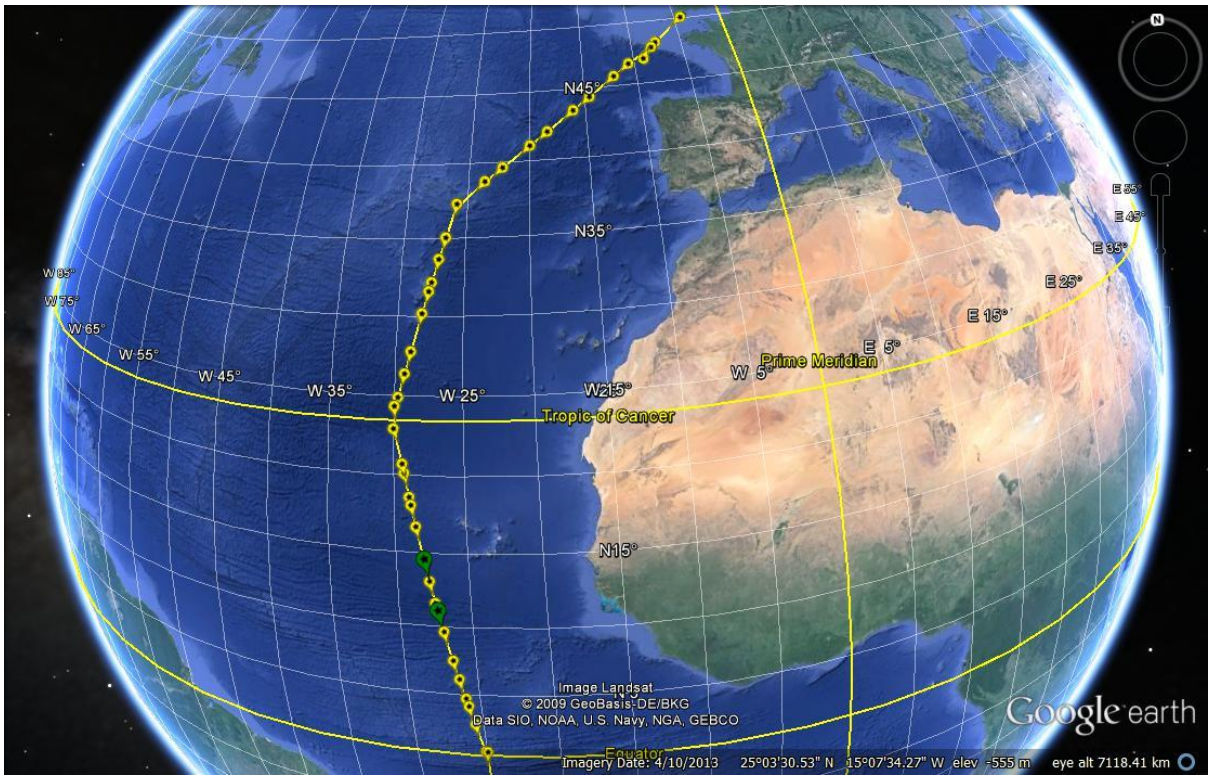
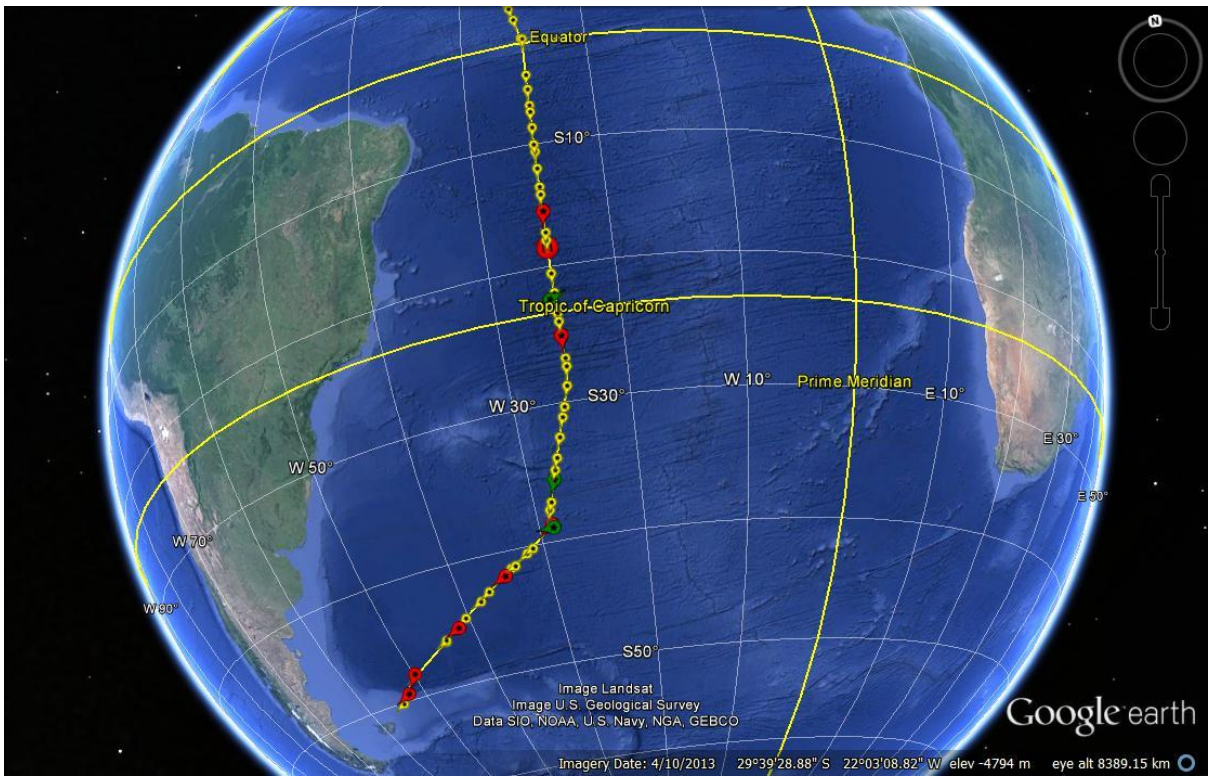
AMT24 Cruise Report





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Overview

AMT24 set sail from Immingham on 22nd September aboard the British Antarctic Survey vessel James Clark Ross, and arrived in Stanley, Falkland Islands on 1st November 2014. The overall aim of the Atlantic Meridional Transect programme funded by the Natural Environmental Research Council as National Capability is: to quantify key biogeochemical and ecosystem processes and their inherent variability over extended time and spatial scales in the Atlantic Ocean. This is achieved by executing an annually repeated meridional transect through contrasting oceanic provinces, ranging from oligotrophic deserts, to highly productive shelf seas.

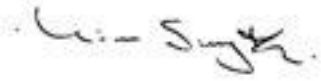
The specific objectives of AMT are:

- To quantify the nature and causes of ecological and biogeochemical variability in planktonic ecosystems;
- To quantify the effects of this variability on nutrient cycling, on biogenic export and on air-sea exchange of climate active gases;
- To construct multi-decadal, multidisciplinary ocean time-series which are integrated within a wider "Pole-to-pole" observatory concept;
- To provide essential sea-truth validation for current and next generation satellite missions;
- To provide essential data for global ecosystem model development and validation;
- To provide a valuable, highly sought after and unique training arena for the next generation of UK and International oceanographers.

The highlights of AMT24 were as follows:

- Launch of 5 Bio-Argo floats, purchased as part of a successful NERC Capital bid by PML, in the sparsely sampled remote tropical Atlantic;
- Launch of 8 Argo floats on behalf of the UK Met Office in the tropical and south Atlantic;
- Recovery of two deep (5000 m) sediment trap moorings in the South Atlantic Gyre for NOC, which had previously been deployed in October 2012 and May 2014, and the construction and deployment of a single sediment trap mooring at the same location. The entire operation was achieved in less than 30 hours;
- Automated process, partly developed and designed on AMT24, to seamlessly send coarse resolution CTD data to the UK Met Office for assimilation into atmosphere / ocean forecasts;
- Seventy CTD profiles at stations spaced approximately 200 nM apart measuring key physical and biogeochemical parameters including: temperature, salinity, chlorophyll, oxygen, nutrients, pH, alkalinity, N_20, CH_4, phytoplankton and zooplankton abundance, primary production, respiration, genetics and microbial dynamics;
- Thousands of underway bio-optical and biogeochemical measurements covering a 100° range in latitude and vastly contrasting ocean biomes;
- Continuous operation of acoustic sensors to probe positions of marine creatures;
- Twice daily trawls of a range of nets to determine the abundance of different species of zooplankton;
- Marine grade extended endurance testing of hyperspectral spectrometers designed to accurately determine direct and diffuse irradiance. This was part of an industrial partnership with Peak Design Ltd.;
- Participation of 24 research scientists from 13 institutes (UK, Netherlands, USA)

All the scientists would like to acknowledge the work of the NMFSS and AME technical support team, the Officers and crew of the JCR for making this a successful and highly enjoyable research cruise. I would like to thank Andy Rees and Glen Tarran for the exceptional pre-cruise planning and logistics and Christina Pardos-Bradley for her assistance, including the compilation of this report.



