 06:57	290	74.50028	29.99815	USNL on bottom (cable out 358m)
28/07/2018 06:47	290	74.50028	29.99818	USNL deployed
28/07/2018 06:41		74.50024	29.99819	Vessel repositioned 000* x 20m
28/07/2018 06:40	289	74.50018	29.99814	USNL recovered to deck
28/07/2018 06:30	289	74.50009	29.99816	Commence recovery of USNL
28/07/2018 06:28	289	74.5001	29.99813	USNL on bottom (cable out 358m)
28/07/2018 06:17	289	74.5001	29.99816	USNL deployed
28/07/2018 06:16		74.5001	29.99837	Vessel repositioned 270* x 20m
28/07/2018 06:14	288	74.50009	29.99879	USNL recovered to deck (failed)
28/07/2018 06:05	288	74.50012	29.99882	Commence recovery of USNL
28/07/2018 06:02	288	74.50011	29.99884	USNL on bottom (cable out 360m)
28/07/2018 05:52	288	74.5001	29.99885	USNL deployed
28/07/2018 05:48		74.50007	29.99891	Vessel repositioned 000* x 20m
28/07/2018 05:45	287	74.49993	29.99886	USNL recovered to deck
28/07/2018 05:36	287	74.49993	29.99893	Commence recovery of USNL
28/07/2018 05:34	287	74.49993	29.99889	USNL on bottom (cable out 358m)
28/07/2018 05:22	287	74.49995	29.99891	USNL deployed
28/07/2018 05:19		74.49994	29.99901	Vessel repositioned 270* x 20m
28/07/2018 05:16	286	74.49995	29.99952	USNL recovered to deck
28/07/2018 05:06	286	74.49994	29.99954	Commence recovery of USNL
28/07/2018 05:04	286	74.49995	29.99954	USNL on bottom (cable out 358m)
28/07/2018 04:53	286	74.49993	29.9996	USNL deployed
28/07/2018 04:25		74.49997	30.00019	Vessel repositioned 254* x 20m
28/07/2018 04:16	285	74.49998	30.00022	CTD recovered to deck
28/07/2018 04:05	285	74.49996	30.00019	CTD stopped at depth 351m

28/07/2018 03:54	285	74.49999	30.00018	CTD deployed
28/07/2018 03:30		74.5005	30.00243	Vessel on DP at B13
27/07/2018 11:43		77.03328	29.33279	Vessel off DP
27/07/2018 11:17	284	77.03328	29.33272	Zooplankton Net recovered
27/07/2018 11:14	284	77.03328	29.33273	Zooplankton Net @ 40m; commenced recovery
27/07/2018 11:12	284	77.0333	29.33285	Zooplankton Net deployed
27/07/2018 10:55	283	77.03329	29.33266	SMBA recovered
27/07/2018 10:49	283	77.0333	29.33274	Commenced recovery of SMBA
27/07/2018 10:45	283	77.0333	29.33263	SMBA @ bottom (~231m)
27/07/2018 10:38	283	77.03327	29.33268	SMBA deployed
27/07/2018 10:37		77.03322	29.33291	Vessel moved to 20m W of centroid
27/07/2018 10:31	282	77.0331	29.33327	SMBA recovered
27/07/2018 10:25	282	77.0331	29.33324	Commenced recovery of SMBA
27/07/2018 10:22	282	77.0331	29.33323	SMBA @ bottom (~227m)
27/07/2018 10:15	282	77.03311	29.33329	SMBA deployed
27/07/2018 10:05	281	77.03314	29.33318	SMBA recovered (failed)
27/07/2018 09:59	281	77.03313	29.33312	Commence recovery of SMBA
27/07/2018 09:55	281	77.03313	29.33322	SMBA on bottom (236m)
27/07/2018 09:48	281	77.03312	29.33326	SMBA deployed
27/07/2018 09:47		77.03315	29.33353	Vessel in position 20m S of Centroid for SMBA deployment
27/07/2018 09:40	280	77.03328	29.33429	SMBA recovered to deck
27/07/2018 09:33	280	77.03327	29.3342	Commence recovery of SMBA
27/07/2018 09:32	280	77.03327	29.33419	SMBA on bottom (236m)
27/07/2018 09:25	280	77.03331	29.33398	SMBA deployed
27/07/2018 09:24		77.03336	29.33391	Vessel in position 20m E of Centroid for SMBA deployment
27/07/2018 09:18	279	77.03348	29.33355	SMBA recovered to deck
27/07/2018 09:11	279	77.0335	29.33353	Commence recovery of SMBA
27/07/2018 09:09	279	77.0335	29.33355	SMBA on bottom (236m)

27/07/2018 09:02	279	77.03344	29.33317	SMBA deployed
27/07/2018 09:00		77.03338	29.33297	Vessel in position 20m N of Centroid for SMBA deployment
27/07/2018 08:54	278	77.03331	29.33331	SMBA recovered to deck
27/07/2018 08:46	278	77.03333	29.33345	Commence recovery of SMBA
27/07/2018 08:44	278	77.03331	29.33337	SMBA on bottom (236m)
27/07/2018 08:37	278	77.03331	29.33332	SMBA deployed
27/07/2018 08:20		77.03331	29.33339	Vessel in position 5m W of Centroid for SMBA deployment
27/07/2018 08:09	277	77.03329	29.33375	Megacorer recovered to deck
27/07/2018 08:02	277	77.0333	29.33373	Commence recovery of Megacorer
27/07/2018 08:00	277	77.03331	29.33371	Megacorer on bottom (236m)
27/07/2018 07:53	277	77.0333	29.33378	Megacorer deployed
27/07/2018 07:39		77.0333	29.33389	Vessel in position 5m E of Centroid for Megacorer deployment
27/07/2018 07:28	276	77.03307	29.33364	USNL recovered to deck
27/07/2018 07:21	276	77.03305	29.33363	Commence recovery of USNL
27/07/2018 07:20	276	77.03306	29.33374	USNL on bottom (cable out 236m)
27/07/2018 07:13	276	77.03309	29.33364	USNL deployed
27/07/2018 07:12		77.03313	29.33369	Vessel repositioned 250* x 20m
27/07/2018 07:07	275	77.03316	29.33442	USNL recovered to deck
27/07/2018 07:00	275	77.03314	29.33435	Commence recovery of USNL
27/07/2018 06:58	275	77.03315	29.33437	USNL on bottom (cable out 235m)
27/07/2018 06:51	275	77.03313	29.33446	USNL deployed
27/07/2018 06:49		77.03316	29.33447	Vessel repositioned 279* x 20m
27/07/2018 06:45	274	77.03312	29.33489	USNL recovered to deck
27/07/2018 06:36	274	77.03311	29.33511	Commence recovery of USNL
27/07/2018 06:35	274	77.03312	29.33524	USNL on bottom (cable out 235m)
27/07/2018 06:27	274	77.03313	29.33517	USNL deployed
27/07/2018 06:26		77.0331	29.33505	Vessel repositioned 066* x 20m
27/07/2018 06:22	273	77.03304	29.33447	USNL recovered to deck

27/07/2018 06:14	273	77.03305	29.33455	Commence recovery of USNL
27/07/2018 06:13	273	77.03305	29.33449	USNL on bottom (cable out 235m)
27/07/2018 06:04	273	77.03301	29.33445	USNL deployed
27/07/2018 06:02		77.03292	29.33416	Vessel repositioned 033* x 20m
27/07/2018 05:59	272	77.03289	29.33404	USNL recovered to deck
27/07/2018 05:52	272	77.03288	29.3341	Commence recovery of USNL
27/07/2018 05:50	272	77.0329	29.33407	USNL on bottom (cable out 230m)
27/07/2018 05:43	272	77.0329	29.3341	USNL deployed
27/07/2018 05:39		77.0329	29.33406	Vessel repositioned 090* x 20m
27/07/2018 05:36	271	77.03291	29.33345	USNL recovered to deck
27/07/2018 05:28	271	77.03289	29.33342	Commence recovery of USNL
27/07/2018 05:27	271	77.03288	29.33338	USNL on bottom (cable out 229m)
27/07/2018 05:19	271	77.03289	29.33347	USNL deployed
27/07/2018 05:16		77.03285	29.33309	Vessel repositioned 061* x 20m
27/07/2018 05:13	270	77.0328	29.33267	USNL recovered to deck
27/07/2018 05:06	270	77.0328	29.33265	Commence recovery of USNL
27/07/2018 05:04	270	77.03279	29.33267	USNL on bottom (cable out 228m)
27/07/2018 04:57	270	77.03279	29.33267	USNL deployed
27/07/2018 04:49		77.0327	29.3327	Vessel repositioned 349* x 20m
27/07/2018 04:46	269	77.03258	29.33288	USNL recovered to deck
27/07/2018 04:39	269	77.03258	29.3328	Commence recovery of USNL
27/07/2018 04:37	269	77.03259	29.33289	USNL on bottom (cable out 228m)
27/07/2018 04:30	269	77.03263	29.33285	USNL deployed
27/07/2018 04:25		77.03259	29.3327	Vessel repositioned 054* x 20m
27/07/2018 04:23	268	77.03251	29.3322	USNL recovered to deck
27/07/2018 04:15	268	77.03252	29.33218	Commence recovery of USNL
27/07/2018 04:14	268	77.03252	29.33222	USNL on bottom (cable out 228m)
27/07/2018 04:06	268	77.03251	29.33229	USNL deployed

27/07/2018 04:02		77.03256	29.33216	Vessel repositioned 121* x 20m
27/07/2018 03:59	267	77.0326	29.33155	USNL recovered to deck
27/07/2018 03:52	267	77.0326	29.33159	Commence recovery of USNL
27/07/2018 03:50	267	77.03259	29.33152	USNL on bottom (cable out 228m)
27/07/2018 03:43	267	77.03258	29.33147	USNL deployed
27/07/2018 03:39		77.03265	29.33158	Vessel repositioned 209* x 20m
27/07/2018 03:36	266	77.03275	29.33197	USNL recovered to deck
27/07/2018 03:29	266	77.03277	29.3319	Commence recovery of USNL
27/07/2018 03:27	266	77.03277	29.33195	USNL on bottom (cable out 227m)
27/07/2018 03:20	266	77.03275	29.33192	USNL deployed
27/07/2018 03:13		77.03278	29.33203	Vessel repositioned 239* x 20m
27/07/2018 03:10	265	77.03286	29.33265	USNL recovered to deck
27/07/2018 03:03	265	77.03288	29.33267	Commence recovery of USNL
27/07/2018 03:01	265	77.03288	29.33262	USNL on bottom (cable out 227m)
27/07/2018 02:54	265	77.03287	29.33269	USNL deployed
27/07/2018 02:51		77.03287	29.33263	Vessel repositioned 093* x 20m
27/07/2018 02:48	264	77.03287	29.33197	USNL recovered to deck
27/07/2018 02:41	264	77.03286	29.33185	Commence recovery of USNL
27/07/2018 02:39	264	77.03285	29.33192	USNL on bottom (cable out 227m)
27/07/2018 02:31	264	77.03288	29.33183	USNL deployed
27/07/2018 02:30		77.03289	29.33178	Vessel repositioned 158* x 20m
27/07/2018 02:26	263	77.03304	29.33155	USNL recovered to deck
27/07/2018 02:19	263	77.03306	29.33159	Commence recovery of USNL
27/07/2018 02:17	263	77.03304	29.3315	USNL on bottom (cable out 227m)
27/07/2018 02:09	263	77.03306	29.33154	USNL deployed
27/07/2018 02:03		77.03307	29.33155	Vessel repositioned 201* x 20m
27/07/2018 01:58	262	77.03321	29.33181	USNL recovered
27/07/2018 01:51	262	77.03321	29.33173	Commenced recovery of USNL

27/07/2018 01:50	262	77.0332	29.33174	USNL @ bottom (~227m)
27/07/2018 01:42	262	77.03323	29.33179	USNL deployed
27/07/2018 01:40		77.03318	29.33178	Vessel moved 20m (300*)
27/07/2018 01:35	261	77.03312	29.33251	USNL recovered
27/07/2018 01:29	261	77.03312	29.33253	Commenced recovery of USNL
27/07/2018 01:28	261	77.03312	29.33251	USNL @ bottom (~227m) [repeat as unsure if fired]
27/07/2018 01:26	261	77.03313	29.33253	Commenced recovery of USNL
27/07/2018 01:24	261	77.03312	29.33251	USNL @ bottom (~227m)
27/07/2018 01:17	261	77.03315	29.33256	USNL deployed
27/07/2018 01:14		77.03312	29.33269	Vessel moved 20m (269*)
27/07/2018 01:10	260	77.03313	29.3333	USNL recovered
27/07/2018 01:04	260	77.03315	29.33331	Commenced recovery of USNL
27/07/2018 01:02	260	77.03315	29.33335	USNL @ bottom (~227m)
27/07/2018 00:54	260	77.03314	29.33335	USNL deployed
26/07/2018 23:03	259	77.02753	29.31635	AGT recovered. Vessel repositioning for USNL deployments.
26/07/2018 22:52	259	77.02809	29.31933	Commenced recovery of AGT
26/07/2018 22:34	259	77.0312	29.33533	Commenced trawl @ 1 kt for 15 min (wire out 342m)
26/07/2018 22:31	259	77.03155	29.33699	AGT @ bottom (~229m)
26/07/2018 22:23	259	77.03218	29.34007	AGT deployed
26/07/2018 22:22	259	77.03222	29.3402	Commenced AGT deployment
26/07/2018 22:20		77.03236	29.34035	Vessel repositioned for next AGT deployment
26/07/2018 22:04	258	77.02925	29.3203	AGT recovered to deck
26/07/2018 21:50	258	77.02862	29.31594	Commenced recovery of AGT
26/07/2018 21:34	258	77.03092	29.33243	Cable stopped at 342m for trawl. Speed 1.0kts
26/07/2018 21:29	258	77.03143	29.33615	AGT on bottom (cable out 227m) Speed 0.5kts
26/07/2018 21:20	258	77.03193	29.33961	AGT deployed
26/07/2018 21:18		77.03197	29.33997	Vessel repositioned for next AGT deployment
26/07/2018 21:08	257	77.02914	29.31514	AGT recovered to deck

26/07/2018 20:53	257	77.02915	29.31527	Commenced recovery of AGT
26/07/2018 20:37	257	77.03123	29.33263	Cable stopped at 345m for trawl. Speed 1.0kts
26/07/2018 20:33	257	77.03176	29.33695	AGT on bottom (cable out 221m) Speed 0.5kts
26/07/2018 20:26	257	77.03209	29.33968	AGT deployed. Speed 0.3kts
26/07/2018 20:24		77.03217	29.34022	Vessel repositioned for next AGT deployment
26/07/2018 20:10	256	77.03025	29.31844	AGT recovered to deck
26/07/2018 19:56	256	77.03057	29.32235	Commenced recovery of AGT
26/07/2018 19:46	256	77.03144	29.33336	Cable stopped at 342m for trawl. Speed 1.0kts
26/07/2018 19:42	256	77.03164	29.33596	AGT on bottom (cable out 220m) Speed 0.5kts
26/07/2018 19:33	256	77.03203	29.34076	AGT deployed. Speed 0.3kts
26/07/2018 19:30		77.03212	29.3414	Vessel repositioned for next AGT deployment
26/07/2018 19:18	255	77.03071	29.32	AGT recovered to deck
26/07/2018 19:02	255	77.03095	29.32393	Commenced recovery of AGT
26/07/2018 18:53	255	77.03161	29.33444	Cable stopped at 342m for trawl. Speed 1.0kts
26/07/2018 18:49	255	77.03179	29.33734	AGT on bottom (cable out 229m) Speed 0.5kts
26/07/2018 18:38	255	77.03215	29.34291	AGT deployed. Speed 0.3kts
26/07/2018 18:36		77.03217	29.34317	Vessel repositioned for next AGT deployment
26/07/2018 18:21	254	77.03081	29.31781	AGT recovered to deck
26/07/2018 18:06	254	77.03108	29.32177	Commenced recovery of AGT
26/07/2018 17:54	254	77.03205	29.33482	Cable stopped at 342m for trawl. Speed 1.0kts
26/07/2018 17:51	254	77.0322	29.33696	AGT on bottom (cable out 228m) Speed 0.5kts
26/07/2018 17:43	254	77.03247	29.34055	AGT deployed. Speed 0.3kts
26/07/2018 17:38		77.03251	29.34071	Vessel repositioned South of box for AGT deployments
26/07/2018 17:27	253	77.03332	29.33345	CTD recovered to deck
26/07/2018 17:02	253	77.03333	29.33347	CTD stopped at depth 221m
26/07/2018 16:51	253	77.0333	29.33359	CTD deployed
26/07/2018 16:44		77.03327	29.33553	Vessel on DP at station X-South centroid
26/07/2018 16:00		76.94349	29.53489	Vessel off DP. Proceeding to station X-South