Tim Smyth, PSO JR303

Plymouth, 4 December 2014

Cruise participants

Back row (left to right): Nina Kamennaya (Warwick), Mike Zubkov (NOC), Gavin Tilstone (PML), Ian Brown (PML), Monica Moniz (Warwick), Gabrielle Kennaway (Natural History Museum), Ryan Pereira (Newcastle), Glen Tarran (PML), Carolyn Harris (PML), John Wynar (NMFSS), Rob Thomas (BODC), Erica Goetze (Hawaii), Laura Lubelczyk (Bigelow), Cat Burd (Southampton), Moritz Machelett (Southampton), Sara Cregeen (NOC), Rafael Rasse Boada (POGO)

Front row (left to right): Tim Smyth (PML), Michelle Jungbluth (Hawaii), Jose Lozano (Vigo), Alice Burridge (Amsterdam), Bita Sabbaghzadeh (Newcastle), Liza Ross (PML), Priscilla Lange (Oxford), Giorgio Dall'Olmo (PML)

Physics

CTD and underway sensor calibrations

Rob Thomas
British Oceanographic Data Centre

CTD profiles

A total of 70 CTD casts were completed during the cruise. All casts were conventional profiling casts with water sampling by 24 x 20L OTE Niskin bottles. Casts were carried out at ~04:00-05:00 and ~13:00-14:00 ship time each day weather permitting.

CTD casts were recorded using the Sea-Bird data collection software Seasave-Win32. The software outputs were then processed following the BODC recommended guidelines using SBE Data Processing-Win32 v7.23.2; the processing routines are named after each stage in brackets < >. The software applied the calibrations as appropriate through the instrument configuration file to the data in engineering units output by the CTD hardware.

An ASCII file (CNV) containing the 24 Hz data for up and down casts was generated from the binary Sea-Bird files for each cast <DatCnv>. Files were created for each cast containing the mean values of all the variables at the bottle firing events <Bottle Summary>. Using the CNV files processing routines were applied to remove pressure spikes <WildEdit>, the oxygen sensor was then shifted relative to the pressure by 2 seconds, to compensate for the lag in the sensor response time <AlignCTD> and the effect of thermal 'inertia' on the conductivity cells was removed <CellTM>. The surface soak was identified for each cast, removed and LoopEdit run. Salinity and oxygen concentration were re-derived and density (sigma-theta) values were derived <Derive> after the corrections for sensor lag and thermal 'inertia' had been applied. The CTD files produced from Sea-Bird processing were converted from 24 Hz ASCII files into 1 dbar downcast files for calibration and visualisation onboard <BinAverage>. The initial salinity and oxygen channels produced at the DatCnv stage, along with the conductivity, voltage and altimeter channels were removed from the 1 dbar downcast files <Strip>.

The sensor values at bottle firing produced by the Bottle Summary routine were collated and used to generate calibrations for the salinity, oxygen and fluorometer channels. Water samples were collected from each cast for measurement of salinity (bench salinometer) and chlorophyll-a (filtration, acetone extraction and fluorometer measurement) and from the pre-dawn cast each day for oxygen (Winkler titration).

The method used for calibration was to generate an offset between the discrete water sample measurement (salinity/oxygen/chl-a) and the nominal value from the sensor at bottle firing. The offsets were then plotted against the discrete sample values and a linear regression applied.

Where the regression was significant the calibration equation was derived by rearranging the regression equation:

Offset = a * Discrete sample + b

Where offset = Discrete sample – Sensor value

To give Calibrated value = 1/(1-a) * Sensor value + b/(1-a)

Where the regression was not significant the mean value of the offset was applied. All calibration datasets are available upon request from BODC post cruise.

Temperature

There were no independent measurements of temperature made during the cruise and the sensors on the rig returned consistent data. No further calibration of these sensors has been carried out. The section generated from the primary sensor has been provided in fig. 1.

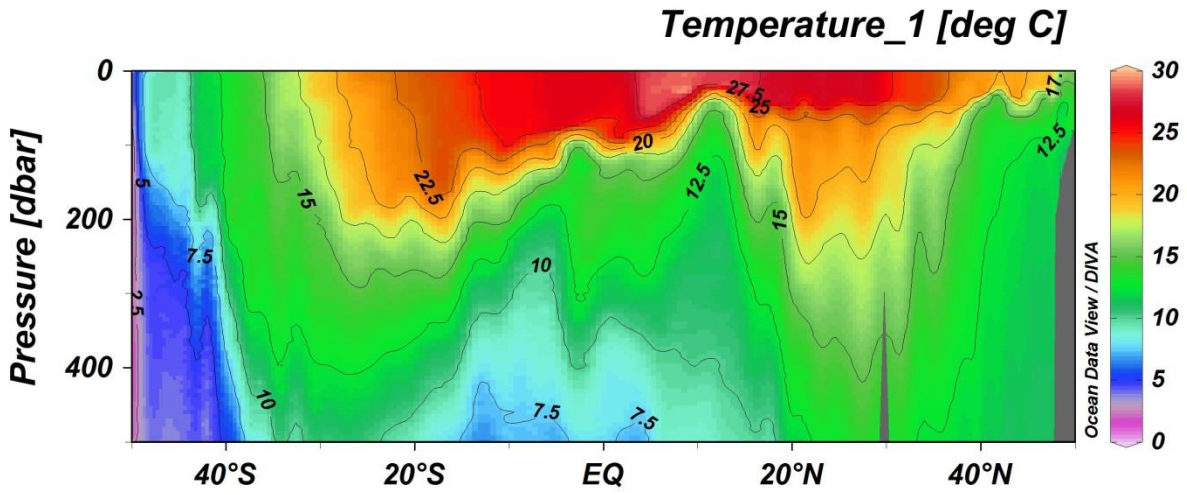


Fig. 1: Temperature section plot along the AMT24 transect by latitude (50 deg N – 50 deg S) from the primary temperature sensor.

Salinity

The salinity channels were calibrated against bench salinometer measurements from 2 - 4 samples collected from each cast. Further details of these measurements can be found in the NMF-SS cruise report section.

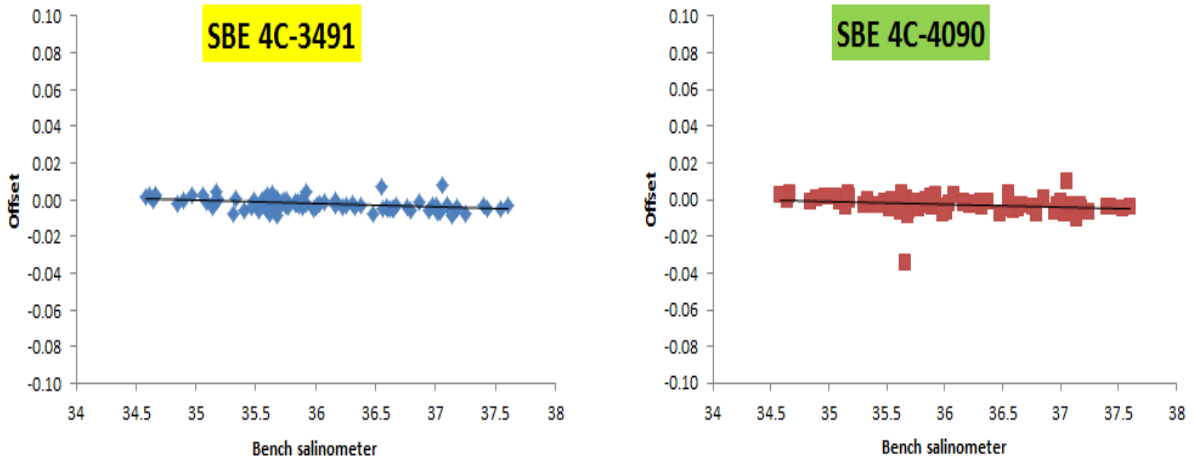


Fig. 2: Salinity offsets for each sensor against discrete sample salinity measured with a bench salinometer.

At the start of the cruise there was some discrepancy between the initial sensors on the CTD set up. The sensors were switched with the spare sensor to determine which may be faulty. Sensors 4C-3491 and 4C-4090 were used for the remainder of the cruise without further problems. The calibration equations for the sensors were:

Sensor SBE 4C-3491 - Calibrated = 0.9982 * sensor + 0.0625 (n = 93; r^2 = 0.177; p < 0.001);

Sensor SBE 4C-4090 - Calibrated = 0.9982 * sensor + 0.0619 (n = 92; r^2 = 0.075; p = 0.004);

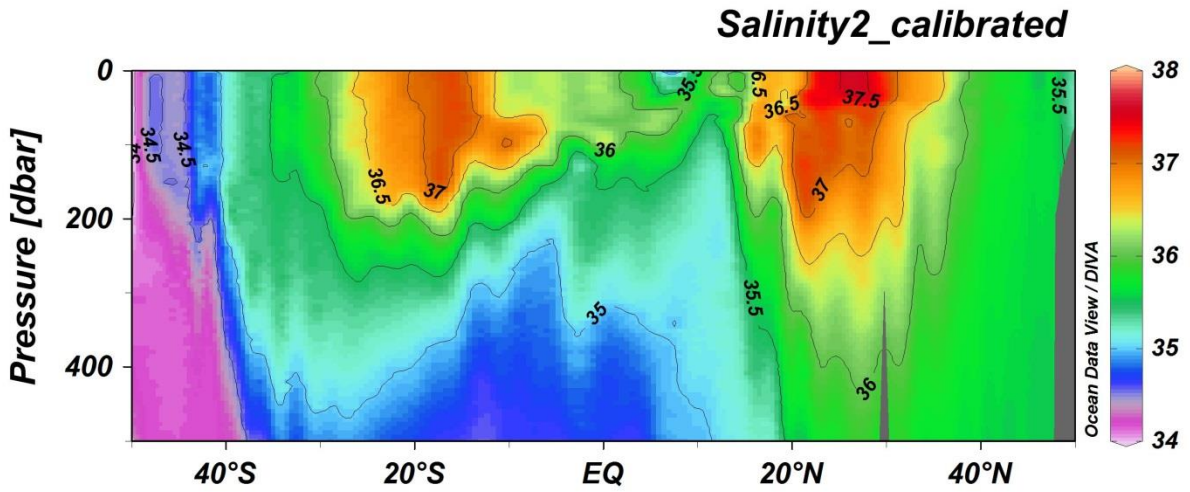


Fig. 3: Salinity section plot along the AMT24 transect by latitude (50 deg N – 50 deg S) from the secondary sensor calibrated against bench salinometer samples.

Oxygen

The oxygen sensor was calibrated against discrete oxygen sample Winkler titration measurements from up to 9 samples collected from the pre-dawn CTD. More details can be found in Jose Lozano's report.

The oxygen sensor operated without problem throughout the cruise.

The Winkler titration samples from cast 19 did not fit the pattern observed with the data from the other casts and were excluded from the calibration data set after discussion with Jose.

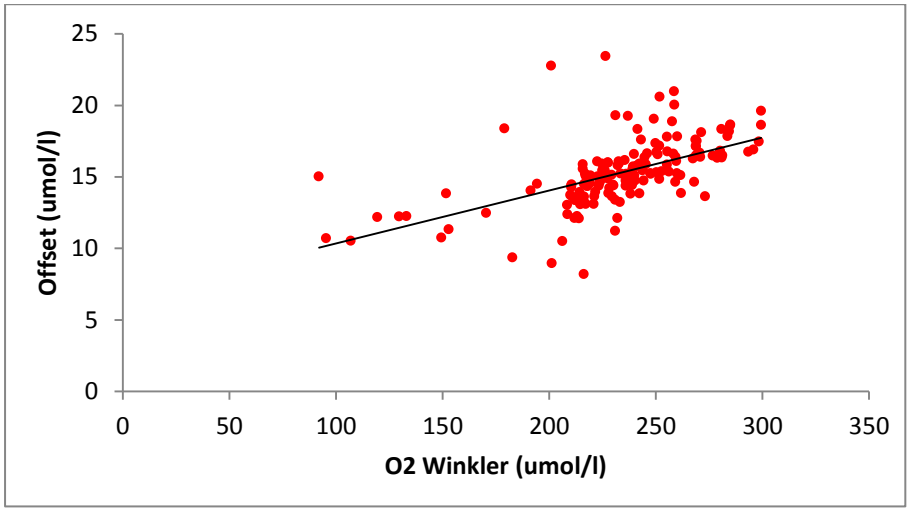


Fig. 4: Oxygen concentration offsets against Winkler titration measurements from discrete samples.

The calibration equation was:

Calibrated $O_{2\ (in\ umol/l)}$ = 1.0385 * sensor $O_{2\ (in\ umol/l)}$ + 6.8857 (n = 161; r^2 = 0.325; p < 0.001);

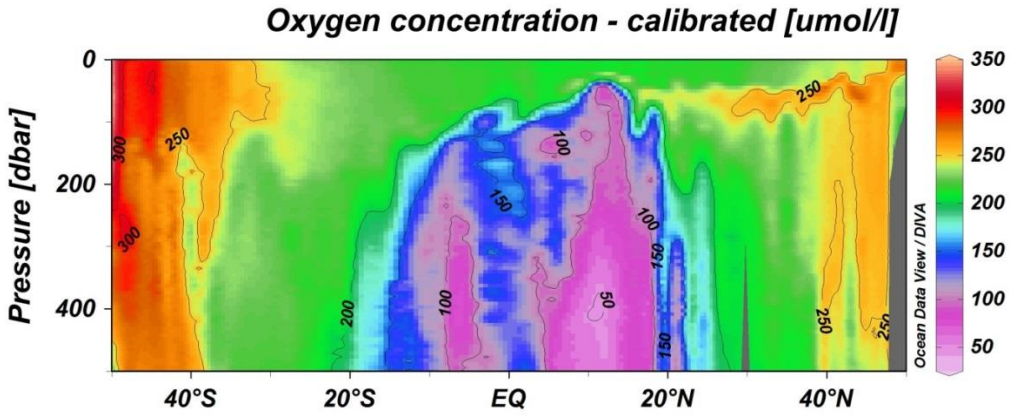


Fig. 5: Oxygen concentration section plot along the AMT24 transect by latitude (50 deg N – 50 deg S) from the SBE43 oxygen sensor calibrated against Winkler titration samples.

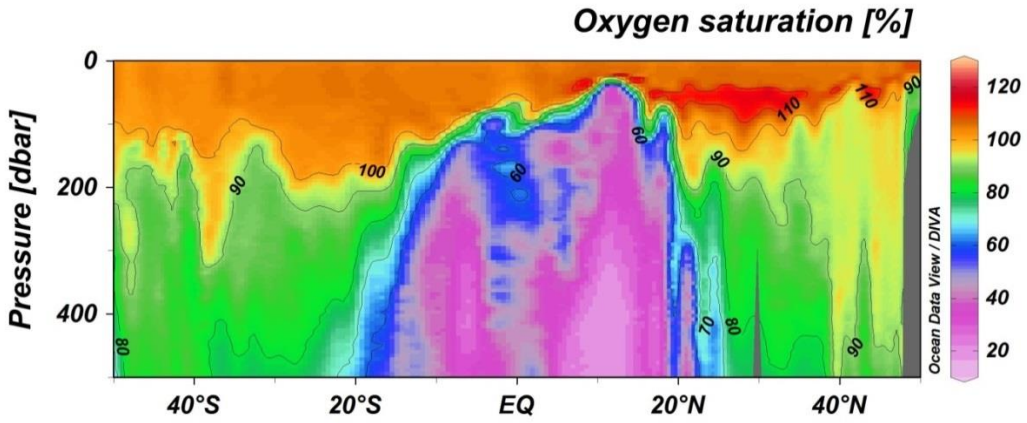


Fig. 6: Oxygen concentration section plot along the AMT24 transect by latitude (50 deg N – 50 deg S) calculated from the SBE43 oxygen sensor calibrated against Winkler titration samples and salinity calibrated against bench salinometer measurements.