26/07/2018 05:32		76.94353	29.53549	Vessel on DP 6' off station X-South. Standing by
26/07/2018 02:24		76.49997	30.49946	Vessel off DP. Proceeding to station X-South
26/07/2018 01:46	252	76.49997	30.49941	SMBA recovered
26/07/2018 01:37	252	76.49996	30.49941	Commenced recovery of SMBA
26/07/2018 01:35	252	76.49996	30.49942	SMBA @ bottom (~296m)
26/07/2018 01:26	252	76.49995	30.49941	SMBA deployed @ 20m W of centroid
26/07/2018 01:19	251	76.49996	30.49953	SMBA recovered
26/07/2018 01:11	251	76.49996	30.49949	Commenced recovery of SMBA
26/07/2018 01:09	251	76.49997	30.49949	SMBA @ bottom (~296m)
26/07/2018 00:59	251	76.49998	30.49956	SMBA deployed @ 20m W of centroid
26/07/2018 00:52	250	76.49979	30.50031	SMBA recovered
26/07/2018 00:44	250	76.49979	30.50028	Commenced recovery of SMBA
26/07/2018 00:42	250	76.49979	30.50028	SMBA @ bottom (~295m)
26/07/2018 00:33	250	76.49981	30.50025	SMBA deployed @ 20m S of centroid
26/07/2018 00:21	249	76.49999	30.501	SMBA recovered
26/07/2018 00:13	249	76.49999	30.50097	Commenced recovery of SMBA
26/07/2018 00:11	249	76.49999	30.50097	SMBA @ bottom (~295m)
26/07/2018 00:02	249	76.5	30.50085	SMBA deployed @ 20m E of centroid
25/07/2018 23:56	248	76.50014	30.5001	SMBA recovered
25/07/2018 23:48	248	76.50014	30.50011	Commenced recovery of SMBA
25/07/2018 23:46	248	76.50014	30.50011	SMBA @ bottom (~295m)
25/07/2018 23:38	248	76.50013	30.50009	SMBA deployed @ 20m N of centroid
25/07/2018 23:32	247	76.49996	30.50004	SMBA recovered
25/07/2018 23:24	247	76.49996	30.50003	Commenced recovery of SMBA
25/07/2018 23:22	247	76.49995	30.50004	SMBA @ bottom (~295m)
25/07/2018 23:12	247	76.49996	30.49999	SMBA deployed @ 5m W of centroid
25/07/2018 22:57		76.50015	30.50147	Vessel on DP @ B14. Science time resumed.
25/07/2018 21:00		76.50061	30.49272	Vessel moving off to empty retention tank

25/07/2018 20:52	246	76.49985	30.50064	Megacorer recovered to deck
25/07/2018 20:42	246	76.49986	30.50064	Commence recovery of Megeacorer
25/07/2018 20:38	246	76.49986	30.50066	Megacorer on bottom (299m cable)
25/07/2018 20:30	246	76.49986	30.50064	Megacorer deployed
25/07/2018 20:27		76.49987	30.50066	Vessel repositioned to 20m SE of Centroid for Megacorer deployment
25/07/2018 20:14	245	76.50014	30.49962	Megacorer recovered to deck
25/07/2018 20:05	245	76.50014	30.49959	Commence recovery of Megeacorer
25/07/2018 20:02	245	76.50013	30.49955	Megacorer on bottom (299m cable)
25/07/2018 19:52	245	76.50014	30.49954	Megacorer deployed
25/07/2018 19:45		76.50013	30.49966	Vessel repositioned to 20m NW of Centroid for Megacorer deployment
25/07/2018 19:36	244	76.50003	30.50039	Megacorer recovered to deck
25/07/2018 19:29	244	76.50003	30.50042	Commence recovery of Megeacorer
25/07/2018 19:23	244	76.50002	30.50039	Megacorer on bottom (cable out 299m)
25/07/2018 19:13	244	76.49999	30.50029	Megacorer deployed
25/07/2018 19:02		76.5	30.50031	Vessel repositioned to 5m E of Centroid for Megacorer deployment
25/07/2018 18:42	243	76.49945	30.5002	USNL recovered to deck
25/07/2018 18:34	243	76.49952	30.50023	Commence recovery of USNL
25/07/2018 18:31	243	76.49953	30.50021	USNL on bottom (cable out 298m)
25/07/2018 18:21	243	76.49953	30.50025	USNL deployed
25/07/2018 18:16		76.49952	30.50039	Vessel repositioned 282* x 20m
25/07/2018 18:14	242	76.49948	30.50082	USNL recovered to deck
25/07/2018 18:05	242	76.49948	30.50097	Commence recovery of USNL
25/07/2018 18:02	242	76.49949	30.50096	USNL on bottom (cable out 295m)
25/07/2018 17:54	242	76.49949	30.50098	USNL deployed
25/07/2018 17:50		76.49949	30.50099	Vessel repositioned 279* x 20m
25/07/2018 17:47	241	76.49946	30.50168	USNL recovered to deck
25/07/2018 17:38	241	76.49947	30.50174	Commence recovery of USNL
25/07/2018 17:35	241	76.49947	30.50177	USNL on bottom (cable out 295m)

25/07/2018 17:27	241	76.49946	30.50175	USNL deployed
25/07/2018 17:22		76.49947	30.50177	Vessel repositioned 066* x 20m
25/07/2018 17:18	240	76.4994	30.50111	USNL recovered to deck
25/07/2018 17:09	240	76.4994	30.5011	Commence recovery of USNL
25/07/2018 17:06	240	76.4994	30.50113	USNL on bottom (cable out 296m)
25/07/2018 16:58	240	76.49941	30.50113	USNL deployed
25/07/2018 16:55		76.49937	30.50103	Vessel repositioned 033* x 20m
25/07/2018 16:52	239	76.49925	30.50068	USNL recovered to deck
25/07/2018 16:43	239	76.49925	30.50064	Commence recovery of USNL
25/07/2018 16:40	239	76.49925	30.50065	USNL on bottom (cable out 294m)
25/07/2018 16:31	239	76.49925	30.50062	USNL deployed
25/07/2018 16:27		76.49926	30.50046	Vessel repositioned 090* x 20m
25/07/2018 16:24	238	76.49925	30.49988	USNL recovered to deck
25/07/2018 16:15	238	76.49924	30.49988	Commence recovery of USNL
25/07/2018 16:13	238	76.49923	30.49987	USNL on bottom (cable out 294m)
25/07/2018 16:04	238	76.49923	30.49994	USNL deployed
25/07/2018 16:02		76.49923	30.49989	Vessel repositioned 061* x 20m
25/07/2018 16:00	237	76.49922	30.49976	USNL recovered to deck
25/07/2018 15:51	237	76.49916	30.49923	Commence recovery of USNL
25/07/2018 15:48	237	76.49917	30.49924	USNL on bottom (cable out 293m)
25/07/2018 15:38	237	76.49916	30.49922	USNL deployed
25/07/2018 15:35		76.4992	30.49922	Vessel repositioned 188* x 20m
25/07/2018 15:32	236	76.49935	30.49934	USNL recovered to deck
25/07/2018 15:23	236	76.49936	30.4993	Commence recovery of USNL
25/07/2018 15:21	236	76.49934	30.49927	USNL on bottom (cable out 293m)
25/07/2018 15:11	236	76.49934	30.49927	USNL deployed
25/07/2018 15:07		76.49932	30.49915	Vessel repositioned 054* x 20m
25/07/2018 15:05	235	76.49926	30.49878	USNL recovered to deck

25/07/2018 14:55	235	76.49925	30.4987	Commence recovery of USNL
25/07/2018 14:53	235	76.49925	30.49869	USNL on bottom (cable out 293m)
25/07/2018 14:44	235	76.49924	30.49868	USNL deployed
25/07/2018 14:41		76.49924	30.49867	Vessel repositioned 121* x 20m
25/07/2018 14:38	234	76.49933	30.49805	USNL recovered to deck
25/07/2018 14:29	234	76.49933	30.49811	Commence recovery of USNL
25/07/2018 14:27	234	76.49934	30.49808	USNL on bottom (cable out 292m)
25/07/2018 14:17	234	76.49934	30.49806	USNL deployed
25/07/2018 14:14		76.49933	30.49806	Vessel repositioned 209* x 20m
25/07/2018 14:10	233	76.49948	30.49842	USNL recovered to deck
25/07/2018 14:01	233	76.49949	30.49837	Commence recovery of USNL
25/07/2018 13:58	233	76.49949	30.49837	USNL @ bottom (~292m)
25/07/2018 13:49	233	76.49948	30.49839	USNL deployed
25/07/2018 13:46		76.4995	30.4985	Vessel moved 20m (239*)
25/07/2018 13:42	232	76.49957	30.49898	USNL recovered
25/07/2018 13:34	232	76.49957	30.49894	Commenced recovery of USNL
25/07/2018 13:32	232	76.49956	30.49896	USNL @ bottom (~292m)
25/07/2018 13:23	232	76.49955	30.49896	USNL deployed
25/07/2018 13:20		76.49956	30.4989	Vessel moved 20m (093*)
25/07/2018 13:16	231	76.49957	30.49825	USNL recovered
25/07/2018 13:08	231	76.49958	30.49829	Commenced recovery of USNL
25/07/2018 13:06	231	76.49957	30.49825	USNL @ bottom (~292m)
25/07/2018 12:57	231	76.49958	30.49828	USNL deployed
25/07/2018 12:54		76.49963	30.49818	Vessel moved 20m (158*)
25/07/2018 12:49	230	76.49974	30.49801	USNL recovered
25/07/2018 12:41	230	76.49975	30.49802	Commenced recovery of USNL
25/07/2018 12:39	230	76.49975	30.49801	USNL @ bottom (~292m)
25/07/2018 12:30	230	76.49976	30.49803	USNL deployed

25/07/2018 12:29		76.49976	30.49806	Vessel moved 20m (201*)
25/07/2018 12:24	229	76.49992	30.4983	USNL recovered
25/07/2018 12:18	229	76.49992	30.49829	Commenced recovery of USNL
25/07/2018 12:15	229	76.49993	30.49832	USNL @ bottom (~291m)
25/07/2018 12:07	229	76.49992	30.49832	USNL deployed
25/07/2018 12:04		76.49991	30.49842	Vessel moved 20m (300*)
25/07/2018 12:00	228	76.49984	30.49896	USNL recovered
25/07/2018 11:52	228	76.49984	30.499	Commenced recovery of USNL
25/07/2018 11:49	228	76.49983	30.49897	USNL @ bottom (~293m)
25/07/2018 11:40	228	76.49982	30.49906	USNL deployed
25/07/2018 11:37		76.49982	30.49919	Vessel moved 20m (269*)
25/07/2018 11:33	227	76.49984	30.49985	USNL recovered
25/07/2018 11:25	227	76.49983	30.49979	Commenced recovery of USNL
25/07/2018 11:21	227	76.49982	30.49977	USNL @ bottom (~292m)
25/07/2018 11:12	227	76.49982	30.49981	USNL deployed
25/07/2018 10:50		76.50185	30.49997	Vessel on DP
25/07/2018 10:38		76.49148	30.52668	Vessel off DP to relocate for USNL deployments
25/07/2018 10:25	226	76.49218	30.52146	AGT recovered
25/07/2018 10:11	226	76.49341	30.51905	Commenced recovery of AGT
25/07/2018 09:57	226	76.4969	30.51212	Cable stopped at 445m for trawl. Speed 1.0kts
25/07/2018 09:51	226	76.49787	30.51013	AGT on bottom (cable out ~306m) Speed 0.5kts
25/07/2018 09:42	226	76.49867	30.50861	AGT deployed. Speed 0.3kts
25/07/2018 09:41		76.49873	30.50849	Vessel repositioned for next AGT deployment
25/07/2018 09:28	225	76.49226	30.50887	AGT recovered to deck
25/07/2018 09:19	225	76.49302	30.50889	AGT off bottom
25/07/2018 09:14	225	76.49323	30.50892	Trawl complete. Commence recovery. Speed 0.3kts
25/07/2018 08:59	225	76.49763	30.50916	Cable stopped at 445m for trawl. Speed 1.0kts
25/07/2018 08:56	225	76.49806	30.50918	AGT on bottom (cable out ~309m) Speed 0.5kts

25/07/2018 08:45	225	76.49936	30.50926	AGT deployed. Speed 0.3kts
25/07/2018 08:39		76.49951	30.50933	Vessel repositioned for next AGT deployment
25/07/2018 08:26	224	76.49284	30.49183	AGT recovered to deck
25/07/2018 08:18	224	76.49339	30.49335	AGT off bottom
25/07/2018 08:13	224	76.49372	30.49432	Trawl complete. Commence recovery. Speed 0.3kts
25/07/2018 07:57	224	76.4974	30.50464	Cable stopped at 445m for trawl. Speed 1.0kts
25/07/2018 07:53	224	76.49787	30.50597	AGT on bottom (cable out ~302m) Speed 0.5kts
25/07/2018 07:43	224	76.49881	30.50874	AGT deployed. Speed 0.3kts
25/07/2018 07:40		76.49892	30.50906	Vessel repositioned for next AGT deployment
25/07/2018 07:27	223	76.49352	30.49	AGT recovered to deck
25/07/2018 07:13	223	76.49404	30.49191	AGT off bottom
25/07/2018 07:08	223	76.49438	30.4932	Trawl complete. Commence recovery. Speed 0.3kts
25/07/2018 06:53	223	76.49752	30.50483	Cable stopped at 445m for trawl. Speed 1.0kts
25/07/2018 06:48	223	76.49809	30.50697	AGT on bottom (cable out ~310m) Speed 0.5kts
25/07/2018 06:39	223	76.49872	30.50939	AGT deployed. Speed 0.3kts
25/07/2018 06:37		76.49888	30.51	Vessel repositioned for next AGT deployment
25/07/2018 06:23	222	76.49492	30.4933	AGT recovered to deck
25/07/2018 06:11	222	76.4955	30.49537	AGT off bottom
25/07/2018 06:07	222	76.49574	30.49616	Trawl complete. Commence recovery. Speed 0.3kts
25/07/2018 05:56	222	76.49807	30.50428	Cable stopped at 445m for trawl. Speed 1.0kts
25/07/2018 05:51	222	76.49869	30.50655	AGT on bottom (cable out ~306m) Speed 0.5kts
25/07/2018 05:41	222	76.49949	30.50938	AGT deployed. Speed 0.3kts
25/07/2018 05:39		76.49946	30.50911	Vessel repositioned for next AGT deployment
25/07/2018 05:28	221	76.49575	30.49435	AGT recovered to deck (empty)
25/07/2018 05:20	221	76.49609	30.49557	AGT off bottom
25/07/2018 05:15	221	76.49638	30.49675	Trawl complete. Commence recovery. Speed 0.3kts
25/07/2018 05:05	221	76.49839	30.50412	Cable stopped at 445m for trawl. Speed 1.0kts
25/07/2018 05:01	221	76.49882	30.50576	AGT on bottom (cable out ~304m) Speed 0.5kts

25/07/2018 04:51	221	76.49959	30.50872	AGT deployed. Speed 0.3kts
25/07/2018 04:43		76.4997	30.50892	Vessel repositioned for next AGT deployment
25/07/2018 04:33	220	76.49642	30.4922	AGT recovered to deck
25/07/2018 04:23	220	76.49663	30.4933	AGT off bottom
25/07/2018 04:17	220	76.497	30.49526	Trawl complete. Commence recovery. Speed 0.3kts
25/07/2018 04:08	220	76.49855	30.50327	Cable stopped at 445m for trawl. Speed 1.0kts
25/07/2018 04:04	220	76.49892	30.50518	AGT on bottom (cable out ~307m) Speed 0.5kts
25/07/2018 03:53	220	76.49966	30.50907	AGT deployed. Speed 0.3kts
25/07/2018 03:50		76.49969	30.50897	Vessel repositioned for next AGT deployment
25/07/2018 03:41	219	76.49635	30.49061	AGT recovered to deck
25/07/2018 03:30	219	76.4963	30.49041	AGT off bottom
25/07/2018 03:24	219	76.49661	30.49198	Trawl complete. Commence recovery. Speed 0.3kts
25/07/2018 03:13	219	76.49838	30.50092	Cable stopped at 445m for trawl. Speed 1.0kts
25/07/2018 03:08	219	76.49888	30.50347	AGT on bottom (cable out ~306m) Speed 0.5kts
25/07/2018 02:58	219	76.4995	30.50671	AGT deployed. Speed 0.3kts
25/07/2018 02:43		76.49978	30.50788	Vessel repositioned to East of box for AGT deployments
25/07/2018 02:31	218	76.50003	30.5003	CTD recovered to deck
25/07/2018 02:04	218	76.50002	30.50026	CTD stopped at depth 285m
25/07/2018 01:53	218	76.50003	30.50024	CTD deployed
25/07/2018 01:38		76.50021	30.50017	Vessel on DP @ B14
24/07/2018 20:20		77.32978	29.99829	Vessel off DP enroute to Station B14
24/07/2018 20:05	217	77.32976	29.99798	USNL recovered to deck
24/07/2018 19:54	217	77.32977	29.99801	Commence recovery of USNL
24/07/2018 19:52	217	77.32979	29.99805	USNL on bottom (cable out 194m)
24/07/2018 19:47	217	77.32978	29.99818	USNL deployed
24/07/2018 19:43		77.32977	29.99824	Vessel moved to 65m x 235* of centroid
24/07/2018 19:39	216	77.32989	29.99868	USNL recovered to deck
24/07/2018 19:33	216	77.32989	29.99875	Commence recovery of USNL

24/07/2018 19:30	216	77.32988	29.99878	USNL on bottom (cable out 194m)
24/07/2018 19:23	216	77.32989	29.99873	USNL deployed
24/07/2018 19:22		77.32988	29.9988	Vessel moved to 45m x 235* of centroid
24/07/2018 19:14	215	77.33	29.99933	USNL recovered to deck (failed)
24/07/2018 19:08	215	77.33001	29.99933	Commence recovery of USNL
24/07/2018 19:01	215	77.33001	29.99927	USNL on bottom (cable out 194m)
24/07/2018 18:55	215	77.33	29.99944	USNL deployed 20m W of Centroid
24/07/2018 18:54		77.32997	29.99963	Vessel moved to 20m W of centroid
24/07/2018 18:46	214	77.32981	30.00024	USNL recovered to deck
24/07/2018 18:41	214	77.32982	30.00032	Commence recovery of USNL
24/07/2018 18:38	214	77.32981	30.00023	USNL on bottom (cable out 197m)
24/07/2018 18:31	214	77.32979	30.00044	USNL deployed 20m S of Centroid
24/07/2018 18:30		77.32982	30.0004	Vessel moved to 20m S of centroid
24/07/2018 18:24	213	77.33005	30.00107	USNL recovered to deck
24/07/2018 18:18	213	77.33002	30.00112	Commence recovery of USNL
24/07/2018 18:17	213	77.33002	30.00115	USNL on bottom (cable out 197m)
24/07/2018 18:07	213	77.33003	30.00102	USNL deployed 20m E of Centroid
24/07/2018 18:06		77.33007	30.00079	Vessel moved to 20m E of centroid
24/07/2018 17:59	212	77.33017	30.00003	USNL recovered to deck (failed)
24/07/2018 17:52	212	77.33018	30.00008	Commence recovery of USNL
24/07/2018 17:50	212	77.3302	30.00008	USNL on bottom (cable out 190m)
24/07/2018 17:44	212	77.33011	30.00043	USNL deployed
24/07/2018 17:43		77.33006	30.00059	Vessel remaining in position 20m N
24/07/2018 17:38	211	77.33019	30.00022	USNL recovered to deck (failed)
24/07/2018 17:30	211	77.3302	30.00025	Commence recovery of USNL
24/07/2018 17:27	211	77.33021	30.00016	USNL on bottom (cable out 189m)
24/07/2018 17:21	211	77.33021	30.00024	USNL deployed
24/07/2018 17:05		77.33019	30.00026	Vessel repositioned 20m N of centroid for USNL

24/07/2018 17:01	210	77.33004	30.00028	CTD recovered to deck
24/07/2018 16:55	210	77.33003	30.00018	CTD stopped at depth 177m
24/07/2018 16:47	210	77.33004	30.00026	CTD deployed
24/07/2018 16:40		77.33027	30.00193	Vessel on DP at B34
24/07/2018 14:18		77.69455	30.08278	Vessel off DP. Tests complete. Science time resumed
24/07/2018 14:06		77.69449	30.08397	Vessel on DP for thruster/DP tests. Downtime commenced
24/07/2018 13:13		77.81238	30.13137	Vessel off DP
24/07/2018 13:03	209	77.81239	30.13137	CTD recovered
24/07/2018 12:56	209	77.81239	30.13137	CTD @ 255m; commenced recovery
24/07/2018 12:46	209	77.8124	30.13137	CTD deployed
24/07/2018 12:35		77.81388	30.13575	Vessel on DP @ X-North
24/07/2018 09:49		78.25141	29.9981	Vessel off DP - enroute to station X North
24/07/2018 09:42	208	78.25141	29.99808	USNL recovered
24/07/2018 09:34	208	78.25142	29.9981	Commenced recovery of USNL
24/07/2018 09:32	208	78.25142	29.99809	USNL @ bottom (~319m)
24/07/2018 09:22	208	78.25141	29.99806	USNL deployed
24/07/2018 09:13		78.25148	29.99824	Vessel repositioned 201* x 20m
24/07/2018 09:12	207	78.25152	29.99833	USNL recovered
24/07/2018 09:03	207	78.2516	29.99843	Commenced recovery of USNL
24/07/2018 09:01	207	78.25161	29.99843	USNL @ bottom (~318m)
24/07/2018 08:51	207	78.2516	29.99842	USNL deployed
24/07/2018 08:45		78.25157	29.99866	Vessel repositioned 300* x 20m
24/07/2018 08:44	206	78.25154	29.99888	USNL recovered
24/07/2018 08:35	206	78.25149	29.99925	Commenced recovery of USNL
24/07/2018 08:32	206	78.25149	29.99928	USNL @ bottom (~318m)
24/07/2018 08:21	206	78.2515	29.99922	USNL deployed
24/07/2018 08:18		78.2515	29.9994	Vessel repositioned 269* x 20m
24/07/2018 08:15	205	78.25152	30.0001	USNL recovered

24/07/2018 08:06	205	78.25151	30	Commenced recovery of USNL
24/07/2018 08:04	205	78.25151	30.00001	USNL @ bottom (~317m)
24/07/2018 07:54	205	78.25152	30.00006	USNL deployed
24/07/2018 07:46		78.2518	30.00121	Vessel on DP @ B15 - 20m 187* of centroid for USNL deployments
23/07/2018 19:09		80.11672	30.06834	Vessel off DP - heading for Station 'B15'
23/07/2018 19:08	204	80.11671	30.06835	Zooplankton net recovered on deck
23/07/2018 19:03	204	80.11671	30.06836	Zooplankton net @ 40m - commence recovery
23/07/2018 19:01	204	80.11671	30.06839	Zooplankton net deployed
23/07/2018 18:33		80.1167	30.06789	Vessel repositioned on centroid for zooplankton net deployment
23/07/2018 18:31	203	80.1167	30.06746	SMBA recovered to deck
23/07/2018 18:23	203	80.1167	30.06741	Commence recovery of SMBA
23/07/2018 18:21	203	80.1167	30.06744	SMBA on bottom (cable out 284m)
23/07/2018 18:13	203	80.11669	30.0674	SMBA deployed
23/07/2018 18:09		80.11663	30.06755	Vessel repositioned to 20m W of centroid
23/07/2018 18:06	202	80.1165	30.06805	SMBA recovered to deck
23/07/2018 17:57	202	80.1165	30.06807	Commence recovery of SMBA
23/07/2018 17:55	202	80.1165	30.06809	SMBA on bottom (cable out 278m)
23/07/2018 17:47	202	80.11651	30.0681	SMBA deployed
23/07/2018 17:46		80.11653	30.06825	Vessel repositioned to 20m S of centroid
23/07/2018 17:41	201	80.11671	30.06923	SMBA recovered to deck
23/07/2018 17:31	201	80.1167	30.06926	Commence recovery of SMBA
23/07/2018 17:29	201	80.11671	30.06923	SMBA on bottom (cable out 278m)
23/07/2018 17:20	201	80.1167	30.06926	SMBA deployed
23/07/2018 17:10		80.11672	30.06926	Vessel repositioned to 20m E of centroid
23/07/2018 17:05	200	80.11689	30.0683	SMBA recovered to deck
23/07/2018 16:55	200	80.11689	30.06825	Commence recovery of SMBA
23/07/2018 16:53	200	80.11689	30.0682	SMBA on bottom (cable out 279m)
23/07/2018 16:45	200	80.1169	30.06823	SMBA deployed

23/07/2018 16:40		80.1168	30.06811	Vessel repositioned to 20m N of centroid
23/07/2018 16:36	199	80.1167	30.06794	SMBA recovered to deck
23/07/2018 16:26	199	80.11671	30.06787	Commence recovery of SMBA
23/07/2018 16:24	199	80.11671	30.06794	SMBA on bottom (cable out 278m)
23/07/2018 16:16	199	80.11671	30.0677	SMBA deployed
23/07/2018 16:06		80.11669	30.06813	Vessel repositioned to 5m W of centroid for SMBA
23/07/2018 15:58	198	80.11659	30.069	Megacorer recovered to deck
23/07/2018 15:51	198	80.11659	30.069	Commence recovery of Megacorer
23/07/2018 15:48	198	80.11659	30.069	Megacorer on bottom (cable out 278m)
23/07/2018 15:40	198	80.11662	30.06899	Megacorer deployed
23/07/2018 15:29		80.11662	30.06889	Vessel repositioned to 20m SE of centroid
23/07/2018 15:19	197	80.11684	30.06759	Megacorer recovered to deck
23/07/2018 15:10	197	80.11685	30.06757	Commence recovery of Megacorer
23/07/2018 15:06	197	80.11684	30.06765	Megacorer on bottom (cable out 278m)
23/07/2018 14:57	197	80.11684	30.06767	Megacorer deployed
23/07/2018 14:50		80.11684	30.06767	Vessel repositioned to 20 NW of centroid
23/07/2018 14:43	196	80.11672	30.06859	Megacorer recovered to deck
23/07/2018 14:34	196	80.11671	30.0686	Commence recovery of Megacorer
23/07/2018 14:30	196	80.11672	30.06855	Megacorer on bottom (cable out 279m)
23/07/2018 14:22	196	80.11678	30.06764	Megacorer deployed at 5m E of centroid
23/07/2018 14:18		80.11686	30.0658	Vessel on DP at B16 5m E
23/07/2018 12:15		80.11612	30.06931	Vessel off DP. Science suspended. Vessel proceeding 6' North to pump out retention tank
23/07/2018 12:09	195	80.11611	30.06932	USNL recovered
23/07/2018 12:02	195	80.11612	30.06936	Commenced recovery of USNL
23/07/2018 11:59	195	80.11611	30.06935	USNL @ bottom (~282m)
23/07/2018 11:50	195	80.11611	30.06937	USNL deployed
23/07/2018 11:48		80.11613	30.06922	Vessel moved 20m (142*)
23/07/2018 11:43	194	80.11626	30.0687	USNL recovered

23/07/2018 11:35	194	80.11624	30.06873	Commenced recovery of USNL
23/07/2018 11:32	194	80.11625	30.06868	USNL @ bottom (~281m)
23/07/2018 11:24	194	80.11626	30.06858	USNL deployed
23/07/2018 11:18		80.11632	30.06864	Vessel moved 20m (186*)
23/07/2018 11:14	193	80.11644	30.06872	USNL recovered
23/07/2018 11:06	193	80.11644	30.06874	Commenced recovery of USNL
23/07/2018 11:03	193	80.11643	30.06873	USNL @ bottom (~281m)
23/07/2018 10:54	193	80.11645	30.06872	USNL deployed
23/07/2018 10:51		80.11643	30.06895	Vessel moved 20m (279*)
23/07/2018 10:46	192	80.11641	30.06976	USNL recovered
23/07/2018 10:38	192	80.1164	30.06972	Commenced recovery of USNL
23/07/2018 10:35	192	80.11642	30.06969	USNL @ bottom (~280m)
23/07/2018 10:27	192	80.11642	30.06972	USNL deployed
23/07/2018 10:20		80.11641	30.0696	Vessel moved 20m (066*)
23/07/2018 10:15	191	80.11635	30.06881	USNL recovered
23/07/2018 10:08	191	80.11633	30.06881	Commenced recovery of USNL
23/07/2018 10:04	191	80.11634	30.06881	USNL @ bottom (~279m)
23/07/2018 09:56	191	80.11634	30.06879	USNL deployed
23/07/2018 09:55		80.11633	30.06879	Vessel repositioned 033* x 20m
23/07/2018 09:49	190	80.11618	30.06825	USNL recovered to deck
23/07/2018 09:41	190	80.11618	30.06815	Commence recovery of USNL
23/07/2018 09:39	190	80.11618	30.06817	USNL on bottom (cable out 285m)
23/07/2018 09:31	190	80.11618	30.0682	USNL deployed
23/07/2018 09:27		80.11618	30.0679	Vessel repositioned 090* x 20m
23/07/2018 09:24	189	80.11618	30.06716	USNL recovered to deck
23/07/2018 09:16	189	80.11619	30.06724	Commence recovery of USNL
23/07/2018 09:13	189	80.1162	30.06719	USNL on bottom (cable out 283m)
23/07/2018 09:05	189	80.11618	30.06728	USNL deployed

23/07/2018 09:03		80.11617	30.067	Due to large amount of stones in boxcore
23/07/2018 08:55	188	80.116	30.06504	USNL recovered to deck
23/07/2018 08:45	188	80.11598	30.06505	Commence recovery of USNL
23/07/2018 08:43	188	80.11597	30.06514	USNL on bottom (284m)
23/07/2018 08:35	188	80.11597	30.06506	USNL deployed
23/07/2018 08:33		80.11596	30.06507	USNL failed. Vessel repositioned 188* x 20m
23/07/2018 08:24	187	80.11616	30.06512	USNL recovered to deck
23/07/2018 08:17	187	80.11615	30.06513	Commence recovery of USNL
23/07/2018 08:14	187	80.11615	30.06514	USNL on bottom (283m)
23/07/2018 08:05	187	80.11616	30.06518	USNL deployed
23/07/2018 08:04		80.11615	30.06547	Vessel repositioned 285* x 20m
23/07/2018 07:58	186	80.11612	30.06614	USNL recovered to deck
23/07/2018 07:49	186	80.11612	30.06612	Commence recovery of USNL
23/07/2018 07:45	186	80.11612	30.06618	USNL on bottom (283m)
23/07/2018 07:36	186	80.11613	30.06611	USNL deployed
23/07/2018 07:28		80.11602	30.0663	Vessel repositioned 347* x 20m
23/07/2018 07:25	185	80.11594	30.0664	USNL recovered to deck
23/07/2018 07:17	185	80.11594	30.06637	Commence recovery of USNL
23/07/2018 07:13	185	80.11595	30.06635	USNL on bottom (283m)
23/07/2018 07:03	185	80.11593	30.06644	USNL deployed
23/07/2018 06:59		80.1159	30.06602	Vessel repositioned 054* x 20m
23/07/2018 06:57	184	80.11583	30.06556	USNL recovered to deck
23/07/2018 06:47	184	80.11584	30.06565	Commence recovery of USNL
23/07/2018 06:44	184	80.11581	30.06556	USNL on bottom (283m)
23/07/2018 06:36	184	80.11584	30.06557	USNL deployed
23/07/2018 06:29		80.1159	30.06585	Vessel repositioned 209* x 20m
23/07/2018 06:25	183	80.11599	30.06608	USNL recovered to deck
23/07/2018 06:15	183	80.11599	30.06609	Commence recovery of USNL

23/07/2018 06:12	183	80.116	30.06609	USNL on bottom (cable out 278m)
23/07/2018 06:04	183	80.116	30.06609	USNL redeployed
23/07/2018 06:01		80.116	30.06608	USNL Failed
23/07/2018 06:00	182	80.116	30.06607	USNL recovered to deck
23/07/2018 05:49	182	80.116	30.06603	Commence recovery of USNL
23/07/2018 05:47	182	80.11599	30.06607	USNL on bottom (cable out 278m)
23/07/2018 05:39	182	80.11599	30.06605	USNL deployed
23/07/2018 05:31		80.116	30.06627	Vessel repositioned 239* x 20m
23/07/2018 05:28	181	80.11608	30.06698	USNL recovered to deck
23/07/2018 05:19	181	80.11607	30.06705	Commence recovery of USNL
23/07/2018 05:17	181	80.11607	30.06703	USNL on bottom (cable out 279m)
23/07/2018 05:09	181	80.11605	30.06703	USNL deployed
23/07/2018 05:05		80.11604	30.067	Vessel repositioned 093* x 20m
23/07/2018 05:01	180	80.11606	30.06594	USNL recovered to deck
23/07/2018 04:51	180	80.11608	30.06593	Recommence recovery of USNL
23/07/2018 04:50	180	80.11608	30.06591	USNL on bottom (cable out 278m)
23/07/2018 04:48	180	80.11609	30.0659	Veering USNL back to seabed (potential misfire)
23/07/2018 04:45	180	80.11608	30.06584	Commence recovery of USNL
23/07/2018 04:44	180	80.11608	30.06582	USNL on bottom (cable out 278m)
23/07/2018 04:35	180	80.11608	30.06585	USNL deployed
23/07/2018 04:29		80.11608	30.06582	Vessel repositioned 158* x 20m
23/07/2018 04:25	179	80.11625	30.0655	USNL recovered to deck
23/07/2018 04:18	179	80.11626	30.06551	Commence recovery of USNL
23/07/2018 04:16	179	80.11626	30.06548	USNL on bottom (cable out 279m)
23/07/2018 04:07	179	80.11626	30.06544	USNL deployed
23/07/2018 04:00		80.11626	30.06548	Vessel repositioned 201* x 20m
23/07/2018 03:57	178	80.11639	30.06588	USNL recovered to deck
23/07/2018 03:48	178	80.11644	30.06583	Commence recovery of USNL

23/07/2018 03:47	178	80.11642	30.06585	USNL on bottom (cable out 279m)
23/07/2018 03:38	178	80.11643	30.06582	USNL deployed
23/07/2018 03:35		80.11644	30.06584	Vessel repositioned 300* x 20m
23/07/2018 03:32	177	80.11635	30.06666	USNL recovered to deck
23/07/2018 03:23	177	80.11634	30.06672	Commence recovery of USNL
23/07/2018 03:21	177	80.11634	30.06678	USNL on bottom (cable out 277m)
23/07/2018 03:13	177	80.11635	30.0668	USNL deployed
23/07/2018 03:09		80.11634	30.0671	Vessel repositioned 269* x 20m
23/07/2018 03:06	176	80.11635	30.06783	USNL recovered to deck
23/07/2018 02:58	176	80.11634	30.06785	Commence recovery of USNL
23/07/2018 02:56	176	80.11634	30.06789	USNL on bottom (cable out 277m)
23/07/2018 02:48	176	80.11632	30.06793	USNL deployed
23/07/2018 02:47		80.11633	30.0679	Science time resumed
23/07/2018 02:32		80.11635	30.06786	Vessel repositioned 187* x 20m
23/07/2018 02:32		80.11635	30.06786	Downtime commenced (miships gantry leak)
23/07/2018 02:26	175	80.11653	30.06797	USNL recovered to deck
23/07/2018 02:12	175	80.11651	30.06786	Commence recovery of USNL
23/07/2018 02:10	175	80.11651	30.06787	USNL on bottom (cable out 278m)
23/07/2018 02:01	175	80.11652	30.06792	USNL deployed
23/07/2018 02:00		80.11652	30.06795	Downtime finished. Science resumed
23/07/2018 01:41		80.11652	30.06803	Engines confirmed OK to resume ops
23/07/2018 01:27		80.11647	30.06876	Vessel on DP @B16 standing by while engine testing continues
23/07/2018 00:34		80.12498	29.92894	Vessel off DP and steaming to test No. 1 engine
23/07/2018 00:01		80.1222	29.95058	Vessel on DP auto head to keep heading - awaiting permission to use propultion
22/07/2018 23:52		80.1222	29.95058	Vessel off DP.
22/07/2018 23:44		80.1222	29.95058	Vessel on DP autohead
22/07/2018 22:42		80.11652	30.06792	Science suspended. Vessel downtime commenced.
22/07/2018 21:23		80.1167	30.06757	Vessel on DP