Fluorometer

The CTD fluorometer operated without problem during the cruise. The calibration is to be carried out after the cruise once the fluorometer has been returned to PML for verification of the calibration against known standards.

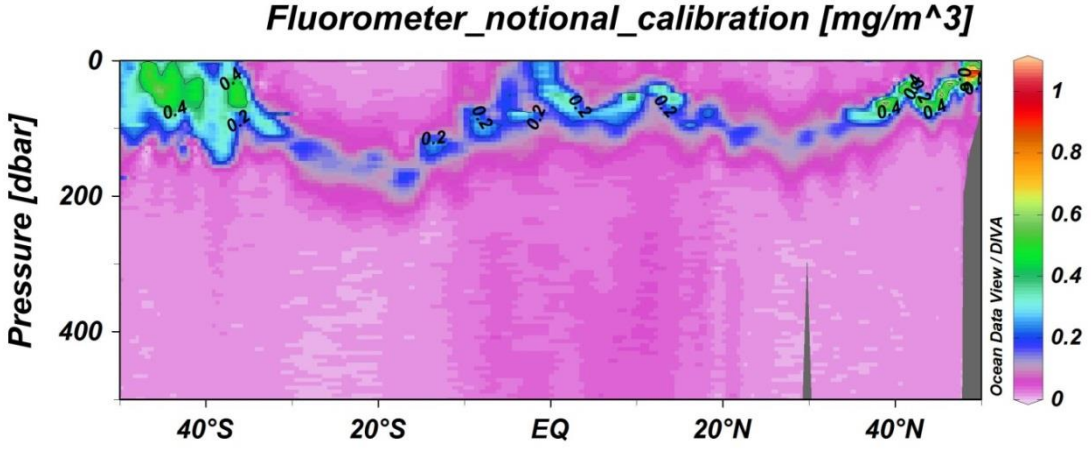


Fig. 7: Fluorometer (nominal calibration) section plot along the AMT24 transect by latitude (50 deg N – 50 deg S).

Underway sensors

The ship's underway meteorological and surface systems were run continuously through the cruise. The sea surface hydrography system started logging from 25/09/2014 07:45 (UT) and was switched off at 02/11/2014 11:00 (UT). Samples were collected to calibrate the TSG and fluorometer connected to the ship's non-toxic flow-through system, which draws water from approximately 7 m below the water line.

SST – hull mounted sensor

The hull temperature sensor was calibrated against the mean of the CTD temperature sensor values at each station. There was a significant regression of the offset with surface CTD sensor values (n = 65; r^2 = 0.177; p < 0.001) and not offset with time (n = 65; r^2 = 0.012; p = 0.18).

Calibrated sstemp = 1.0034 * sstemp + 0.1069

The correction will be applied during BODC processing after the cruise before the data is made available online.

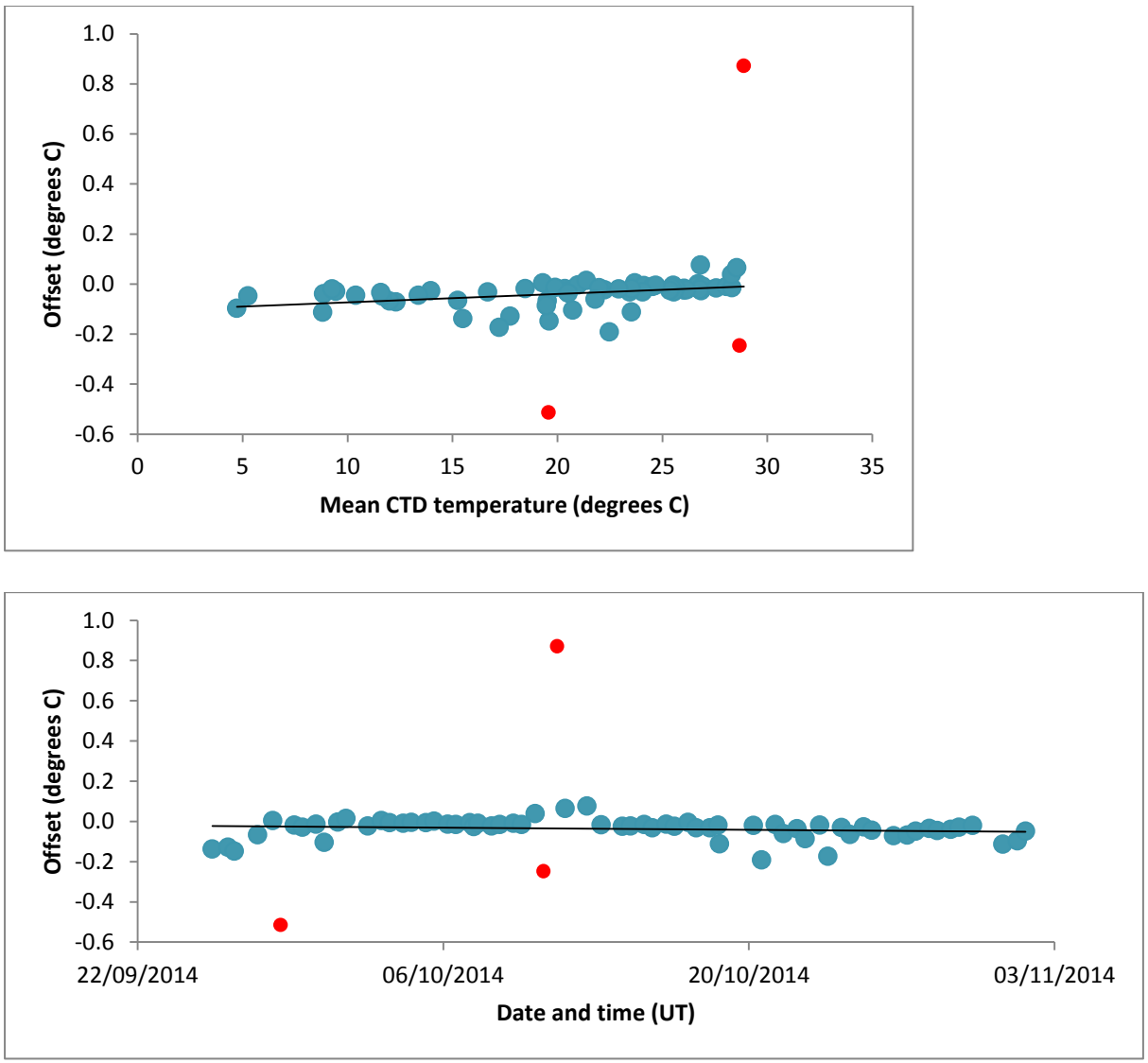


Fig. 8: Hull sensor temperature offsets against surface CTD temperature measurements and date/time.

Salinity

The TSG sensor salinity data were calibrated against samples collected and analysed with a bench salinometer. Up to three samples were collected each day. There was a significant regression of the offset with bench salinity measurement (n = 86; r^2 = 0.241; p < 0.001).

Calibrated salinity = 0.9978 * TSG salinity + 0.0588

The correction will be applied during BODC processing after the cruise before the data is made available online.

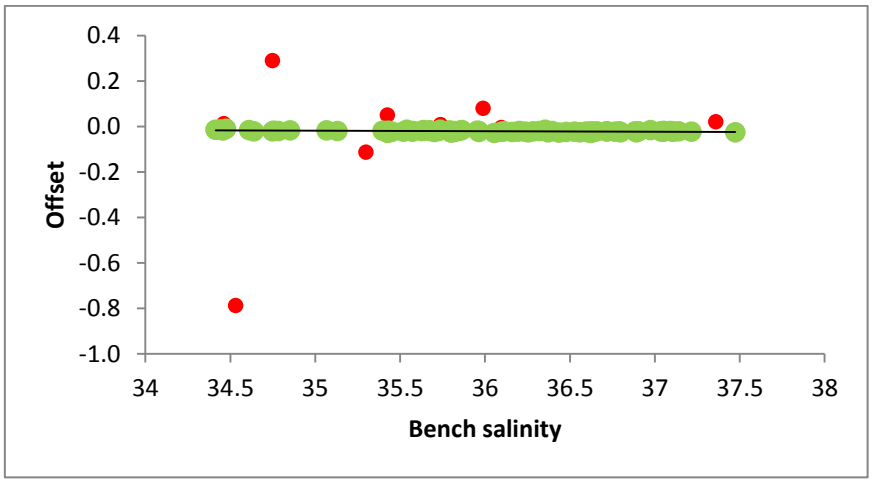


Fig. 9: Salinity offsets against bench salinometer measurements on discrete underway samples.