22/07/2018 20:58		80.108	30.06716	Vessel off DP. Repositioning for USNL deployments
22/07/2018 20:48	174	80.10897	30.06422	AGT recovered to deck
22/07/2018 20:31	174	80.10961	30.06217	AGT off bottom
22/07/2018 20:25	174	80.11006	30.06077	Trawl complete. Commence recovery. Speed 0.3kts
22/07/2018 20:10	174	80.11375	30.04937	Cable stopped at 420m for trawl. Speed 1.0kts
22/07/2018 20:06	174	80.11409	30.04837	AGT on bottom (cable out 292m) Speed 0.5kts
22/07/2018 19:56	174	80.11518	30.04508	AGT deployed
22/07/2018 19:54		80.11532	30.04462	Vessel in position for AGT deployment
22/07/2018 19:43		80.10951	30.06557	Vessel repositioning for next AGT
22/07/2018 19:41	173	80.10932	30.06622	AGT recovered to deck
22/07/2018 19:23	173	80.11016	30.0636	AGT off bottom
22/07/2018 19:16	173	80.11084	30.06156	Trawl complete. Commence recovery. Speed 0.3kts
22/07/2018 19:01	173	80.11444	30.05059	Cable stopped at 420m for trawl. Speed 1.0kts
22/07/2018 18:57	173	80.11504	30.04885	AGT on bottom (cable out 292m) Speed 0.5kts
22/07/2018 18:47	173	80.11593	30.046	AGT deployed. Speed 0.3kts
22/07/2018 18:46		80.11601	30.04571	Vessel in position for AGT deployment
22/07/2018 18:31		80.10993	30.06898	Vessel repositioning for next AGT
22/07/2018 18:27	172	80.10993	30.06896	AGT recovered to deck
22/07/2018 18:14	172	80.11081	30.06593	AGT off bottom
22/07/2018 18:09	172	80.11115	30.06478	Trawl complete. Commence recovery. Speed 0.3kts
22/07/2018 17:52	172	80.11508	30.05187	Cable stopped at 420m for trawl. Speed 1.0kts
22/07/2018 17:48	172	80.11562	30.05017	AGT on bottom (cable out 282m) Speed 0.5kts
22/07/2018 17:39	172	80.11647	30.04722	AGT deployed. Speed 0.3kts
22/07/2018 17:34		80.11649	30.0471	Vessel in position for AGT deployment
22/07/2018 17:20		80.1091	30.07268	Vessel repositioning for next AGT
22/07/2018 17:17	171	80.1091	30.0726	AGT recovered to deck
22/07/2018 17:08	171	80.10953	30.07238	AGT off bottom
22/07/2018 17:03	171	80.11007	30.07194	Trawl complete. Commence recovery. Speed 0.3kts

22/07/2018 16:48	171	80.11407	30.06967	Cable stopped at 420m for trawl. Speed 1.0kts
22/07/2018 16:44	171	80.11469	30.06933	AGT on bottom (cable out 286m) Speed 0.5kts
22/07/2018 16:36	171	80.11552	30.06882	AGT deployed. Speed 0.3kts
22/07/2018 16:26		80.11563	30.06881	Vessel in position for AGT deployment
22/07/2018 16:15		80.10941	30.07538	Vessel repositioning for next AGT
22/07/2018 16:14	170	80.10903	30.0762	AGT recovered to deck
22/07/2018 16:04	170	80.10936	30.07608	AGT off bottom
22/07/2018 16:00	170	80.10967	30.07593	Trawl complete. Commence recovery. Speed 0.3kts
22/07/2018 15:45	170	80.1138	30.07338	Cable stopped at 420m for trawl. Speed 1.0kts
22/07/2018 15:40	170	80.1146	30.07288	AGT on bottom (cable out 288m) Speed 0.5kts
22/07/2018 15:30	170	80.11569	30.07218	AGT deployed. Speed 0.3kts
22/07/2018 15:24		80.11576	30.07207	Vessel in position for AGT deployment
22/07/2018 15:13		80.10929	30.07741	Vessel repositioning for next AGT
22/07/2018 15:12	169	80.10913	30.07787	AGT recovered to deck
22/07/2018 15:01	169	80.10942	30.07771	AGT off bottom
22/07/2018 14:55	169	80.11005	30.07747	Trawl complete. Commence recovery. Speed 0.3kts
22/07/2018 14:40	169	80.11414	30.07493	Cable stopped at 420m for trawl. Speed 1.0kts
22/07/2018 14:36	169	80.1147	30.07459	AGT on bottom (cable out 289m) Speed 0.5kts
22/07/2018 14:26	169	80.11578	30.07398	AGT deployed. Speed 0.3kts
22/07/2018 14:20		80.11583	30.07393	Vessel in position for next AGT deployment
22/07/2018 14:10		80.11162	30.07788	Vessel repositioning for next AGT
22/07/2018 14:09	168	80.11158	30.07791	AGT recovered to deck
22/07/2018 13:50	168	80.11271	30.07714	Commenced recovery of AGT
22/07/2018 13:39	168	80.11566	30.07525	Commenced trawl @ 1 kt for 5 min (wire out 420m)
22/07/2018 13:35	168	80.11624	30.07492	AGT @ bottom (~282m)
22/07/2018 13:25	168	80.11735	30.0743	AGT deployed
22/07/2018 13:23	168	80.1175	30.07416	Commenced AGT deployment
22/07/2018 13:15		80.1174	30.07217	Vessel in position for next AGT deployment

22/07/2018 13:04	167	80.11202	30.08818	AGT recovered
22/07/2018 12:51	167	80.11317	30.08524	Commenced recovery of AGT
22/07/2018 12:39	167	80.11606	30.07775	Commenced trawl @ 1 kt for 5 min (wire out 420m)
22/07/2018 12:36	167	80.1165	30.07665	AGT @ bottom (~288m)
22/07/2018 12:27	167	80.11735	30.07433	AGT deployed
22/07/2018 12:25	167	80.11747	30.07402	Commenced AGT deployment
22/07/2018 12:13		80.11692	30.07533	Vessel in position for next AGT deployment
22/07/2018 12:00	166	80.11071	30.09771	AGT recovered
22/07/2018 11:46	166	80.11193	30.09362	Commenced recovery of AGT
22/07/2018 11:28	166	80.11619	30.07948	Commenced trawl @ 1kt for 5 min (wire out 420m)
22/07/2018 11:24	166	80.11674	30.07768	AGT @ bottom (~283m)
22/07/2018 11:16	166	80.11751	30.07503	AGT deployed
22/07/2018 11:15	166	80.11756	30.07493	Commenced AGT deployment
22/07/2018 11:10		80.11762	30.0747	Vessel in position for AGT deployment
22/07/2018 10:51	165	80.11669	30.06834	CTD recovered
22/07/2018 10:28	165	80.1167	30.06827	CTD @ 267m; commenced recovery
22/07/2018 10:18	165	80.1167	30.06826	CTD deployed
22/07/2018 10:08		80.11698	30.06797	Vessel on DP @ B16
22/07/2018 08:05		80.40785	29.89149	Vessel off DP. Proceeding to station B16
22/07/2018 08:04	164	80.40785	29.89147	CTD recovered to deck
22/07/2018 07:57	164	80.40784	29.89152	CTD stopped at depth 160m
22/07/2018 07:50	164	80.40785	29.89155	CTD deployed
22/07/2018 07:42		80.408	29.89097	Vessel stopped on DP at B16A
22/07/2018 05:34		80.69908	29.70902	Vessel off DP. Proceeding to station B16A
22/07/2018 05:31	163	80.69908	29.70897	CTD recovered to deck
22/07/2018 05:21	163	80.69906	29.709	CTD stopped at depth 389m
22/07/2018 05:09	163	80.69905	29.70899	CTD deployed
22/07/2018 05:06		80.6992	29.70793	Vessel on DP at station B16B

22/07/2018 03:11		80.99021	29.52146	Vessel off DP. Proceeding to station B16B
22/07/2018 03:06	162	80.99022	29.52144	CTD recovered to deck
22/07/2018 02:57	162	80.99021	29.52143	CTD stopped at depth 288m
22/07/2018 02:46	162	80.99026	29.52108	CTD deployed
22/07/2018 02:38		80.99156	29.5195	Vessel stopped on DP at B16C
21/07/2018 20:29		81.79998	27.79281	Vessel off DP and proceeding to station 'B16C'
21/07/2018 20:25	161	81.79995	27.79275	CTD recovered to deck
21/07/2018 20:11	161	81.79997	27.79268	CTD stopped at depth 100m
21/07/2018 20:04	161	81.79997	27.79274	CTD Deployed
21/07/2018 19:54		81.80006	27.79228	Vessel on DP at station 'E'
21/07/2018 18:29		81.95653	27.38464	Clear of ice edge
21/07/2018 17:14		82.04446	27.24517	Vessel off DP. Proceeding to station 'E'
21/07/2018 17:10		82.04443	27.24785	Ice sampling complete
21/07/2018 16:56		82.04384	27.25771	Commenced ice sampling
21/07/2018 16:50		82.04415	27.26141	Vessel manouevring on joystick DP for ice sampling
21/07/2018 16:41	160	82.04445	27.2703	CTD recovered to deck
21/07/2018 16:20	160	82.0445	27.27501	CTD stopped at depth 100m
21/07/2018 16:11	160	82.04443	27.2773	CTD deployed
21/07/2018 16:07		82.0445	27.27765	Vessel on DP at "ice edge" station 'B'
21/07/2018 10:36		82.56503	27.30007	Vessel off DP and proceeding to ice edge station
21/07/2018 09:58		82.56536	27.30297	Commenced ice sample recovery in basket
21/07/2018 09:53		82.56542	27.3036	Vessel on DP for Ice and algae
21/07/2018 09:28		82.54386	27.17181	Vessel off DP to relocate for ice and algae
21/07/2018 09:24	159	82.54387	27.17176	CTD recovered
21/07/2018 09:06	159	82.54386	27.17177	CTD @ 100m; commenced recovery
21/07/2018 08:58	159	82.54386	27.1717	CTD deployed
21/07/2018 08:53		82.54386	27.17189	Vessel on DP @ Station 'R'
20/07/2018 23:43		83.04613	27.68917	Vessel commenced proceeding South to next station

20/07/2018 23:36		83.04697	27.68809	Ice samples recovered in basket
20/07/2018 23:19		83.04907	27.68574	Ice samples recovered in basket
20/07/2018 22:57		83.04408	27.65918	Vessel off DP to collect ice samples
20/07/2018 22:52	158	83.04453	27.6579	CTD recovered
20/07/2018 22:31	158	83.04621	27.6543	CTD @ 100m; commenced recovery
20/07/2018 22:24	158	83.04647	27.65231	CTD deployed
20/07/2018 22:09		83.04706	27.64842	Vessel on DP @ Station 'A'
20/07/2018 13:00		82.50076	28.5399	Vessel off DP
20/07/2018 12:54	157	82.50133	28.53761	TEST STATION - CTD recovered
20/07/2018 12:36	157	82.50331	28.52862	TEST STATION - CTD @ 100m; commenced recovery
20/07/2018 12:29	157	82.50441	28.52317	TEST STATION - CTD deployed
20/07/2018 12:09		82.50578	28.52262	Vessel on DP
20/07/2018 09:35		82.26107	28.95269	Vessel off DP. End of Downtime
20/07/2018 06:06		82.26387	28.97938	Vessel on DP - commence downtime for thruster
20/07/2018 03:14		82.04382	29.01053	Vessel entered light pack ice. Continues to proceed Northwards
19/07/2018 23:00		81.52647	29.46429	Vessel off DP and proceeding to ice edge
19/07/2018 22:43	156	81.52647	29.46425	CTD recovered
19/07/2018 22:03	156	81.52645	29.46436	CTD @ 994m; commenced recovery
19/07/2018 21:40	156	81.52603	29.46549	CTD Deployed
19/07/2018 21:30		81.52621	29.46459	Vessel on DP @ 1000m CTD
19/07/2018 19:43		81.28168	29.32676	Vessel off DP and proceeding to 1000m CTD
19/07/2018 19:40	155	81.28169	29.32677	Zooplankton Net recovered
19/07/2018 19:36	155	81.28169	29.32675	Zooplankton Net @ 40m; commenced recovery
19/07/2018 19:33	155	81.28169	29.32681	Zooplankton Net deployed
19/07/2018 19:12		81.28158	29.32646	Vessel moved to centroid for Zooplankton net deployment
19/07/2018 19:07	154	81.28154	29.326	SMBA on deck
19/07/2018 18:57	154	81.28153	29.32597	Commence recovery of SMBA
19/07/2018 18:54	154	81.28153	29.32597	SMBA on bottom (cable out 339m)

19/07/2018 18:44	154	81.28153	29.32591	SMBA deployed
19/07/2018 18:42		81.28153	29.32591	Vessel moved position 180* x 10m
19/07/2018 18:37	153	81.28162	29.32593	SMBA recovered to deck
19/07/2018 18:28	153	81.2816	29.32591	Commence recovery of SMBA
19/07/2018 18:26	153	81.2816	29.3259	SMBA on bottom (cable out 339m)
19/07/2018 18:15	153	81.28163	29.32589	SMBA deployed
19/07/2018 18:13		81.28162	29.32587	Vessel moved position 180* x 5m
19/07/2018 18:08	152	81.28168	29.3259	SMBA recovered to deck
19/07/2018 17:58	152	81.28169	29.32591	Commence recovery of SMBA
19/07/2018 17:55	152	81.28169	29.32593	SMBA on bottom (cable out 335m)
19/07/2018 17:46	152	81.28168	29.326	SMBA deployed
19/07/2018 17:39		81.28168	29.32597	Vessel moved position 180* x 5m
19/07/2018 17:36	151	81.28176	29.32594	SMBA recovered to deck
19/07/2018 17:26	151	81.28176	29.32599	Commence recovery of SMBA
19/07/2018 17:24	151	81.28176	29.32601	SMBA on bottom (cable out 334m)
19/07/2018 17:14	151	81.28176	29.32595	SMBA deployed
19/07/2018 17:07		81.28175	29.326	Vessel moved position 090* x 5m
19/07/2018 17:03	150	81.28176	29.32553	SMBA recovered to deck
19/07/2018 16:53	150	81.28177	29.32554	Commence recovery of SMBA
19/07/2018 16:50	150	81.28176	29.32551	SMBA on bottom (cable out 334m)
19/07/2018 16:40	150	81.28175	29.3255	SMBA deployed
19/07/2018 16:38		81.28172	29.32555	Vessel moved position 000* x 5m
19/07/2018 16:31	149	81.28168	29.32549	SMBA recovered to deck
19/07/2018 16:21	149	81.28169	29.32558	Commence recovery of SMBA
19/07/2018 16:19	149	81.28169	29.32559	SMBA on bottom (cable out 335m)
19/07/2018 16:12	149	81.28169	29.32558	SMBA deployed
19/07/2018 16:10		81.28166	29.32575	Vessel repositioned to 20m W of centroid
19/07/2018 15:48	148	81.28149	29.32668	SMBA recovered to deck

19/07/2018 15:36	148	81.2815	29.32674	Commence recovery of SMBA
19/07/2018 15:32	148	81.28148	29.32673	SMBA on bottom (cable out 334m)
19/07/2018 15:23	148	81.28149	29.32673	SMBA deployed
19/07/2018 15:19		81.28152	29.32697	Vessel repositioned to 20m S of centroid
19/07/2018 15:15	147	81.28169	29.32778	SMBA recovered to deck
19/07/2018 15:05	147	81.28169	29.32776	Commence recovery of SMBA
19/07/2018 15:03	147	81.2817	29.32776	SMBA on bottom (cable out 334m)
19/07/2018 14:53	147	81.2817	29.32781	SMBA deployed
19/07/2018 14:50		81.28171	29.32778	Vessel repositioned to 20m E of centroid
19/07/2018 14:45	146	81.28185	29.3268	SMBA recovered to deck
19/07/2018 14:35	146	81.28184	29.32682	Commence recovery of SMBA
19/07/2018 14:32	146	81.28186	29.32682	SMBA on bottom (cable out 334m)
19/07/2018 14:23	146	81.28186	29.32676	SMBA deployed
19/07/2018 14:21		81.28185	29.32681	Vessel repositioned to 20m N of centroid
19/07/2018 14:15	145	81.2817	29.32673	SMBA recovered to deck
19/07/2018 14:05	145	81.28171	29.3267	Commence recovery of SMBA
19/07/2018 14:02	145	81.2817	29.32669	SMBA on bottom (cable out 334m)
19/07/2018 13:53	145	81.28169	29.32667	SMBA deployed
19/07/2018 13:36		81.28168	29.32687	Vessel moved to 5m W of centroid for SMBA deployment
19/07/2018 13:22	144	81.28157	29.32775	Megacorer recovered
19/07/2018 13:13	144	81.28157	29.32774	Commenced recovery of Megacorer
19/07/2018 13:07	144	81.28157	29.32775	Megacorer @ bottom (~336m)
19/07/2018 12:58	144	81.28157	29.32778	Megacorer deployed (repeat location)
19/07/2018 12:36	143	81.28156	29.32777	Megacorer recovered
19/07/2018 12:27	143	81.28157	29.32778	Commenced recovery of Megacorer
19/07/2018 12:23	143	81.28157	29.3278	Megacorer @ bottom (~334m)
19/07/2018 12:14	143	81.28146	29.32788	Megacorer deployed
19/07/2018 12:05		81.2816	29.32728	Vessel moved to 20m SE of centroid for Megacorer deployment