Fluorometer

The underway fluorometer data were calibrated against samples collected and analysed with a bench fluorometer. Up to five samples were collected each day. The calibration is to be carried out after the cruise once the fluorometer has been returned to PML for verification of the calibration against known standards. The correction will be applied during BODC processing after the cruise before the data is made available online.

Optical properties

Giorgio Dall'Olmo, Jelizaveta Ross, Rafael Rasse Boada, and Tim Smyth

Plymouth Marine Laboratory

Goals

- To determine the optical properties along the AMT24 transect in support of satellite calibration/validation activities.
- To establish empirical relationships between depth-resolved measurements of optical scattering and the concentrations of particulate organic carbon and suspended particles.

Methods

- Particulate optical backscattering coefficient (470, 532, 700 nm) and beam-attenuation and absorption coefficients (400 – 750 nm) were determined quasi-continuously from the ship's underway water following Dall'Olmo et al. (2009).
- In-situ optical backscattering measurements were also collected by means of a profiling package mounting a WETLabs ECO-BB3 sensor (3 channels) and a HobiLabs Hydroscat 6 sensor (6 channels plus chlorophyll fluorescence). The profiling package was deployed twice a day, at the same time as the main ship's rosette.
- A WETLAbs AC9 was also mounted on the optical profiling package to determine the particulate absorption and attenuation coefficients over the upper 250 m.
- Particulate optical backscattering and attenuation were also determined by instruments (WETLabs BBRTD and C-star, respectively) mounted on the rosette over the upper 500 m of the water column.
- Discrete water samples were collected from the rosette and filtered for determining total suspended matter (Table 1; Van der Linde, 1998) and particulate organic carbon (Table 1; Menzel, 1967).
- Above-water radiometric measurements were taken quasi-continuously using a Satlantic HyperSAS system. The HyperSAS optical remote sensing system provided high precision hyperspectral measurements of spectral water-leaving radiance and downwelling spectral irradiance, from which the above-water remote-sensing reflectance was computed. The 136-channel HyperOCR radiance and irradiance sensors were mounted onboard the ship for simultaneous viewing of the sea surface and sky. Above-water remote-sensing reflectance data are to be used for calibration and validation of satellite ocean colour products and alongside measurements of in-water optical properties obtained simultaneously with HyperSAS, for use in bio-optical modelling.

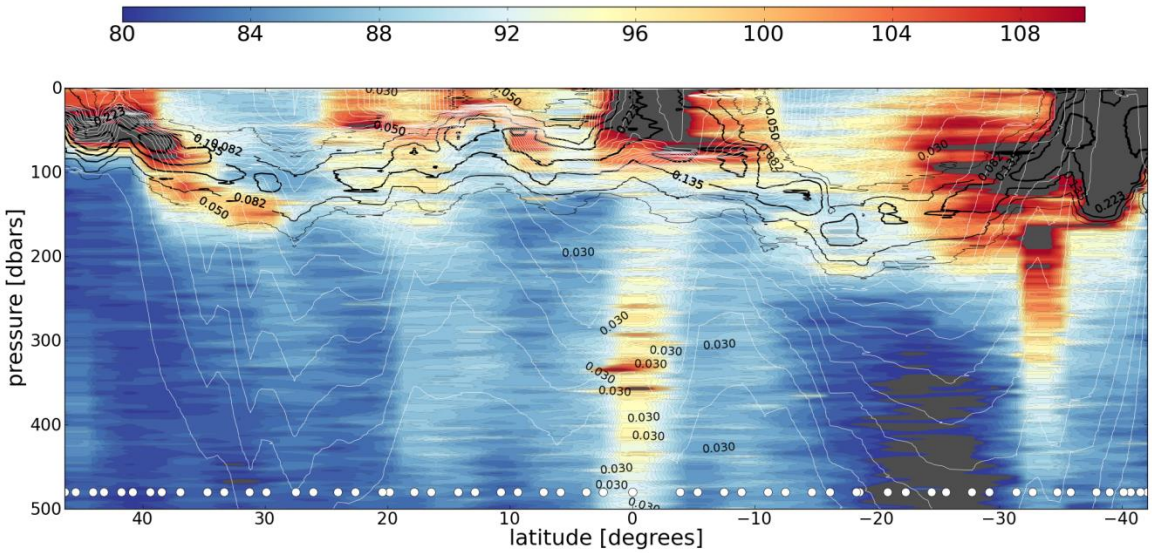


Figure 1. Raw counts from the optical backscattering meter (700-nm channel) mounted on the rosette. Black and white contours represent chlorophyll fluorescence and potential density data, respectively.

Table 1. Total suspended matter and particulate organic carbon sampling.

CTD no	Lat.	Lon.	POC depths							TSM vols						
ctd001	49.83	-4.76	70	60	50	40	30	10	0	0	0	0	0	0	0	0
ctd002	47.87	-7.94	400	300	200	100	29	5	0	0	0	0	0	0	0	0
ctd003	47.19	-8.83	500	400	300	200	30	1	0	0	0	0	0	0	0	0
ctd004	47.57	-8.5	500	400	300	200	44	5	0	0	0	0	0	0	0	0
ctd005	46.39	-10.98	500	400	300	200	35	5	0	0	0	0	0	0	0	0
ctd006	45.5	-12.49	500	400	300	200	49	2	0	500	0	300	0	0	0	0
ctd007	44.09	-14.92	500	400	300	200	67	5	0	500	400	0	0	67	0	0
ctd008	43.17	-16.43	500	400	300	200	64	2	400	500	0	300	0	0	2	0
ctd009	41.77	-18.76	500	400	300	200	35	5	35	500	400	0	0	0	5	0
ctd010	40.84	-20.21	500	400	300	200	40	2	500	0	400	300	0	0	2	0
ctd011	39.4	-22.46	500	400	300	200	63	5	63	500	400	0	0	0	5	0
ctd012	38.5	-23.89	500	480	300	200	60	2	500	0	480	300	0	0	2	0
ctd013	36.95	-25.91	0	400	0	0	78	2	78	0	400	0	0	78	2	0
ctd014	34.56	-26.61	500	400	300	200	75	5	200	500	400	300	0	0	0	0
ctd015	33.35	-27.1	500	400	300	200	100	2	500	0	400	300	0	0	2	0
ctd016	31.3	-27.7	500	400	300	200	100	5	5	500	400	0	0	0	0	0
ctd017	29.9	-28.17	500	400	300	200	115	2	500	0	400	300	0	0	0	0
ctd018	27.51	-28.86	500	400	300	160	135	5	135	500	0	0	160	0	5	0
ctd019	26.11	-29.31	500	350	200	135	120	2	500	0	350	0	135	0	2	0
ctd020	24.06	-29.88	500	350	200	115	100	5	500	0	0	0	0	0	0	0
ctd021	22.66	-29.87	500	350	200	135	100	2	500	0	350	0	135	0	2	0
ctd022	20.45	-29.25	500	350	200	130	95	5	350	500	0	0	130	0	5	0
ctd024	19.86	-29.14	500	350	200	140	90	2	500	0	350	0	140	0	2	0
ctd025	17.83	-28.68	500	350	200	113	67	5	200	500	0	0	113	0	5	0
ctd026	16.44	-28.4	500	350	200	130	79	2	500	0	350	0	130	0	2	0
ctd027	14.22	-27.91	500	350	200	100	52	5	100	500	350	0	0	0	5	0
ctd028	12.84	-27.65	500	350	200	100	40	2	500	0	350	200	0	0	2	0
ctd029	10.76	-27.2	500	350	200	98	50	5	350	500	0	0	98	0	5	0
ctd030	9.37	-26.92	500	350	200	120	45	2	500	0	350	0	120	0	2	0
ctd031	7.28	-26.51	500	350	200	94	70	5	350	500	0	0	94	0	5	0
ctd032	5.9	-26.2	500	350	200	110	75	2	500	0	350	0	110	0	2	0
ctd033	3.75	-25.77	500	350	200	110	79	5	200	500	0	0	110	0	5	0
ctd034	2.38	-25.49	500	350	200	100	66	2	500	0	350	0	100	0	2	0
ctd035	0	-25	500	350	200	70	50	5	200	500	0	0	70	0	5	0
ctd036	-3.9	-25	500	350	200	100	72	5	350	500	0	0	100	0	5	0
ctd037	-5.32	-25.03	500	350	200	175	70	2	500	0	350	0	175	0	2	0
ctd038	-7.48	-25.01	500	350	200	125	92	5	200	500	0	0	125	0	5	0
ctd039	-8.91	-25.04	500	350	200	140	82	2	500	0	350	0	140	0	2	0
ctd040	-11.05	-25.02	500	350	200	150	125	5	350	500	0	0	150	0	5	0
ctd041	-12.49	-25.07	500	350	200	145	122	2	500	0	350	0	145	0	2	0
ctd042	-14.67	-25.07	500	350	200	165	125	5	200	500	0	0	165	0	5	0
ctd043	-16.13	-25.08	500	400	300	0	165	2	500	0	400	0	0	0	2	0
ctd044	-18.31	-25.06	500	350	200	190	160	5	5	500	0	0	190	0	5	0
ctd045	-18.56	-25.07	500	350	210	200	175	2	0	500	350	210	0	0	0	0
ctd047	-20.86	-25.07	500	350	200	180	140	5	5	500	0	0	180	0	5	0
ctd048	-22.32	-25.06	500	400	300	200	155	2	400	500	0	300	0	0	2	0
ctd049	-24.43	-25.04	500	400	300	200	150	5	400	500	0	0	200	0	5	0
ctd050	-25.59	-25.04	500	400	300	200	135	2	400	500	0	300	0	0	2	0
ctd051	-27.75	-25.03	500	400	300	200	125	5	400	500	0	0	200	0	5	0
ctd052	-29.15	-25.28	500	400	300	200	125	2	400	500	0	300	0	0	2	0
ctd053	-31.36	-26.1	500	400	300	200	100	5	100	500	0	0	200	0	5	0
ctd054	-32.72	-26.63	500	400	300	200	87	2	400	500	0	300	0	0	2	0
ctd055	-34.57	-27.43	500	400	300	200	70	5	70	500	0	0	200	0	5	0
ctd056	-35.8	-27.87	500	400	300	200	44	2	400	500	0	300	0	0	2	0
ctd057	-37.89	-28.78	500	400	300	200	40	5	400	500	0	300	0	0	5	0
ctd058	-38.96	-29.17	500	400	300	200	50	2	400	500	0	300	0	0	2	0
ctd059	-40.12	-30.94	500	400	300	200	50	5	400	500	0	0	200	0	5	0
ctd060	-40.69	-32.1	500	400	300	200	40	2	500	0	400	300	0	0	2	0
ctd061	-41.47	-33.88	500	400	300	200	50	5	200	500	0	300	0	0	5	0
ctd062	-42.08	-35.1	500	400	300	200	40	5	400	500	0	300	0	0	5	0
ctd064	-43.59	-38.39	500	400	300	200	42	2	400	500	0	0	0	0	0	0
ctd065	-44.63	-40.73	500	400	300	200	45	5	5	500	400	0	0	0	5	0
ctd066	-45.29	-42.2	500	400	300	200	46	2	400	500	0	300	0	0	2	0
ctd067	-46.07	-44.21	500	400	300	200	37	5	400	500	0	300	0	0	5	0

References

Dall'Olmo et al. (2009) Significant contribution of large particles to optical backscattering in the open ocean. Biogeosciences, 6, 947–967.

Menzel, D. W. (1967), Particulate organic carbon in deep sea, Deep Sea Res., 14(2), 229–238, doi:10.1016/0011-7471(67)90008-3.

Van der Linde (1998) Protocol for the determination of total suspended matter in oceans and coastal waters. Technical Note No. I.98.182, European Commission, Join Research Centre.

Particulate Inorganic Carbon concentration

Laura Lubelczyk (for William Balch)

Bigelow Laboratory for Ocean Sciences

Cruise Objectives

1. Collection of CTD and underway samples for analysis of particulate organic carbon (POC), particulate inorganic carbon (PIC), coccolith enumeration (cell counts), biogenic silica concentration (BSi), and scanning electron microscopy for coccolithophore species identification. The purpose of these samples was to provide an assessment of the inorganic and organic particle concentrations in surface water, provide indices of community composition, and analytical means to calibrate satellite PIC algorithms.

2. Operation of an along-track flow-through system from the ship's non-toxic seawater system to characterize the fine-scale hydrographic and bio-optical variability of the various water masses for satellite development of the NASA PIC algorithm.

3. Water-leaving radiance measurements in the visible and near infrared taken for characterizing the particulate content of the seawater and to provide sea-truth data for NASA's satellite-based radiance measurements.

Underway Sampling

Discrete underway samples were collected from the ship's Surf-Met (underway surface and meteorological data collection) flow system in the prep lab 3 to 4 times per day. Samples for particulate organic carbon (POC), particulate inorganic carbon (PIC), biogenic silica (BSi), and coccolith enumeration were obtained along with chlorophyll and salinity samples taken for fluorometer calibration (chlorophylls measured by Rob Thomas, BODC and salinity measured by John Wynar).

PIC samples were collected on 0.4 µm polycarbonate filters, rinsed with potassium tetraborate buffer, dried and stored in metal free centrifuge tubes. These will be analyzed by ICPOES for particulate calcium.

Coccolith and cell counts were collected on 0.45 µm Millipore HA (nitrocellulose) filters, rinsed with potassium tetraborate buffer, frozen at 20ºC, dried, then mounted onto slides using Norland Optical Adhesive. They will later be enumerated by birefringence microscopy.

Biogenic silica (BSi) samples were filtered onto 0.4 µm polycarbonate filters, dried in clean centrifuge tubes, and will be analyzed following the protocol of Brzezinski and Nelson (1989).

POC samples were filtered onto pre-combusted glass fiber filters, rinsed with 0.2 µm filtered seawater, dried, and will later be fumed with concentrated HCl to remove inorganic carbon. They will be analyzed ashore at Bigelow Analytical Services.

Scanning electron microscopy (SEM) samples were collected at select underway stations on 0.4 um polycarbonate filters, rinsed with potassium tetraborate buffer, dried, and stored in petri dishes for analysis on shore.

Blanks for filtered samples were collected twice weekly.

CTD Sampling

During the pre-dawn CTD eight depths down to 500 m were analyzed for POC, PIC, BSi, coccolith enumeration, and SEM as described above. For the afternoon CTD, eight depths down to 200m were also analyzed for PIC and BSi with only 5m samples collected for POC and cell counts. Scanning electron microscopy samples were collected at the DCM and 5m for the pre-dawn CTD and at 5m only for the afternoon CTD.

Flow-through Bio-optical System

This system operates semi-continuously with water from the ships non-toxic sea water supply flowing at a rate of 3-4 liters per minute. Every 5-10 minutes temperature and salinity are measured (with a SeaBird sensor), chlorophyll fluorescence (WETLabs Wet star), total backscattering at 532nm (bb_{tot}; WETLabs ECO-VSF), acidified backscattering (bb_{acid}; backscattering of the seawater suspension after the pH has been lowered to dissolve calcite and aragonite), and acid labile backscattering (bb'; the difference between the bb_{tot} and bb_{acid}).

A WETLabs AC-9 is used to measure absorption and attenuation at 9 visible wavelengths (412, 440, 488, 510, 555, 630, 650, 676, and 715 nm) every 4 minutes and absorption and attenuation at the same wavelengths after the water was routed through a serially-mounted 1 µm poresize, then 0.2µm poresize filter (during the intervening 4 minute segments).

Each morning an AC-9 and bb calibration was performed using 0.2 µm (absolute) filtered seawater. Once per week the entire system was disassembled, cleaned, and calibrated using Milli-Q water and also filtered seawater.

Above-water Radiance Measurements

In order to check the PIC algorithm performance, free of atmospheric error, total upwelling radiance, downwelling sky radiance and total downwelling irradiance were measured on the *RRS James Cook* using a Satlantic SeaWiFS Aircraft Simulator (MicroSAS). The same wavelengths are measured with the MicroSAS as are used in the 2-band and 3-band PIC algorithms (except the IR bands which are not needed for the implementation of the ship-derived, three-band algorithm because there is negligible atmospheric correction when measurements are made from ship).