19/07/2018 11:53	142	81.28174	29.32601	Megacorer recovered
19/07/2018 11:45	142	81.28176	29.32595	Commenced recovery of Megacorer
19/07/2018 11:41	142	81.28176	29.32599	Megacorer @ bottom (~335m)
19/07/2018 11:32	142	81.28175	29.32601	Megacorer deployed
19/07/2018 11:20		81.28173	29.32625	Vessel moved to 20m NW of centroid for Megacorer deployment
19/07/2018 11:14	141	81.28162	29.32732	Megacorer recovered
19/07/2018 11:03	141	81.28164	29.32726	Commenced recovery of Megacorer
19/07/2018 11:00	141	81.28163	29.32727	Megacorer @ bottom (~335m)
19/07/2018 10:50	141	81.28163	29.3272	Megacorer deployed
19/07/2018 10:45		81.28158	29.32714	Vessel in position 5m E of centroid for Megacorer deployment
19/07/2018 10:29	140	81.28107	29.32743	USNL recovered
19/07/2018 10:20	140	81.28106	29.32739	Commenced recovery of USNL
19/07/2018 10:18	140	81.28106	29.32739	USNL @ bottom (~336m)
19/07/2018 10:08	140	81.28105	29.32746	USNL deployed
19/07/2018 10:04		81.28108	29.32719	Vessel moved 20m (142*)
19/07/2018 09:59	139	81.28119	29.32671	USNL recovered to deck
19/07/2018 09:49	139	81.28122	29.32669	Commence recovery of USNL
19/07/2018 09:46	139	81.28121	29.3267	USNL on bottom (cable out 340m)
19/07/2018 09:39	139	81.2812	29.32669	USNL Deployed
19/07/2018 09:36		81.28124	29.32671	Vessel moved position 186* x 20m
19/07/2018 09:32	138	81.28134	29.32724	USNL recovered to deck
19/07/2018 09:24	138	81.28136	29.32723	Commence recovery of USNL
19/07/2018 09:22	138	81.28136	29.32721	USNL on bottom (cable out 340m)
19/07/2018 09:12	138	81.28135	29.32762	USNL Deployed
19/07/2018 09:05		81.28131	29.32988	Vessel on DP @ B17 - 20m 282* of previous USNL
19/07/2018 06:30		81.28138	29.32701	Vessel off DP to relocate for retention tank
19/07/2018 06:25	137	81.28136	29.32801	USNL recovered to deck
19/07/2018 06:14	137	81.28136	29.32804	Commence recovery of USNL

19/07/2018 06:13	137	81.28136	29.32802	USNL on bottom (cable out 345m)
19/07/2018 06:01	137	81.28138	29.32805	USNL deployed
19/07/2018 05:58		81.28135	29.32803	Vessel moved position 279* x 20m
19/07/2018 05:54	136	81.28132	29.32929	USNL recovered to deck
19/07/2018 05:44	136	81.28132	29.32937	Commence recovery of USNL
19/07/2018 05:43	136	81.28133	29.32941	USNL on bottom (cable out 337m)
19/07/2018 05:33	136	81.28133	29.32931	USNL deployed
19/07/2018 05:29		81.28131	29.32939	Vessel moved position 066* x 20m
19/07/2018 05:26	135	81.28125	29.3284	USNL recovered to deck
19/07/2018 05:16	135	81.28124	29.32832	Commence recovery of USNL
19/07/2018 05:15	135	81.28124	29.32828	USNL on bottom (cable out 337m)
19/07/2018 05:05	135	81.28122	29.32831	USNL deployed
19/07/2018 05:00		81.28122	29.32834	Vessel moved position 033* x 20m
19/07/2018 04:56	134	81.28108	29.32762	USNL recovered to deck
19/07/2018 04:47	134	81.28107	29.32785	Commence recovery of USNL
19/07/2018 04:45	134	81.28105	29.32781	USNL on bottom (cable out 337m)
19/07/2018 04:35	134	81.28105	29.32795	USNL deployed
19/07/2018 04:30		81.28108	29.32731	Vessel moved position 090* x 20m
19/07/2018 04:27	133	81.28107	29.3267	USNL recovered to deck
19/07/2018 04:18	133	81.28108	29.32666	Commence recovery of USNL
19/07/2018 04:16	133	81.28107	29.32666	USNL on bottom (cable out 335m)
19/07/2018 04:07	133	81.28108	29.32673	USNL deployed
19/07/2018 03:57		81.28108	29.32663	Vessel moved position 061* x 20m
19/07/2018 03:54	132	81.281	29.32572	USNL recovered to deck
19/07/2018 03:44	132	81.281	29.32563	Commence recovery of USNL
19/07/2018 03:43	132	81.281	29.32565	USNL on bottom (cable out 335m)
19/07/2018 03:33	132	81.28099	29.32578	USNL deployed
19/07/2018 03:29		81.28099	29.32579	Vessel moved position 054* x 20m

19/07/2018 03:27	131	81.28094	29.32518	USNL recovered to deck
19/07/2018 03:16	131	81.28087	29.32488	Commence recovery of USNL
19/07/2018 03:15	131	81.28089	29.32487	USNL on bottom (cable out 334m)
19/07/2018 03:05	131	81.28088	29.32489	USNL deployed
19/07/2018 03:00		81.28093	29.32444	Vessel moved position 121* x 20m
19/07/2018 02:58	130	81.28098	29.32388	USNL recovered to deck
19/07/2018 02:48	130	81.28099	29.32374	Commence recovery of USNL
19/07/2018 02:47	130	81.28099	29.32381	USNL on bottom (cable out 333m)
19/07/2018 02:37	130	81.28099	29.32378	USNL deployed
19/07/2018 02:32		81.28099	29.32385	Vessel moved position 209* x 20m
19/07/2018 02:28	129	81.28113	29.3243	USNL recovered to deck
19/07/2018 02:20	129	81.28114	29.32432	Commence recovery of USNL
19/07/2018 02:18	129	81.28114	29.32433	USNL on bottom (cable out 334m)
19/07/2018 02:08	129	81.28115	29.32436	USNL deployed
19/07/2018 02:04		81.28114	29.32437	Vessel moved position 239* x 20m
19/07/2018 01:59	128	81.28124	29.32543	USNL recovered
19/07/2018 01:50	128	81.28125	29.32544	Commenced recovery of USNL
19/07/2018 01:49	128	81.28125	29.3254	USNL @ bottom (~334m)
19/07/2018 01:39	128	81.28127	29.32536	USNL deployed
19/07/2018 01:36		81.28124	29.3254	Vessel moved 20m (093*)
19/07/2018 01:31	127	81.28126	29.32419	USNL recovered
19/07/2018 01:23	127	81.28127	29.32426	Commenced recovery of USNL
19/07/2018 01:22	127	81.28126	29.32422	USNL @ bottom (~333m)
19/07/2018 01:12	127	81.28126	29.32423	USNL deployed
19/07/2018 01:04		81.28127	29.32414	Vessel moved 20m (158*)
19/07/2018 01:00	126	81.28142	29.32383	USNL recovered
19/07/2018 00:52	126	81.28143	29.32387	Commenced recovery of USNL
19/07/2018 00:50	126	81.28144	29.32383	USNL @ bottom (~332m)

19/07/2018 00:40	126	81.28144	29.32384	USNL deployed
19/07/2018 00:38		81.28146	29.32391	Vessel moved 20m (201*)
19/07/2018 00:34	125	81.2816	29.32427	USNL recovered
19/07/2018 00:26	125	81.28158	29.32432	Commenced recovery of USNL
19/07/2018 00:24	125	81.28144	29.32382	USNL @ bottom (~332m)
19/07/2018 00:14	125	81.2816	29.32434	USNL deployed
19/07/2018 00:12		81.28157	29.32463	Vessel moved 20m (300*)
19/07/2018 00:07	124	81.28151	29.32538	USNL recovered
18/07/2018 23:59	124	81.28151	29.32527	Commenced recovery of USNL
18/07/2018 23:57	124	81.28151	29.32527	USNL @ bottom (~334m)
18/07/2018 23:47	124	81.28151	29.32525	USNL deployed
18/07/2018 23:44		81.2815	29.32543	Vessel moved 20m (269*)
18/07/2018 23:40	123	81.28151	29.32643	USNL recovered
18/07/2018 23:32	123	81.28152	29.32633	Commenced recovery of USNL
18/07/2018 23:30	123	81.28151	29.32635	USNL @ bottom (~337m)
18/07/2018 23:20	123	81.28151	29.3263	USNL deployed
18/07/2018 22:21		81.28196	29.32633	Vessel on DP for USNL deployment
18/07/2018 21:53		81.27764	29.38569	Vessel off DP to relocate for USNL deployements
18/07/2018 21:52	122	81.27764	29.38573	AGT recovered to deck
18/07/2018 21:33	122	81.27814	29.38193	AGT off bottom
18/07/2018 21:25	122	81.27875	29.37752	Trawl complete. Commence recovery. Speed 0.3kts
18/07/2018 21:02	122	81.28303	29.34653	Cable stopped at 508m for trawl. Speed 1.0kts
18/07/2018 20:56	122	81.28415	29.33843	AGT on bottom (cable out 340m). Speed 0.5kts
18/07/2018 20:45	122	81.28475	29.33391	AGT Deployed
18/07/2018 20:44		81.28482	29.33351	Vessel in position for AGT deployment
18/07/2018 20:27		81.27652	29.33951	Vessel repositioning for next AGT
18/07/2018 20:26	121	81.27653	29.33948	AGT recovered to deck
18/07/2018 20:14	121	81.2774	29.34019	AGT off bottom

18/07/2018 20:07	121	81.278	29.34062	Trawl complete. Commence recovery. Speed 0.3kts
18/07/2018 19:52	121	81.28213	29.34337	Cable stopped at 508m for trawl. Speed 1.0kts
18/07/2018 19:46	121	81.2831	29.34406	AGT on bottom (cable out 350m). Speed 0.5kts
18/07/2018 19:36	121	81.28394	29.34459	AGT deployed. Speed 0.3kts
18/07/2018 19:32		81.284	29.34454	Vessel in position for AGT deployment
18/07/2018 19:22		81.28338	29.3	Vessel repositioning for next AGT
18/07/2018 19:20	120	81.28336	29.29741	AGT recovered to deck
18/07/2018 19:05	120	81.28342	29.30313	AGT off bottom
18/07/2018 18:57	120	81.28348	29.30736	Trawl complete. Commence recovery. Speed 0.3kts
18/07/2018 18:42	120	81.28382	29.33425	Cable stopped at 508m for trawl. Speed 1.0kts
18/07/2018 18:36	120	81.28388	29.34098	AGT on bottom (cable out 354m). Speed 0.5kts
18/07/2018 18:26	120	81.28397	29.34701	AGT deployed. Speed 0.3kts
18/07/2018 18:23		81.28397	29.3481	Vessel in position for AGT deployment
18/07/2018 18:10		81.28393	29.34429	Vessel repositioning for next AGT
18/07/2018 18:09	119	81.28314	29.30039	AGT recovered to deck
18/07/2018 17:58	119	81.28322	29.30639	AGT off bottom
18/07/2018 17:52	119	81.28327	29.31033	Trawl complete. Commence recovery. Speed 0.3kts
18/07/2018 17:37	119	81.28363	29.33693	Cable stopped at 502m for trawl. Speed 1.0kts
18/07/2018 17:33	119	81.28366	29.3407	AGT on bottom (cable out 340m). Speed 0.5kts
18/07/2018 17:22	119	81.28378	29.34869	AGT deployed. Speed 0.3kts
18/07/2018 17:17		81.28376	29.3488	Vessel in position for AGT deployment
18/07/2018 17:07		81.28292	29.30561	Vessel repositioning for next AGT
18/07/2018 17:06	118	81.2829	29.30523	AGT recovered to deck
18/07/2018 16:51	118	81.28297	29.30954	AGT off bottom
18/07/2018 16:45	118	81.283	29.31324	Commence recovery of AGT. Speed 0.3kts
18/07/2018 16:32	118	81.28332	29.33683	AGT on bottom (cable out 339m). Speed 0.5kts
18/07/2018 16:29	118	81.2834	29.34145	Cable stopped at 502m for trawl. Speed 1.0kts
18/07/2018 16:15	118	81.28354	29.35273	AGT deployed. Speed 0.3kts

18/07/2018 16:14		81.28355	29.35323	Vessel in position for AGT
18/07/2018 16:04		81.28269	29.30929	Vessel repositioning for next AGT deployment
18/07/2018 16:03	117	81.28268	29.30929	AGT recovered to deck
18/07/2018 15:49	117	81.28277	29.31516	AGT off bottom
18/07/2018 15:46	117	81.2828	29.31725	Trawl complete. Commence recovery. Speed 0.3kts
18/07/2018 15:30	117	81.2832	29.34531	Cable stopped at 502m for trawl. Speed 1.0kts
18/07/2018 15:26	117	81.28324	29.34905	AGT on bottom (cable out 339m). Speed 0.5kts
18/07/2018 15:16	117	81.28334	29.35586	AGT deployed. Speed 0.3kts
18/07/2018 15:12		81.28331	29.35718	Vessel on DP
18/07/2018 14:55		81.27843	29.23873	Vessel off DP. Repositioning for next AGT
18/07/2018 14:54	116	81.27843	29.23874	AGT recovered to deck
18/07/2018 14:42	116	81.27847	29.24346	AGT off bottom
18/07/2018 14:35	116	81.27851	29.24792	Trawl complete. Commence recovery. Speed 0.3kts
18/07/2018 14:19	116	81.27874	29.2761	Cable stopped at 502m for 15 min trawl. Speed 1.0kts
18/07/2018 14:15	116	81.27876	29.2797	AGT on bottom (cable out 339m). Speed 0.5kts
18/07/2018 14:05	116	81.27882	29.28686	AGT deployed. Speed 0.3kts
18/07/2018 13:46	115	81.27885	29.2882	AGT recovered
18/07/2018 13:30	115	81.27891	29.29744	Commenced recovery of AGT
18/07/2018 13:15	115	81.27916	29.32463	Commenced trawl @ 1 kt for 15 min (wire out 502m)
18/07/2018 13:10	115	81.27919	29.32988	AGT @ bottom (~344m)
18/07/2018 13:00	115	81.27938	29.33635	AGT deployed
18/07/2018 12:58	115	81.27939	29.33728	Commenced AGT deployment
18/07/2018 12:57		81.2794	29.33756	Vessel on DP
18/07/2018 12:40		81.28093	29.29801	Vessel off DP to relocate for next AGT deployment
18/07/2018 12:37	114	81.28088	29.29652	AGT recovered
18/07/2018 12:20	114	81.28078	29.30626	Commenced recovery of AGT
18/07/2018 11:59	114	81.28024	29.34352	Commenced trawl @ 1 kt for 15 min (wire out 502m)
18/07/2018 11:54	114	81.28022	29.34901	AGT @ bottom (~337m)

18/07/2018 11:45	114	81.2802	29.35526	AGT deployed
18/07/2018 11:42	114	81.28025	29.35684	Commenced AGT deployment
18/07/2018 11:40		81.28005	29.3568	Vessel on DP
18/07/2018 11:27		81.27972	29.28402	Vessel off DP to relocate for next AGT deployment
18/07/2018 11:21	113	81.27979	29.26345	AGT recovered
18/07/2018 10:59	113	81.27971	29.27676	Commenced recovery of AGT
18/07/2018 10:28	113	81.27938	29.33298	Commenced trawl @ 1 kt for 5 min (wire out 502m)
18/07/2018 10:23	113	81.27935	29.33803	AGT @ bottom (~340m)
18/07/2018 10:13	113	81.27922	29.3446	AGT deployed
18/07/2018 10:12	113	81.27922	29.34515	Commenced AGT deployment
18/07/2018 10:11		81.27931	29.3452	Vessel in position for next AGT deployment
18/07/2018 09:57	112	81.28076	29.28519	AGT recovered to deck
18/07/2018 09:44	112	81.28065	29.29233	AGT off bottom
18/07/2018 09:38	112	81.28057	29.29609	Finish 5min trawl. Commence recovery speed 0.3kts
18/07/2018 09:33	112	81.28037	29.30505	Start 5 min trawl at 1.0 kts
18/07/2018 09:19	112	81.27975	29.33023	Cable stopped at 502m
18/07/2018 09:13	112	81.2796	29.33682	AGT on bottom 349m
18/07/2018 09:03	112	81.27941	29.34432	AGT deployed. Speed 0.3kts
18/07/2018 09:02		81.27937	29.34475	Vessel in position for AGT deployment
18/07/2018 08:50		81.28084	29.28664	Vessel repositioning for next AGT deployment
18/07/2018 08:48	111	81.28084	29.28688	AGT recovered to deck
18/07/2018 08:34	111	81.28077	29.2926	AGT off bottom
18/07/2018 08:29	111	81.28075	29.29538	Trawl complete. Commence recovery. Speed 0.3kts
18/07/2018 08:22	111	81.28059	29.30791	Cable stopped at 502m for 5 min trawl. Speed 1.0kts
18/07/2018 08:00	111	81.28014	29.3435	AGT on bottom (cable out 324m). Speed 0.5kts
18/07/2018 07:50	111	81.28007	29.34901	AGT deployed. Speed 0.3kts
18/07/2018 07:30		81.28004	29.34902	Vessel in position for AGT deployment
18/07/2018 07:20		81.28158	29.32698	Vessel repositioning for next AGT deployment