The system consists of a down-looking ocean radiance sensor and an up-looking sky-viewing radiance sensor, both mounted on the meteorological platform. The water-viewing radiance detector was set to view the ocean surface at 40^{o} from nadir and the sky-viewing radiance sensor was set to view the sky 40^{o} from zenith (used in the correction for Fresnel reflectance) as recommended by Mueller et al. (2003b). The downwelling irradiance sensor was mounted at the top of the main mast. Data from these sensors will be used to calculate spectral normalized water-leaving radiance (after filtering out white-caps and high pitch/roll anomalies) for comparison to the satellite estimates of normalized water-leaving radiance.

Sensors were rinsed regularly with Milli-Q water in order to remove salt deposits and any dust. The water radiance sensor was able to view over an azimuth range of ~180^{o} across the ship's heading with no contamination from the ship's deck or wake. The direction of the sensor was adjusted constantly to view the water 120^{o} from the sun's azimuth, to minimize sun glint. This was done using a computer-based system that calculated the sun's azimuth angle relative to the ship's heading and elevation constantly. The system used the ship's gyro-compass to determine the heading of the ship. Depending on the ship's course, the computer controlled a stepper motor that turned the sensors to the proper viewing angle. Protocols for operation and calibration were performed according to Mueller (Mueller et al. 2003a; Mueller et al. 2003b; Mueller et al. 2003c). Data were collected between when the sun was above 20^{o} elevation. Post-cruise, the 16Hz data will be filtered to remove as much residual white cap and glint as possible (we accept the lowest 5% of the data). Calibrations with 10%

reflectance plaque were performed several times during the cruise in order to assess the status of the radiometric calibrations. A factory calibration of the radiometers was performed before the cruise.

Sampling statistics

Flow-through optics: 38 days

Above water radiance measurements: 38 days

Underway samples: 106

CTD casts sampled: 68

Total PIC samples collected: 641

Total POC samples collected: 421

Total coccolith enumeration samples collected: 441

Total biogenic silica samples collected: 641

Total SEM samples collected: 130

CTD discrete samples collected

Date	CTD Cast	Latitude (N)	Longitude (E)	Depths Sampled
25/09/2014	001	49.83	-4.76	5m
26/09/2014	002	47.87	-7.94	200m, 75m, 50m, 29m, 22m, 13m, 5m
26/09/2014	003	47.19	-8.83	200m, 65m, 50m, 38m, 30m, 28m, 16m, 5m
27/09/2014	004	47.57	-8.50	200m, 98m, 65m, 50m, 44m, 38m, 16m, 5m
28/09/2014	005	46.39	-10.98	500m, 200m, 82m, 55m, 35m, 23m, 7m, 5m
28/09/2014	006	45.50	-12.49	200m, 112m, 75m, 57m, 49m, 32m, 18m, 5m
29/09/2014	007	44.09	-14.92	200m, 112m, 75m, 67m, 43m, 32m, 18m, 5m
29/09/2014	008	43.17	-16.43	200m, 132m, 88m, 67m, 64m, 38m, 22m, 5m
30/09/2014	009	41.77	-18.76	500m, 200m, 90m, 60m, 35m, 26m, 15m, 5m
30/09/2014	010	40.84	-20.21	200m, 99m, 66m, 51m, 40m, 38m, 16m, 5m

01/10/2014	011	39.40	-22.46	200m, 113m, 75m, 63m, 44m, 33m, 19m, 5m
01/10/2014	012	38.50	-23.89	200m, 96m, 64m, 60m, 49m, 28m, 16m, 5m
02/10/2014	013	36.95	-25.91	200m, 125m, 83m, 78m, 64m, 36m, 20m, 5m
03/10/2014	014	34.56	-26.61	500m, 200m, 125m, 83m, 75m, 48m, 20m, 5m
03/10/2014	015	33.35	-27.10	200m, 158m, 100m, 80m, 61m, 45m, 26m, 5m
04/10/2014	016	31.30	-27.70	200m, 158m, 105m, 100m, 60m, 45m, 26m, 5m
04/10/2014	017	29.90	-28.17	200m, 180m, 120m, 115m, 92m, 70m, 29m, 5m
05/10/2014	018	27.51	-28.86	500m, 203m, 160m, 135m, 78m, 58m, 33m, 5m
05/10/2014	019	26.11	-29.31	200m, 180m, 120m, 92m, 70m, 52m, 29m, 5m
06/10/2014	020	24.06	-29.88	500m, 200m, 150m, 115m, 100m, 58m, 25m, 5m
06/10/2014	021	22.66	-29.87	200m, 150m, 100m, 77m, 58m, 43m, 25m, 5m
07/10/2014	022	20.45	-29.25	200m, 158m, 105m, 95m, 61m, 45m, 26m, 5m
07/10/2014	024	19.86	-29.14	200m, 143m, 95m, 90m, 73m, 55m, 13m, 5m
08/10/2014	025	17.83	-28.68	500m, 200m, 113m, 75m, 67m, 44m, 20m, 5m
08/10/2014	026	16.44	-28.40	200m, 143m, 95m, 79m, 73m, 55m, 23m, 5m
09/10/2014	027	14.22	-27.91	200m, 100m, 65m, 52m, 38m, 28m, 16m, 5m
09/10/2014	028	12.84	-27.65	200m, 93m, 62m, 48m, 40m, 36m, 15m, 5m
10/10/2014	029	10.76	-27.20	500m, 200m, 98m, 65m, 50m, 28m, 16m, 5m
10/10/2014	030	9.37	-26.92	200m, 78m, 52m, 45m, 40m,

				23m, 13m, 5m
11/10/2014	031	7.28	-26.51	200m, 111m, 94m, 70m, 43m, 32m, 18m, 5m
11/10/2014	032	5.90	-26.20	200m, 124m, 83m, 75m, 63m, 48m, 20m, 5m
12/10/2014	033	3.78	-25.77	500m, 200m, 110m, 120m, 82m, 74m, 47m, 20m,5m
12/10/2014	034	2.38	-25.49	200m, 129m, 86m, 66m, 50m, 37m, 20m, 5m
13/10/2014	035	0.00	-25.00	200m, 90m, 70m, 60m, 50m, 35m, 26m, 15m,5m
14/10/2014	036	-3.90	-25.00	200m, 120m, 80m, 72m, 47m, 35m, 20m, 5m
14/10/2014	037	-5.32	-25.03	200m, 117m, 78m, 70m, 60m, 45m, 20m, 5m
15/10/2014	038	-7.48	-25.01	200m, 143m, 125m, 92m, 55m, 41m, 23m, 5m
15/10/2014	039	-8.91	-25.04	200m, 143m, 95m, 82m, 73m, 55m, 23m, 5m
16/10/2014	040	-11.05	-25.02	500m, 200m, 150m, 130m, 125m, 476m, 56m, 32m,5m
16/10/2014	041	-12.49	-25.07	200m, 164m, 122m, 110m, 84m, 64m, 27m, 5m
17/10/2014	042	-14.67	-25.07	200m, 165m, 130m, 125m, 75m, 56m, 32m, 17m,5m
17/10/2014	043	-16.13	-25.08	255m, 170m, 165m, 130m, 99m, 73m, 41m, 5m
18/10/2014	044	-18.31	-25.06	500m, 240m, 190m, 160m, 93m, 69m, 39m, 21m,5m
18/10/2014	045	-18.56	-25.07	270m, 210m, 200m, 180m, 175m, 138m, 104m, 24m,5m
20/10/2014	047	-20.86	-25.07	210m, 200m, 180m, 140m, 81m, 60m, 34m, 5m
20/10/2014	048	-22.32	-25.06	240m, 200m, 155m, 122m, 93m, 69m, 39m, 5m
21/10/2014	049	-24.43	-25.04	225m, 150m, 87m, 65m, 37m, 20m, 5m