18/07/2018 07:18	110	81.2816	29.32686	CTD Recovered to deck
18/07/2018 06:50	110	81.28161	29.3269	CTD stopped at depth 328m. Commence recovery
18/07/2018 06:37	110	81.28163	29.32675	CTD deployed on centroid
18/07/2018 06:30		81.28141	29.32614	Vessel on DP @ Station B17
17/07/2018 10:52		78.25166	29.99986	Vessel off DP and proceeding to next science station
17/07/2018 10:41	109	78.25166	29.99983	Zooplankton Net recovered
17/07/2018 10:39	109	78.25166	29.99987	Zooplankton Net @ 40m; commenced recovery
17/07/2018 10:37	109	78.25166	29.99988	Zooplankton Net deployed
17/07/2018 10:18		78.25164	29.99888	Vessel moved to centroid for Zooplankton net deployment
17/07/2018 10:13	108	78.25163	29.99882	SMBA recovered
17/07/2018 10:04	108	78.25163	29.99877	Commenced recovery of SMBA
17/07/2018 10:02	108	78.25163	29.9988	SMBA @ bottom (~315m)
17/07/2018 09:52	108	78.25163	29.99882	SMBA deployed
17/07/2018 09:50		78.25162	29.99893	Vessel in position 20m W of centroid
17/07/2018 09:42	107	78.25144	29.99979	SMBA recovered to deck
17/07/2018 09:34	107	78.25143	29.99973	Commence recovery of SMBA
17/07/2018 09:32	107	78.25143	29.99976	SMBA on bottom (cable out 316m)
17/07/2018 09:23	107	78.25144	29.99977	SMBA deployed
17/07/2018 09:21		78.25145	29.99975	Vessel in position 20m S of centroid
17/07/2018 09:11	106	78.25162	30.00077	SMBA recovered to deck
17/07/2018 09:01	106	78.25162	30.00083	Commence recovery of SMBA
17/07/2018 09:00	106	78.25162	30.00083	SMBA on bottom (cable out 315m)
17/07/2018 08:52	106	78.25161	30.00082	SMBA deployed
17/07/2018 08:51		78.25162	30.0008	Vessel in position 20m E of centroid
17/07/2018 08:43	105	78.25178	29.99989	SMBA recovered to deck
17/07/2018 08:32	105	78.25178	29.99978	Commence recovery of SMBA
17/07/2018 08:30	105	78.25178	29.99979	SMBA on bottom (cable out 317m)
17/07/2018 08:21	105	78.25178	29.99987	SMBA deployed

17/07/2018 08:17		78.25169	29.99979	Vessel in position 20m N of centroid
17/07/2018 08:12	104	78.25163	29.99975	SMBA recovered to deck
17/07/2018 08:02	104	78.25165	29.99973	Commence recovery of SMBA
17/07/2018 07:59	104	78.25163	29.99974	SMBA on bottom (cable out 317m)
17/07/2018 07:48	104	78.25163	29.99975	SMBA deployed
17/07/2018 07:40		78.25163	29.99972	Vessel in position 5m W of centroid
17/07/2018 07:25	103	78.25149	30.00056	Megacorer recovered to deck
17/07/2018 07:13	103	78.2515	30.00056	Commence recovery of Megacorer
17/07/2018 07:10	103	78.25149	30.00055	Megacorer on bottom (cable out 319m)
17/07/2018 07:00	103	78.25149	30.00059	Megacorer deployed
17/07/2018 06:57		78.2515	30.00056	Vessel in position 20m SE of centroid
17/07/2018 06:35	102	78.25173	29.99927	Megacorer recovered to deck
17/07/2018 06:25	102	78.25175	29.99926	Commence recovery of Megacorer
17/07/2018 06:22	102	78.25174	29.99924	Megacorer on bottom (cable out 318m)
17/07/2018 06:12	102	78.25174	29.99928	Megacorer deployed
17/07/2018 05:57		78.25174	29.9994	Vessel in position 20m NW
17/07/2018 05:51	101	78.25168	30.00007	Megacorer recovered to deck
17/07/2018 05:41	101	78.25167	30.0001	Commence recovery of Megacorer
17/07/2018 05:38	101	78.25167	30.00013	Megacorer on bottom (cable out 312m)
17/07/2018 05:28	101	78.25163	30.00015	Megacorer deployed
17/07/2018 05:08		78.25156	30.00024	Vessel in position 5m E
17/07/2018 05:03		78.25139	30.00082	Vessel repositioning to 5m E of centroid for Megacorer deployment
17/07/2018 05:02	100	78.25135	30.00093	USNL recovered to deck
17/07/2018 04:52	100	78.2513	30.00094	Commence recovery of USNL
17/07/2018 04:50	100	78.2513	30.00094	USNL on bottom (cable out 312m)
17/07/2018 04:40	100	78.25131	30.00096	USNL deployed
17/07/2018 04:36		78.25136	30.00097	Vessel moved position 186* x 20m
17/07/2018 04:33	99	78.25149	30.00106	USNL recovered to deck

17/07/2018 04:23	99	78.25148	30.00106	Commence recovery of USNL
17/07/2018 04:22	99	78.25148	30.00104	USNL on bottom (cable out 312m)
17/07/2018 04:12	99	78.25149	30.00101	USNL deployed
17/07/2018 04:08		78.2515	30.00116	Vessel moved position 279* x 20m
17/07/2018 04:05	98	78.25147	30.00189	USNL recovered to deck
17/07/2018 03:56	98	78.25146	30.00195	Commence recovery of USNL
17/07/2018 03:54	98	78.25147	30.00194	USNL on bottom (cable out 312m)
17/07/2018 03:45	98	78.25147	30.00192	USNL deployed
17/07/2018 03:38		78.25145	30.00171	Vessel moved position 066* x 20m
17/07/2018 03:35	97	78.25138	30.00118	USNL recovered to deck
17/07/2018 03:26	97	78.25139	30.00114	Commence recovery of USNL
17/07/2018 03:24	97	78.25139	30.00116	USNL on bottom (cable out 312m)
17/07/2018 03:15	97	78.25139	30.00116	USNL deployed
17/07/2018 03:10		78.25136	30.00104	Vessel moved position 033* x 20m
17/07/2018 03:07	96	78.25124	30.00064	USNL recovered to deck
17/07/2018 02:59	96	78.25124	30.00066	Commence recovery of USNL
17/07/2018 02:57	96	78.25122	30.00062	USNL on bottom (cable out 312m)
17/07/2018 02:47	96	78.25124	30.00058	USNL deployed
17/07/2018 02:38		78.25122	30.00037	Vessel moved position 090* x 20m
17/07/2018 02:34	95	78.25122	29.99971	USNL recovered to deck
17/07/2018 02:25	95	78.25122	29.99973	Commence recovery of USNL
17/07/2018 02:24	95	78.25123	29.99972	USNL on bottom (cable out 312m)
17/07/2018 02:14	95	78.25123	29.99973	USNL deployed
17/07/2018 02:11		78.25122	29.99969	Vessel moved position 061* x 20m
17/07/2018 02:06	94	78.25114	29.99895	USNL recovered to deck
17/07/2018 01:57	94	78.25113	29.99896	Commenced recovery of USNL
17/07/2018 01:55	94	78.25114	29.999	USNL @ bottom (~311m)
17/07/2018 01:45	94	78.25114	29.99897	USNL deployed

17/07/2018 01:43		78.25114	29.99899	Science time resumed
17/07/2018 01:24		78.25115	29.99898	Vessel downtime commenced to control leak on gantry
17/07/2018 01:23		78.25114	29.99899	Vessel moved 20m (347*)
17/07/2018 01:19	93	78.25097	29.99914	USNL recovered
17/07/2018 01:11	93	78.25098	29.99918	Commenced recovery of USNL
17/07/2018 01:09	93	78.25098	29.99917	USNL @ bottom (~311m)
17/07/2018 00:59	93	78.25098	29.99919	USNL deployed
17/07/2018 00:54		78.25095	29.99898	Vessel moved 20m (054*)
17/07/2018 00:50	92	78.25088	29.99851	USNL recovered
17/07/2018 00:42	92	78.25088	29.99848	Commenced recovery of USNL
17/07/2018 00:40	92	78.25089	29.99848	USNL @ bottom (~310m)
17/07/2018 00:30	92	78.25086	29.99847	USNL deployed
17/07/2018 00:28		78.25086	29.99847	Science time resumed
17/07/2018 00:12		78.25086	29.99845	Vessel downtime commenced to control leak on gantry
17/07/2018 00:11		78.2509	29.9982	Vessel moved 20m (121*)
17/07/2018 00:07	91	78.25096	29.99774	USNL recovered
16/07/2018 23:59	91	78.25097	29.99778	Commenced recovery of USNL
16/07/2018 23:56	91	78.25095	29.99772	USNL @ bottom (~311m)
16/07/2018 23:46	91	78.25096	29.99764	USNL deployed
16/07/2018 23:42		78.25099	29.99773	Vessel moved 20m (209*)
16/07/2018 23:38	90	78.25113	29.99809	USNL recovered
16/07/2018 23:30	90	78.25112	29.99811	Commenced recovery of USNL
16/07/2018 23:28	90	78.25112	29.99809	USNL @ bottom (~311m)
16/07/2018 23:19	90	78.25114	29.99818	USNL deployed
16/07/2018 23:09		78.25116	29.9984	Vessel moved 20m (239*)
16/07/2018 23:05	89	78.25121	29.99898	USNL recovered
16/07/2018 22:56	89	78.25122	29.99893	Commenced recovery of USNL
16/07/2018 22:54	89	78.25122	29.99896	USNL @ bottom (~312m)

16/07/2018 22:44	89	78.25121	29.99897	USNL deployed
16/07/2018 22:01		78.25121	29.99885	Vessel moved 20m (093*)
16/07/2018 21:55	88	78.25122	29.99804	USNL recovered to deck
16/07/2018 21:45	88	78.25122	29.998	Commence recovery of USNL
16/07/2018 21:44	88	78.25123	29.99801	USNL on bottom (cable out 315m)
16/07/2018 21:34	88	78.25122	29.99806	USNL deployed
16/07/2018 21:32		78.25125	29.99795	Vessel moved 20m (158*)
16/07/2018 21:28	87	78.2514	29.9977	USNL recovered to deck
16/07/2018 21:19	87	78.25139	29.99778	Commence recovery of USNL
16/07/2018 21:17	87	78.25139	29.99773	USNL on bottom (cable out 315m)
16/07/2018 21:08	87	78.25138	29.99769	USNL deployed
16/07/2018 21:04		78.25143	29.99779	Vessel moved 20m (201*)
16/07/2018 21:01	86	78.25156	29.9981	USNL recovered to deck
16/07/2018 20:51	86	78.25155	29.99799	Commence recovery of USNL
16/07/2018 20:50	86	78.25154	29.99799	USNL on bottom (cable out 316m)
16/07/2018 20:39	86	78.25157	29.99807	USNL deployed
16/07/2018 20:36		78.25155	29.99794	End of downtime
16/07/2018 20:24		78.25154	29.99807	Commence downtime to contain leak on side gantry
16/07/2018 20:23		78.25151	29.99834	Vessel moved 20m (300*)
16/07/2018 20:20	85	78.25147	29.99872	USNL recovered to deck
16/07/2018 20:08	85	78.25147	29.99882	Commence recovery of USNL
16/07/2018 20:07	85	78.25146	29.99883	USNL on bottom (cable out 320m)
16/07/2018 19:56	85	78.25147	29.99881	USNL deployed
16/07/2018 19:54		78.25146	29.99906	Vessel moved 20m (269*)
16/07/2018 19:51	84	78.25147	29.9996	USNL recovered to deck
16/07/2018 19:41	84	78.25146	29.99971	Commence recovery of USNL
16/07/2018 19:39	84	78.25146	29.99971	USNL on bottom (cable out 320m)
16/07/2018 19:28	84	78.25146	29.99975	USNL deployed

16/07/2018 19:13		78.25149	29.9988	Vessel on DP (20m 187* of Centroid)
16/07/2018 18:55		78.25887	29.99132	Vessel off DP to relocate
16/07/2018 18:41	83	78.25865	29.99139	AGT recovered to deck
16/07/2018 18:24	83	78.25725	29.99137	AGT off bottom
16/07/2018 18:18	83	78.2567	29.99136	Trawl complete. Commence recovery. Speed 0.3kts
16/07/2018 18:03	83	78.25256	29.99137	Cable stopped at 475m for 15 min trawl. Speed 1.0kts
16/07/2018 17:57	83	78.25151	29.9914	AGT on bottom (cable out 317m). Speed 0.5kts
16/07/2018 17:47	83	78.25045	29.99142	AGT deployed. Speed 0.3kts
16/07/2018 17:46		78.25046	29.99141	Vessel in position for AGT deployment
16/07/2018 17:36		78.25741	29.99028	Vessel repositioning for next AGT deployment
16/07/2018 17:35	82	78.25763	29.99027	AGT recovered to deck
16/07/2018 17:20	82	78.25701	29.99017	AGT off bottom
16/07/2018 17:14	82	78.25647	29.99011	Trawl complete. Commence recovery. Speed 0.3kts
16/07/2018 16:58	82	78.25216	29.98958	Cable stopped at 475m for 15 min trawl. Speed 1.0kts
16/07/2018 16:53	82	78.25131	29.98939	AGT on bottom (cable out 316m). Speed 0.5kts
16/07/2018 16:44	82	78.25046	29.98937	AGT deployed. Speed 0.3kts
16/07/2018 16:42		78.25035	29.98942	Vessel in position for AGT deployment
16/07/2018 16:31		78.24956	29.96735	Vessel repositioning for next AGT deployment
16/07/2018 16:30	81	78.24954	29.96685	AGT recovered to deck
16/07/2018 16:16	81	78.24967	29.97033	AGT off bottom
16/07/2018 16:10	81	78.24975	29.97257	Trawl complete. Commence recovery. Speed 0.3kts
16/07/2018 15:54	81	78.25051	29.99358	Cable stopped at 475m for 15 min trawl. Speed 1.0kts
16/07/2018 15:50	81	78.2506	29.99624	AGT on bottom (cable out 318m). Speed 0.5kts
16/07/2018 15:40	81	78.25077	30.00108	AGT deployed. Speed 0.3kts
16/07/2018 15:36		78.25078	30.00157	Vessel in position for next AGT deployment
16/07/2018 15:28		78.24785	29.97642	Vessel repositioning for next AGT deployment
16/07/2018 15:27	80	78.24779	29.97596	AGT recovered to deck
16/07/2018 15:16	80	78.24811	29.9788	AGT off bottom

16/07/2018 15:10	80	78.24834	29.98112	Trawl complete. Commence recovery. Speed 0.3kts
16/07/2018 14:57	80	78.25	29.99661	Cable stopped at 475m for 5 min trawl at 1.0kts
16/07/2018 14:52	80	78.25032	29.99983	AGT on bottom (cable out 317m). Speed 0.5kts
16/07/2018 14:42	80	78.25082	30.00442	AGT deployed. Speed 0.3kts
16/07/2018 14:40		78.25085	30.00459	Vessel stopped in position for AGT deployment
16/07/2018 14:31		78.24687	29.97766	Vessel repositioning for next AGT deployment
16/07/2018 14:30	79	78.24686	29.97761	AGT recovered to deck
16/07/2018 14:16	79	78.24729	29.98053	AGT off bottom
16/07/2018 14:10	79	78.24765	29.98304	Trawl complete. Commence recovery. Speed 0.3kts
16/07/2018 13:56	79	78.24971	29.99707	Commenced trawl @ 1kt for 5 min (wire out 475m)
16/07/2018 13:51	79	78.25018	30.0004	AGT @ bottom (~316m)
16/07/2018 13:43	79	78.25061	30.00321	AGT deployed
16/07/2018 13:42	79	78.25066	30.00362	Commenced AGT deployment
16/07/2018 13:35		78.25065	30.00359	Vessel in position for next AGT deployment
16/07/2018 13:24	78	78.24635	29.9796	AGT recovered
16/07/2018 13:10	78	78.24723	29.98481	Commenced recovery of AGT
16/07/2018 12:57	78	78.24951	29.99809	Commenced AGT trawl @ 1kt for 5 min (wire out 475m)
16/07/2018 12:52	78	78.25001	30.00109	AGT @ bottom (~315m)
16/07/2018 12:43	78	78.25065	30.00463	AGT deployed
16/07/2018 12:42	78	78.2507	30.00488	Commenced AGT deployment
16/07/2018 12:34		78.25078	30.00435	Vessel in position for AGT deployment
16/07/2018 12:21	77	78.25165	30.00043	CTD recovered
16/07/2018 11:50	77	78.25166	30.00021	CTD @ 305m; commenced recovery
16/07/2018 11:37	77	78.25166	29.99992	CTD deployed
16/07/2018 11:35	77	78.25163	29.99983	Commenced CTD deployment
16/07/2018 11:27		78.25259	30.00371	Vessel on DP @ B15 (centroid)
15/07/2018 12:42		74.49708	29.97666	Vessel off DP and proceeding to next science station
15/07/2018 12:32	76	74.49709	29.97669	Zooplankton Net recovered

15/07/2018 12:29	76	74.49707	29.97673	Zooplankton Net @ 40m; commenced recovery
15/07/2018 12:27	76	74.49707	29.97672	Zooplankton Net deployed
15/07/2018 11:56	75	74.49876	29.98302	AGT recovered
15/07/2018 11:39	75	74.49988	29.98707	Commenced recovery of AGT
15/07/2018 11:24	75	74.50278	29.99782	Commenced trawl @ 1kt for 15 min (wire out 535m)
15/07/2018 11:19	75	74.50333	29.99987	AGT @ bottom (~365m)
15/07/2018 11:08	75	74.50407	30.00267	AGT deployed
15/07/2018 11:07	75	74.50414	30.0029	Commenced AGT deployment
15/07/2018 10:57		74.50398	30.00448	Vessel moved to next AGT deployment site
15/07/2018 10:44	74	74.49823	29.98735	AGT recovered
15/07/2018 10:26	74	74.49944	29.99172	Commenced recovery of AGT
15/07/2018 10:11	74	74.50236	30.00207	Commenced trawl @ 1kt for 15 mins (wire out 534m)
15/07/2018 10:06	74	74.50295	30.00419	AGT @ bottom (~360m)
15/07/2018 09:55	74	74.50365	30.00714	AGT deployed. Speed 0.3kts
15/07/2018 09:53		74.50371	30.00747	In position for next AGT
15/07/2018 09:40	73	74.49783	29.98235	AGT recovered to deck
15/07/2018 09:25	73	74.49838	29.9847	AGT off bottom
15/07/2018 09:18	73	74.49891	29.98688	Trawl complete. Commence recovery. Speed 0.3kts
15/07/2018 09:12	73	74.50001	29.99145	Commence 5 min trawl. Speed 1.0kts
15/07/2018 09:04	73	74.50152	29.9976	Cable stopped at 534m. Speed 1.0kts
15/07/2018 08:58	73	74.50217	30.0003	AGT on bottom (cable out 324m). Speed 0.5kts
15/07/2018 08:48	73	74.50281	30.00295	AGT deployed. Speed 0.3kts
15/07/2018 08:47		74.50286	30.00314	On DP for next AGT
15/07/2018 08:25		74.49523	29.98936	Off DP to relocate to NE corner
15/07/2018 08:24	72	74.49524	29.98936	AGT recovered to deck
15/07/2018 08:05	72	74.49575	29.99212	AGT off bottom
15/07/2018 08:00	72	74.49604	29.99366	Trawl complete. Commence recovery. Speed 0.3kts
15/07/2018 07:54	72	74.49701	29.99878	Commence 5 min trawl. Speed 1.0kts

15/07/2018 07:47	72	74.49806	30.00438	Cable stopped at 534m. Speed 1.0kts
15/07/2018 07:42	72	74.4985	30.00678	AGT on bottom (cable out 361m). Speed 0.5kts
15/07/2018 07:32	72	74.49904	30.00965	AGT deployed. Speed 0.3kts
15/07/2018 07:27		74.49901	30.00951	Vessel repositioned for next AGT deployment
15/07/2018 07:11		74.49608	29.9906	ATG Failed - heading for next AGT station
15/07/2018 07:10	71	74.49607	29.99049	AGT recovered to deck
15/07/2018 06:46	71	74.49696	29.99626	Trawl complete. Commence recovery. Speed 0.3kts
15/07/2018 06:39	71	74.49798	30.00241	Commence 5 min trawl. Speed 1.0kts
15/07/2018 06:37	71	74.49813	30.00327	Cable stopped at 536m. Speed 1.0kts
15/07/2018 06:31	71	74.49866	30.00619	AGT on bottom (cable out 363m). Speed 0.5kts
15/07/2018 06:19	71	74.49913	30.00944	AGT deployed. Speed 0.3kts
15/07/2018 06:15		74.49818	30.00351	Vessel repositioned for next AGT deployment
15/07/2018 06:04	70	74.49627	29.98598	AGT recovered to deck
15/07/2018 05:39	70	74.49661	29.98897	AGT off bottom
15/07/2018 05:32	70	74.49684	29.99083	Trawl complete. Commence recovery. Speed 0.3kts
15/07/2018 05:27	70	74.49742	29.99538	Commence 5 min trawl. Speed 1.0kts
15/07/2018 05:18	70	74.49843	30.00329	Cable stopped at 540m. Speed 1.0kts
15/07/2018 05:12	70	74.49882	30.00661	AGT on bottom (cable out 362m). Speed 0.5kts
15/07/2018 04:59	70	74.49931	30.01046	AGT deployed. Speed 0.3kts
15/07/2018 04:57		74.49935	30.01075	Vessel repositioned for next AGT deployment
15/07/2018 04:42	69	74.49633	29.98116	AGT recovered to deck
15/07/2018 04:26	69	74.49657	29.98313	AGT off bottom
15/07/2018 04:19	69	74.49682	29.98514	Trawl complete. Commence recovery. Speed 0.3kts
15/07/2018 04:13	69	74.49738	29.98958	Commence 5 minute trawl at 1.0kts
15/07/2018 04:03	69	74.49851	29.99879	Cable stopped at 540m. Speed 1.0kts
15/07/2018 03:57	69	74.49888	30.00172	AGT on bottom (cable out 361m). Speed 0.5kts
15/07/2018 03:40	69	74.49952	30.00697	AGT deployed. Speed 0.3kts
15/07/2018 03:18		74.49948	30.00757	Vessel in position for AGT deployment

15/07/2018 03:02		74.49972	29.99962	Vessel repositioning for AGT deployment
15/07/2018 02:50	68	74.49967	30.00024	USNL recovered to deck
15/07/2018 02:40	68	74.49967	30.00021	Commence recovery of USNL
15/07/2018 02:38	68	74.49968	30.00025	USNL on bottom (cable out 362m)
15/07/2018 02:27	68	74.49967	30.00015	USNL deployed
15/07/2018 02:21		74.49966	30.00019	Vessel moved position 066* x 20m
15/07/2018 02:16	67	74.49961	29.99961	USNL recovered to deck
15/07/2018 02:06	67	74.49958	29.99965	Commence recovery of USNL
15/07/2018 02:04	67	74.49959	29.99964	USNL on bottom (cable out 362m)
15/07/2018 01:53	67	74.4996	29.99962	USNL deployed
15/07/2018 01:47	66	74.49961	29.99963	USNL recovered. Failed deployment
15/07/2018 01:37	66	74.49962	29.99965	Commenced recovery of USNL
15/07/2018 01:35	66	74.49962	29.99966	USNL @ bottom (~360m)
15/07/2018 01:24	66	74.49962	29.99966	USNL deployed
15/07/2018 01:21		74.49957	29.99958	Vessel moved 20m (033*)
15/07/2018 01:17	65	74.49947	29.99933	USNL recovered
15/07/2018 01:08	65	74.49947	29.99934	Commenced recovery of USNL
15/07/2018 01:06	65	74.49947	29.99929	USNL @ bottom (~360m)
15/07/2018 00:55	65	74.49947	29.9993	USNL deployed
15/07/2018 00:50		74.49945	29.99926	Vessel moved 20m (090*)
15/07/2018 00:46	64	74.49945	29.99867	USNL recovered
15/07/2018 00:37	64	74.49945	29.99869	Commenced recovery of USNL
15/07/2018 00:34	64	74.49944	29.9987	USNL @ bottom (~361m)
15/07/2018 00:24	64	74.49944	29.99868	USNL deployed
15/07/2018 00:19		74.49944	29.99851	Vessel moved 20m (061*)
15/07/2018 00:15	63	74.4994	29.9981	USNL recovered
15/07/2018 00:06	63	74.49937	29.99809	Commenced recovery of USNL
15/07/2018 00:04	63	74.49938	29.99807	USNL @ bottom (~361m)

14/07/2018 23:53	63	74.49937	29.99805	USNL deployed
14/07/2018 23:47		74.49938	29.99801	Vessel moved 20m (188*)
14/07/2018 23:42	62	74.49955	29.99812	USNL recovered
14/07/2018 23:32	62	74.49955	29.99811	Commenced recovery of USNL
14/07/2018 23:30	62	74.49955	29.99814	USNL @ bottom (~360m)
14/07/2018 23:19	62	74.49956	29.99819	USNL deployed
14/07/2018 23:15		74.49953	29.9983	Vessel moved 20m (285*)
14/07/2018 23:10	61	74.49951	29.99887	USNL recovered
14/07/2018 23:01	61	74.49951	29.9988	Commenced recovery of USNL
14/07/2018 22:59	61	74.4995	29.99878	USNL @ bottom (~360m)
14/07/2018 22:48	61	74.49949	29.99882	USNL deployed
14/07/2018 22:43		74.49945	29.99885	Vessel moved 20m (347*)
14/07/2018 22:39	60	74.49931	29.99895	USNL recovered
14/07/2018 22:29	60	74.49934	29.99895	Commenced recovery of USNL
14/07/2018 22:28	60	74.49934	29.99894	USNL @ bottom (~364m)
14/07/2018 22:16	60	74.49932	29.99899	USNL deployed
14/07/2018 21:33		74.49931	29.99891	Vessel moved position 054* x 20m
14/07/2018 21:28	59	74.49923	29.99842	USNL recovered to deck
14/07/2018 21:16	59	74.49923	29.99842	Commence recovery of USNL
14/07/2018 21:15	59	74.49923	29.99841	USNL on bottom (cable out 366m)
14/07/2018 21:04	59	74.49922	29.99843	USNL deployed
14/07/2018 21:02		74.49921	29.99839	Vessel moved position 121* x 20m
14/07/2018 20:57	58	74.4993	29.99797	USNL recovered to deck
14/07/2018 20:48	58	74.49931	29.99795	Commence recovery of USNL
14/07/2018 20:46	58	74.49931	29.99792	USNL on bottom (cable out 367m)
14/07/2018 20:34	58	74.49931	29.99794	USNL deployed
14/07/2018 20:30		74.49938	29.99804	Vessel moved position 209* x 20m
14/07/2018 20:26	57	74.49931	29.99795	USNL recovered to deck

14/07/2018 20:15	57	74.49945	29.9983	Commence recovery of USNL
14/07/2018 20:14	57	74.49945	29.9983	USNL on bottom (cable out 367m)
14/07/2018 20:02	57	74.49945	29.99826	USNL deployed
14/07/2018 20:00		74.49948	29.99834	Vessel moved position 239* x 20m
14/07/2018 19:55	56	74.49955	29.9988	USNL recovered to deck
14/07/2018 19:45	56	74.49955	29.99885	Commence recovery of USNL
14/07/2018 19:44	56	74.49955	29.99886	USNL on bottom (cable out 367m)
14/07/2018 19:31	56	74.49954	29.99884	USNL deployed
14/07/2018 19:26		74.49955	29.99884	Vessel moved position 093* x 20m
14/07/2018 19:21	55	74.49955	29.99821	USNL recovered to deck
14/07/2018 19:10	55	74.49957	29.99819	Commence recovery of USNL
14/07/2018 19:09	55	74.49957	29.99819	USNL on bottom (cable out 366m)
14/07/2018 18:56	55	74.49953	29.99819	USNL deployed
14/07/2018 18:53		74.49957	29.99812	Vessel moved position 158* x 20m
14/07/2018 18:48	54	74.49969	29.99785	USNL recovered to deck
14/07/2018 18:38	54	74.4997	29.99784	Commence recovery of USNL
14/07/2018 18:36	54	74.4997	29.99781	USNL on bottom (cable out 366m)
14/07/2018 18:24	54	74.49971	29.99786	USNL deployed
14/07/2018 18:22		74.4997	29.99786	End of downtime
14/07/2018 18:05		74.4997	29.99784	Downtime commenced. (Midships gantry leak)
14/07/2018 18:02		74.49973	29.99789	Vessel moved position 201* x 20m
14/07/2018 17:57	53	74.49988	29.99811	USNL recovered to deck
14/07/2018 17:44	53	74.49986	29.99814	Commence recovery of USNL
14/07/2018 17:42	53	74.49987	29.99815	USNL on bottom (cable out 362m)
14/07/2018 17:31	53	74.49988	29.9981	USNL deployed
14/07/2018 17:26		74.49987	29.99809	End of downtime
14/07/2018 17:10		74.49986	29.99818	Downtime commenced. (Midships gantry leak)
14/07/2018 17:06		74.49986	29.99812	Vessel moved position 300* x 20m

14/07/2018 17:02	52	74.49978	29.99869	USNL recovered to deck
14/07/2018 16:50	52	74.49977	29.99868	Commence recovery of USNL
14/07/2018 16:48	52	74.49977	29.99872	USNL on bottom (cable out 362m)
14/07/2018 16:36	52	74.49979	29.99875	USNL deployed
14/07/2018 16:33		74.49978	29.9987	End of downtime
14/07/2018 15:58		74.49977	29.99873	Downtime commenced. (Midships gantry leak)
14/07/2018 15:50		74.49977	29.99888	Vessel moved postion 269* x 20m
14/07/2018 15:45	51	74.49978	29.99939	USNL recovered to deck
14/07/2018 15:30	51	74.49978	29.99942	Commence recovery of USNL
14/07/2018 15:28	51	74.49978	29.99945	USNL on bottom (cable out 362m)
14/07/2018 15:14	51	74.49977	29.99943	USNL deployed
14/07/2018 14:59		74.49978	29.99938	Vessel moved position 187* x 20m
14/07/2018 14:47	50	74.50006	29.99955	SMBA recovered to deck
14/07/2018 14:34	50	74.50006	29.9995	Commence recovery SMBA
14/07/2018 14:32	50	74.50007	29.9995	SMBA on bottom (cable out 363m)
14/07/2018 14:20	50	74.50003	29.99952	SMBA deployed
14/07/2018 14:17		74.50003	29.99952	Vessel moved position to 20m W of centroid
14/07/2018 14:10	49	74.49981	30.00022	SMBA recovered to deck
14/07/2018 13:59	49	74.4998	30.00019	Commenced recovery of SMBA
14/07/2018 13:56	49	74.49981	30.00024	SMBA @ bottom (~364m)
14/07/2018 13:44	49	74.4998	30.00026	SMBA deployed
14/07/2018 13:42		74.49982	30.0003	Vessel moved 20m S of centroid for next deployment
14/07/2018 13:34	48	74.49996	30.00082	SMBA recovered
14/07/2018 13:24	48	74.49997	30.00082	Commenced recovery of SMBA
14/07/2018 13:22	48	74.49996	30.00083	SMBA @ bottom (~364m)
14/07/2018 13:10	48	74.49996	30.00086	SMBA deployed
14/07/2018 13:07		74.49999	30.00075	Vessel moved to 20m E of centroid for next deployment
14/07/2018 12:59	47	74.50017	30.00026	SMBA recovered

14/07/2018 12:50	47	74.50018	30.00022	Commenced recovery of SMBA
14/07/2018 12:48	47	74.50017	30.00026	SMBA @ bottom (~361m)
14/07/2018 12:38	47	74.50021	30.00024	SMBA deployed
14/07/2018 12:36		74.50012	30.00025	Vessel moved to 20m N of centroid for next deployment
14/07/2018 12:25	46	74.49998	30.00022	SMBA recovered
14/07/2018 12:17	46	74.49998	30.00019	Commenced recovery of SMBA
14/07/2018 12:14	46	74.49998	30.00021	SMBA @ bottom (~363m)
14/07/2018 12:02	46	74.49998	30.00019	SMBA deployed
14/07/2018 11:50	45	74.49997	30.00011	SMBA recovered. Deployment failed.
14/07/2018 11:39	45	74.49997	30.00014	Commenced recovery of SMBA
14/07/2018 11:36	45	74.49997	30.0002	SMBA @ bottom (~361m)
14/07/2018 11:24	45	74.49998	29.9999	SMBA deployed
14/07/2018 11:04		74.49998	30.00027	Vessel moved to 5m W of centroid for next deployment
14/07/2018 10:56	44	74.4999	30.00066	Megacorer recovered
14/07/2018 10:46	44	74.4999	30.0007	Commenced recovery of Megacorer
14/07/2018 10:42	44	74.4999	30.0007	Megacorer @ bottom (~364m)
14/07/2018 10:31	44	74.49988	30.00068	Megacorer deployed
14/07/2018 10:24		74.49989	30.00061	Vessel moved to next deployment position 20m SE of centroid
14/07/2018 10:12	43	74.50013	29.9997	Megacorer recovered
14/07/2018 10:00	43	74.50013	29.9997	Start recovering megacorer
14/07/2018 09:59	43	74.50013	29.99972	Megacorer on bottom (365m cable)
14/07/2018 09:46	43	74.50012	29.99964	Megacorer deployed
14/07/2018 09:30				Vessel in position at 20m NW
14/07/2018 09:22	42	74.49999	30.00044	Megacorer recovered to deck
14/07/2018 09:11	42	74.49999	30.00047	Commence recovery of Megacorer
14/07/2018 09:08	42	74.49999	30.00045	Megacorer on bottom (cable out 364m)
14/07/2018 08:56	42	74.49999	30.00043	Megacorer deployed
14/07/2018 08:28		74.50004	30.00042	Vessel in position 5m E

14/07/2018 08:24	41	74.50006	30.00032	CTD Recovered on deck
14/07/2018 07:52	41	74.50007	30.00027	CTD stopped at depth 348m. Commence recovery
14/07/2018 07:38	41	74.50002	30.0003	CTD deployed
14/07/2018 07:34		74.50006	30.00027	Vessel on DP at B13
13/07/2018 13:55		72.62998	19.24167	Vessel off DP and proceeding to next science station
13/07/2018 13:28	40	72.63008	19.2452	AGT on deck
13/07/2018 13:23	40	72.63008	19.24592	AGT recovered
13/07/2018 13:08	40	72.63016	19.25016	Commenced recovery of AGT
13/07/2018 12:53	40	72.6303	19.25717	Commenced AGT trawl @ 0.5 kts for 15 mins (wire out 545m)
13/07/2018 12:48	40	72.63039	19.26181	AGT @ bottom (~372m)
13/07/2018 12:37	40	72.63047	19.26599	AGT deployed
13/07/2018 12:35	40	72.63046	19.26627	Commenced AGT deployment
13/07/2018 12:25	39	72.63058	19.24535	AGT on deck. Vessel re-positioning for next AGT deployment
13/07/2018 12:21	39	72.63058	19.24546	AGT recovered
13/07/2018 12:05	39	72.63073	19.24998	Commenced recovery of AGT
13/07/2018 11:49	39	72.63096	19.25728	Commenced AGT trawl @ 0.5 kts for 15 mins (wire out 545m)
13/07/2018 11:44	39	72.63104	19.25984	AGT @ bottom (~370m)
13/07/2018 11:32	39	72.63115	19.26396	AGT deployed
13/07/2018 11:31	39	72.63115	19.26419	Commenced AGT deployment
13/07/2018 11:22	38	72.63103	19.24374	AGT on deck. Vessel re-positioning for next AGT deployment
13/07/2018 11:19	38	72.63101	19.24371	AGT recovered
13/07/2018 11:02	38	72.63115	19.24866	Commenced recovery of AGT
13/07/2018 10:47	38	72.63134	19.25566	Commenced AGT trawl @ 0.5 kts for 15 mins (wire out 545m)
13/07/2018 10:41	38	72.63144	19.25943	AGT @ bottom (~370m)
13/07/2018 10:30	38	72.63154	19.26316	AGT deployed
13/07/2018 10:29	38	72.63156	19.26315	Commenced AGT deployment
13/07/2018 10:19	37	72.63152	19.24401	AGT on deck. Vessel re-positioning for next AGT deployment
13/07/2018 10:14	37	72.63173	19.24444	AGT recovered

13/07/2018 09:57	37	72.63178	19.24942	Finish trawl
13/07/2018 09:52	37	72.63177	19.24881	Start trawl (546m cable)
13/07/2018 09:48	37	72.63185	19.25596	AGT on bottom
13/07/2018 09:36	37	72.63188	19.25963	AGT deployed
13/07/2018 09:35		72.63188	19.25994	In position for AGT 3
13/07/2018 09:20	36	72.63203	19.2354	AGT on deck
13/07/2018 08:58	36	72.63201	19.23786	Finish trawl
13/07/2018 08:52	36	72.63202	19.24343	Start trawl (546m cable)
13/07/2018 08:47	36	72.63204	19.24804	AGT on bottom
13/07/2018 08:35	36	72.63204	19.2517	AGT deployed
13/07/2018 08:33		72.63202	19.25222	In position for AGT 2
13/07/2018 08:19	35	72.63231	19.24055	AGT on deck
13/07/2018 07:58	35	72.63233	19.2457	Finish trawl
13/07/2018 07:52	35	72.63231	19.2508	Start trawl (545m cable)
13/07/2018 07:48	35	72.63231	19.25262	AGT on bottom
13/07/2018 07:33	35	72.63232	19.25735	AGT deployed
13/07/2018 07:21		72.63233	19.25711	Vessel in position for AGT
13/07/2018 06:50	34	72.63321	19.2515	Small boxcorer recovered to deck
13/07/2018 06:38	34	72.63321	19.25149	Commence recovery of Small Boxcorer
13/07/2018 06:37	34	72.63321	19.25149	Small Boxcorer on bottom (cable out 372m)
13/07/2018 06:25	34	72.63322	19.25147	Small Boxcorer deployed
13/07/2018 06:09				Remain in position due to misfire
13/07/2018 06:08	33	72.6332	19.25152	Small boxcorer recovered to deck
13/07/2018 05:56	33	72.63319	19.25152	Commence recovery of Small Boxcorer
13/07/2018 05:55	33	72.63319	19.25152	Small Boxcorer on bottom (cable out 370m)
13/07/2018 05:43	33	72.63318	19.2514	Small Boxcorer deployed
13/07/2018 05:40		72.63319	19.25141	Vessel moved position 010å¡ x 20m
13/07/2018 05:35	32	72.63299	19.25133	Small Boxcorer recovered to deck

13/07/2018 05:23	32	72.633	19.25132	Commence recovery of Small Boxcorer
13/07/2018 05:21	32	72.63302	19.25129	Small Boxcorer on bottom (cable out 371m)
13/07/2018 05:09	32	72.63302	19.25131	Small Boxcorer deployed
13/07/2018 05:04		72.63301	19.25125	Vessel moved position 031å¡ x 20m
13/07/2018 04:59	31	72.63287	19.25094	Small Boxcorer recovered to deck
13/07/2018 04:48	31	72.63287	19.25095	Commence recovery of Small Boxcorer
13/07/2018 04:46	31	72.63287	19.25097	Small Boxcorer on bottom (cable out 370m)
13/07/2018 04:35	31	72.63286	19.25097	Small Boxcorer deployed
13/07/2018 04:32		72.63285	19.25111	Vessel moved position 282å¡ x 20m
13/07/2018 04:26	30	72.63283	19.25154	Small Boxcorer recovered to deck
13/07/2018 04:14	30	72.63282	19.25154	Commence recovery of Small Boxcorer
13/07/2018 04:12	30	72.63284	19.25153	Small Boxcorer on bottom (cable out 371m)
13/07/2018 04:00	30	72.63283	19.25161	Small Boxcorer deployed
13/07/2018 03:57		72.63284	19.25159	Vessel moved position 279å¡ x 20m
13/07/2018 03:51	29	72.63281	19.25214	Small Boxcorer recovered to deck
13/07/2018 03:40	29	72.6328	19.25218	Commence recovery of Small Boxcorer
13/07/2018 03:38	29	72.6328	19.25219	Small Boxcorer on bottom (cable out 371m)
13/07/2018 03:26	29	72.6328	19.25219	Small Boxcorer deployed
13/07/2018 03:14		72.63278	19.25218	Vessel remaining in same postion
13/07/2018 03:12	28	72.63278	19.25215	Small Boxcorer recovered to deck
13/07/2018 03:01	28	72.63281	19.25214	Commence recovery of Small Boxcorer
13/07/2018 02:59	28	72.63281	19.25218	Small Boxcorer on bottom (cable out 370m)
13/07/2018 02:47	28	72.63278	19.25212	Small Boxcorer deployed
13/07/2018 02:36		72.63278	19.25214	Vessel moved position 066å¡ x 20m
13/07/2018 02:29	27	72.63271	19.25157	Small Boxcorer recovered to deck
13/07/2018 02:18	27	72.6327	19.25159	Commence recovery of Small Boxcorer
13/07/2018 02:16	27	72.63272	19.25159	Small Boxcorer on bottom (cable out 370m)
13/07/2018 02:04	27	72.63273	19.25157	Small Boxcorer deployed

13/07/2018 01:58		72.63271	19.25155	Vessel moved 20m (033*)
13/07/2018 01:53	26	72.63258	19.25122	Small Boxcorer recovered
13/07/2018 01:43	26	72.63258	19.25124	Commenced recovery of Small Boxcorer
13/07/2018 01:41	26	72.63258	19.25126	Small Boxcorer @ bottom (~369m)
13/07/2018 01:29	26	72.63258	19.25128	Small Boxcorer deployed
13/07/2018 01:24		72.63258	19.25087	Vessel moved 20m (090*)
13/07/2018 01:20	25	72.63258	19.25067	Small Boxcorer recovered
13/07/2018 01:10	25	72.63258	19.25068	Commenced recovery of Small Boxcorer
13/07/2018 01:08	25	72.63258	19.25066	Small Boxcorer @ bottom (~373m)
13/07/2018 00:56	25	72.63255	19.25072	Small Boxcorer deployed
13/07/2018 00:52		72.63255	19.25056	Vessel moved 20m (061*)
13/07/2018 00:47	24	72.63249	19.25017	Small Boxcorer recovered
13/07/2018 00:37	24	72.63249	19.25017	Commenced recovery of Small Boxcorer
13/07/2018 00:35	24	72.63249	19.25017	Small Boxcorer @ bottom (~373m)
13/07/2018 00:23	24	72.6325	19.25016	Small Boxcorer deployed
13/07/2018 00:20		72.63255	19.25016	Vessel moved 20m (188*)
13/07/2018 00:14	23	72.63268	19.25024	Small Boxcorer recovered
13/07/2018 00:05	23	72.63271	19.25021	Commenced recovery of Small Boxcorer
13/07/2018 00:03	23	72.63269	19.25022	Small Boxcorer @ bottom (~373m)
12/07/2018 23:51	23	72.63268	19.25018	Small Boxcorer deployed
12/07/2018 23:49		72.63267	19.25035	Vessel moved 20m (285* - skipped one random location due to repeat sampling)
12/07/2018 23:40	22	72.63264	19.2508	Small Boxcorer recovered
12/07/2018 23:29	22	72.63265	19.25078	Commenced recovery of Small Boxcorer
12/07/2018 23:27	22	72.63266	19.25078	Small Boxcorer @ bottom (~373m)
12/07/2018 23:15	22	72.63265	19.25079	Small Boxcorer deployed
12/07/2018 23:12		72.63263	19.25077	Vessel moved 20m (054*)
12/07/2018 23:06	21	72.63254	19.25032	Small Boxcorer recovered
12/07/2018 22:57	21	72.63254	19.25033	Commenced recovery of Small Boxcorer

12/07/2018 22:54	21	72.63253	19.25032	Small Boxcorer @ bottom (~373m)
12/07/2018 22:42	21	72.63252	19.25031	Small Boxcorer deployed
12/07/2018 22:34		72.63257	19.25006	Vessel moved 20m (121*)
12/07/2018 22:30	20	72.63263	19.2498	Small Boxcorer recovered
12/07/2018 22:20	20	72.63263	19.2498	Commenced recovery of Small Boxcorer
12/07/2018 22:18	20	72.63263	19.24982	Small Boxcorer @ bottom (~376m)
12/07/2018 22:06	20	72.63264	19.2498	Small Boxcorer deployed
12/07/2018 21:54		72.63269	19.24993	Vessel moved position 209å¡ x 20m
12/07/2018 21:51	19	72.63278	19.25008	Small Boxcorer recovered to deck
12/07/2018 21:40	19	72.63277	19.25009	Commence recovery of Small Boxcorer
12/07/2018 21:38	19	72.63278	19.25009	Small Boxcorer on bottom (cable out 377m)
12/07/2018 21:25	19	72.63278	19.25009	Small boxcorer deployed
12/07/2018 21:23		72.63281	19.25012	Vessel moved position 239å¡ x 20m
12/07/2018 21:09	18	72.63287	19.25065	Small Boxcorer recovered to deck
12/07/2018 21:00	18	72.63288	19.2506	Commence recovery of Small Boxcorer
12/07/2018 20:58	18	72.63288	19.25059	Small Boxcorer on bottom (cable out 375m)
12/07/2018 20:46	18	72.63289	19.25064	Small boxcorer deployed
12/07/2018 20:44		72.63288	19.25058	Vessel moved position 093å¡ x 20m
12/07/2018 20:35	17	72.63288	19.24999	Small Boxcorer recovered to deck
12/07/2018 20:23	17	72.63288	19.25001	Commence recovery of Small Boxcorer
12/07/2018 20:22	17	72.63288	19.25001	Small Boxcorer on bottom (cable out 375m)
12/07/2018 20:09	17	72.63289	19.24999	Small boxcorer deployed
12/07/2018 20:08		72.63289	19.25	Vessel moved position 158å¡ x 20m
12/07/2018 19:59	16	72.63304	19.24981	Small Boxcorer recovered to deck
12/07/2018 19:47	16	72.63302	19.24985	Commence recovery of Small Boxcorer
12/07/2018 19:45	16	72.63304	19.24982	Small Boxcorer on bottom (cable out 375m)
12/07/2018 19:33	16	72.63305	19.24979	Small boxcorer deployed
12/07/2018 19:32		72.63304	19.2498	Vessel moved position 201å¡ x 20m

12/07/2018 19:22	15	72.63321	19.25004	Small Boxcorer recovered to deck
12/07/2018 19:10	15	72.6332	19.25003	Commence recovery of Small Boxcorer
12/07/2018 19:09	15	72.63319	19.25003	Small Boxcorer on bottom (cable out 373m)
12/07/2018 18:57	15	72.6332	19.25004	Small boxcorer deployed
12/07/2018 18:52		72.63318	19.25003	Vessel moved position 300å¡ x 20m
12/07/2018 18:43	14	72.63312	19.25054	Small Boxcorer recovered to deck
12/07/2018 18:31	14	72.63313	19.25053	Commence recovery of Small Boxcorer
12/07/2018 18:30	14	72.63313	19.25057	Small Boxcorer on bottom (cable out 373m)
12/07/2018 18:18	14	72.63313	19.25053	Small boxcorer deployed
12/07/2018 18:12		72.63313	19.25071	Vessel moved position 269å¡ x 20m
12/07/2018 18:03	13	72.63314	19.25113	Small Boxcorer recovered to deck
12/07/2018 17:51	13	72.63313	19.25118	Commence recovery of Small Boxcorer
12/07/2018 17:49	13	72.63313	19.25116	Small Boxcorer on bottom (cable out 369m)
12/07/2018 17:37	13	72.63313	19.25114	Small boxcorer deployed
12/07/2018 17:15		72.63313	19.25109	Vessel moved position 187å¡ x 20m
12/07/2018 17:06	12	72.63331	19.25115	Large Boxcorer recovered to deck
12/07/2018 16:55	12	72.6333	19.25115	Commence recovery of Large Boxcorer
12/07/2018 16:52	12	72.63329	19.25113	Large Boxcorer on bottom (cable out 366m)
12/07/2018 16:39	12	72.63329	19.25118	Large Boxcorer deployed
12/07/2018 16:37		72.63327	19.2513	Vessel in position 20m W
12/07/2018 16:29	11	72.63314	19.2519	Large Boxcorer recovered to deck
12/07/2018 16:15	11	72.63313	19.25192	Commence recovery of Large Boxcorer
12/07/2018 16:13	11	72.63313	19.25193	Large Boxcorer on bottom (cable out 366m)
12/07/2018 16:00	11	72.63314	19.25189	Large Boxcorer deployed
12/07/2018 15:55		72.63314	19.2519	Vessel in position 20m S
12/07/2018 15:46	10	72.6333	19.2524	Large Boxcorer recovered to deck
12/07/2018 15:36	10	72.63332	19.25238	Commence recovery of Large Boxcorer
12/07/2018 15:34	10	72.63331	19.25238	Large Boxcorer on bottom (cable out 365m)

12/07/2018 15:23	10	72.63331	19.2524	Large Boxcorer deployed
12/07/2018 14:54		72.63293	19.25174	Vessel on DP at B3 20m E
11/07/2018 11:48		72.63351	19.25174	Vessel off DP
11/07/2018 11:28	9	72.6335	19.25179	Large Boxcorer recovered. Science suspended. Commenced securing deck for return to T
11/07/2018 11:19	9	72.63349	19.25177	Commenced recovery of Large Boxcorer
11/07/2018 11:17	9	72.63349	19.25179	Large Boxcorer on bottom (~370m)
11/07/2018 11:05	9	72.63348	19.25181	Large Boxcorer deployed (20m North of Centroid)
11/07/2018 10:50	8	72.63333	19.25172	Large Boxcorer recovered
11/07/2018 10:39	8	72.63332	19.2517	Commenced recovery of Large Boxcorer
11/07/2018 10:37	8	72.63333	19.25178	Large Boxcorer on bottom (~366m)
11/07/2018 10:25	8	72.63328	19.25173	Large Boxcorer Deployed
11/07/2018 10:00		72.63332	19.2517	Vessel in position 5m W of Centroid
11/07/2018 09:48	7	72.63321	19.25223	Megacorer recovered on deck
11/07/2018 09:36	7	72.63317	19.25228	Commence recovery of megacorer
11/07/2018 09:30	7	72.63319	19.25226	Megacorer on bottom (cable out 376m)
11/07/2018 09:20	7	72.63318	19.25228	Megacorer deployed at 20m SE
11/07/2018 08:45		72.63321	19.25229	Remain in position (20m SE)
11/07/2018 08:43	6	72.63321	19.25222	Megacorer recovered on deck
11/07/2018 08:30	6	72.63319	19.25234	Commence recovery of megacorer
11/07/2018 08:27	6	72.6332	19.25227	Megacorer on bottom (cable out 375m)
11/07/2018 08:15	6	72.6332	19.25227	Megacorer deployed at 20m SE
11/07/2018 07:49		72.63316	19.25222	Vessel in position 20m SE of Centroid
11/07/2018 07:40	5	72.63346	19.2514	Megacorer recovered on deck
11/07/2018 07:27	5	72.63348	19.25138	Commence recovery of megacorer
11/07/2018 07:24	5	72.63348	19.25136	Megacorer on bottom (cable out 374m)
11/07/2018 07:10	5	72.63348	19.25146	Megacorer deployed at 20m NW
11/07/2018 06:43		72.63347	19.25139	Remain in position (20m NW) due to lost tube
11/07/2018 06:42	4	72.63348	19.25141	Megacorer recovered on deck

11/07/2018 06:18	4	72.63347	19.25143	Commence recovery of megacorer
11/07/2018 06:16	4	72.63346	19.25143	Megacorer on bottom (Cable Out 374m)
11/07/2018 06:10	4	72.63347	19.25145	Megacorer deployed
11/07/2018 05:51		72.63348	19.25138	Vessel in position at 20m NW
11/07/2018 05:41	3	72.63325	19.25198	Megacorer recovered to deck
11/07/2018 05:29	3	72.63328	19.252	Commence recovery of Megacorer
11/07/2018 05:25	3	72.63329	19.25196	Megacorer on bottom (cable out 364m)
11/07/2018 05:13	3	72.6333	19.25199	Megacorer deployed
11/07/2018 05:10		72.63333	19.25191	Vessel remaining in position 5m E
11/07/2018 05:01	2	72.63332	19.25198	Megacorer recovered to deck
11/07/2018 04:50	2	72.63329	19.25196	Commence recovery of Megacorer
11/07/2018 04:49	2	72.63328	19.25196	Megacorer on bottom (cable out 364m)
11/07/2018 04:37	2	72.63329	19.25193	Megacorer deployed
11/07/2018 04:15		72.63331	19.25195	Vessel in position 5m E
11/07/2018 03:53	1	72.63333	19.25179	CTD recovered to deck
11/07/2018 03:23	1	72.63331	19.25181	CTD stopped at depth 357m. Commence recovery
11/07/2018 03:10	1	72.63333	19.25178	CTD deployed
11/07/2018 02:56		72.63347	19.25301	Vessel on DP at B3

ENDS.