21/10/2014	050	-25.59	-25.04	200m, 135m, 103m, 78m, 58m, 33m, 18m, 5m
22/10/2014	051	-27.75	-25.03	500m, 300m, 188m, 125m, 73m, 54m, 17m, 5m
22/10/2014	052	-29.15	-25.28	200m, 195m, 130m, 125m, 99m, 76m, 32m, 5m
23/10/2014	053	-31.36	-26.10	300m, 150m, 100m, 58m, 43m, 25m, 13m, 5m
23/10/2014	054	-32.72	-26.63	200m, 138m, 93m, 87m, 71m, 54m, 23m, 5m
24/10/2014	055	-34.57	-27.43	500m, 200m, 135m, 90m, 70m, 52m, 22m, 5m
24/10/2014	056	-35.80	-27.87	200m, 93m, 62m, 44m, 36m, 27m, 15m, 5m
25/10/2014	057	-37.89	-28.78	200m, 100m, 45m, 40m, 26m, 20m, 5m
25/10/2014	058	-38.96	-29.17	100m, 50m, 28m, 5m
26/10/2014	059	-40.12	-30.94	500m, 200m, 105m, 70m, 50m, 41m, 5m
26/10/2014	060	-40.69	-32.10	200m, 83m, 56m, 43m, 40m, 32m, 14m, 5m
27/10/2014	061	-41.47	-33.88	200m, 105m, 70m, 50m, 41m, 30m, 17m, 5m
27/10/2014	062	-42.08	-35.10	200m, 105m, 70m, 60m, 50m, 40m, 30m, 5m
28/10/2014	063	-43.00	-37.14	500m, 200m, 90m, 60m, 50m, 35m, 26m, 5m
28/10/2014	064	-43.59	-38.39	200m, 94m, 63m, 48m, 42m, 27m, 16m, 5m
29/10/2014	065	-44.63	-40.73	200m, 98m, 50m, 45m, 40m, 28m, 15m, 5m
29/10/2014	066	-45.29	-42.20	200m, 90m, 75m, 60m, 46m, 35m, 26m, 5m
30/10/2014	067	-46.07	-44.21	500m, 200m, 100m, 55m, 37m, 24m, 14m, 5m
31/10/2014	068	-48.25	-50.34	200m, 150m, 120m, 80m, 61m, 41m, 20m, 5m

01/11/2014	069	-49.58	-53.07	200m, 150m, 100m, 80m, 65m, 40m, 15m, 5m
01/11/2014	70	-50.26	-54.53	200m, 150m, 100m, 75m, 60m, 35m, 20m, 5m

Underway discrete samples collected

Sample	Date and Time (UT)	Latitude N	Longitude E
AA	25/09/2014 18:11	48.9657	-6.1945
AB	26/09/2014 08:08	47.4299	-8.5738
AC	26/09/2014 16:01	47.3109	-8.6912
AD	26/09/2014 20:06	47.2172	-8.8146
AE	27/09/2014 03:21	47.3044	-8.7672
AF	27/09/2014 08:17	47.5017	-8.612
AG	27/09/2014 15:56	47.568	-8.7517
AH	27/09/2014 20:09	47.1803	-9.5739
AI	28/09/2014 09:05	45.9443	-11.7202
AJ	28/09/2014 17:06	45.231	-12.9516
AK	28/09/2014 20:18	44.8631	-13.5852
AL	29/09/2014 09:03	43.6237	-15.6766
AM	29/09/2014 17:08	42.8884	-16.9042
AN	29/09/2014 20:10	42.5322	-17.4851
AO	30/09/2014 09:11	41.2761	-19.5273
AP	30/09/2014 17:08	40.5504	-20.6903
AQ	30/09/2014 20:10	40.1918	-21.2513
AR	1/10/2014 9:11	38.9298	-23.228
AS	1/10/2014 17:08	38.2645	-24.2472
AT	2/10/2014 17:12	36.4617	-26.0747
AU	2/10/2014 20:21	35.9044	-26.2607
AV	3/10/2014 9:11	34.011	-26.8753
AW	3/10/2014 17:01	32.9106	-27.2251

Sample	Date and Time (UT)	Latitude N	Longitude E
AX	3/10/2014 20:09	32.3552	-27.4004
AY	4/10/2014 9:06	30.5743	-27.9546
AZ	4/10/2014 17:02	29.434	-28.3012
BA	4/10/2014 19:56	28.9164	-28.4667
BB	5/10/2014 10:06	26.7848	-29.1072
BC	5/10/2014 18:07	25.6445	-29.4449
BD	5/10/2014 21:12	25.0956	-29.607
BE	6/10/2014 10:00	23.3664	-29.9532
BF	6/10/2014 18:11	22.1712	-29.734
BG	6/10/2014 20:58	21.6777	-29.5804
BH	7/10/2014 10:01	19.8553	-29.1406
BI	7/10/2014 18:08	19.3776	-29.0374
BJ	7/10/2014 21:03	18.847	-28.923
BK	8/10/2014 10:06	17.1123	-28.5486
BL	8/10/2014 18:07	15.9662	-28.303
BM	8/10/2014 21:10	15.4174	-28.1894
BN	9/10/2014 10:04	13.5294	-27.7887
BO	9/10/2014 18:09	12.3869	-27.5491
BP	9/10/2014 21:04	11.8774	-27.4436
BQ	10/10/2014 10:08	10.0582	-27.0631
BR	10/10/2014 18:12	9.0411	-26.845
BS	10/10/2014 21:11	8.5038	-26.7427
BT	11/10/2014 10:09	6.5734	-26.3566
BU	11/10/2014 18:11	5.432	-26.1235
BV	11/10/2014 21:08	4.9124	-26.0035
BW	12/10/2014 10:09	3.0532	-25.6213
BX	12/10/2014 18:14	1.9257	-25.3936
BY	12/10/2014 21:16	1.3391	-25.2727

Sample	Date and Time (UT)	Latitude N	Longitude E
BZ	13/10/2014 10:13	-0.6549	-25.0055
CA	14/10/2014 10:38	-4.7263	-25.0222
CB	14/10/2014 18:17	-5.8345	-25.0325
CC	14/10/2014 21:13	-6.3736	-25.0343
CD	15/10/2014 10:08	-8.2213	-25.045
CE	15/10/2014 18:08	-9.3823	-25.052
CF	15/10/2014 21:04	-9.922	-25.0529
CG	16/10/2014 10:06	-11.7942	-25.0594
CH	16/10/2014 18:18	-13.0095	-25.07
CI	16/10/2014 21:08	-13.5349	-25.0721
CJ	17/10/2014 10:08	-15.4277	-25.0823
CK	17/10/2014 18:10	-16.6428	-25.0904
CL	17/10/2014 21:01	-17.1649	-25.0923
CM	18/10/2014 10:12	-18.5503	-25.097
CN	18/10/2014 18:07	-18.5624	-25.1296
CO	19/10/2014 09:38	-18.55	-25.0954
CP	19/10/2014 19:46	-19.3603	-25.0895
CQ	20/10/2014 10:11	-21.6324	-25.0732
CR	20/10/2014 18:04	-22.7949	-25.0595
CS	20/10/2014 20:31	-23.2504	-25.0525
CT	21/10/2014 10:02	-25.1384	-25.0379
CU	21/10/2014 18:20	-26.1137	-25.0286
CV	21/10/2014 21:25	-26.6797	-25.0203
CW	22/10/2014 10:01	-28.4793	-25.0288
CX	22/10/2014 18:07	-29.5957	-25.4401
CY	22/10/2014 21:07	-30.103	-25.6267
CZ	23/10/2014 11:05	-32.0565	-26.375
DA	23/10/2014 19:08	-33.1944	-26.8161

Sample	Date and Time (UT)	Latitude N	Longitude E
DB	23/10/2014 22:18	-33.7501	-27.0329
DC	24/10/2014 11:17	-35.1735	-27.6465
DD	24/10/2014 19:02	-36.3078	-28.0764
DE	24/10/2014 22:10	-36.865	-28.303
DF	25/10/2014 11:03	-38.4687	-28.9715
DG	25/10/2014 19:02	-39.382	-29.3637
DH	25/10/2014 21:58	-39.6111	-29.8414
DI	26/10/2014 11:08	-40.4081	-31.4918
DJ	26/10/2014 19:04	-40.9142	-32.5804
DK	26/10/2014 22:05	-41.1696	-33.1236
DL	27/10/2014 11:12	-41.811	-34.5081
DM	27/10/2014 20:09	-42.3251	-35.6236
DN	28/10/2014 11:04	-43.3067	-37.7543
DO	28/10/2014 19:05	-43.8076	-38.8652
DP	28/10/2014 21:57	-44.04	-39.3846
DQ	29/10/2014 11:05	-44.9685	-41.4708
DR	29/10/2014 19:10	-45.5408	-42.7816
DS	29/10/2014 22:01	-45.8211	-43.4119
DT	30/10/2014 11:03	-46.3883	-44.8768
DU	30/10/2014 18:58	-46.9551	-46.5007
DV	30/10/2014 22:31	-47.2272	-47.2579
DW	31/10/2014 05:49	-47.6236	-48.5851
DX	31/10/2014 10:50	-47.9134	-49.4606
DY	31/10/2014 19:08	-48.5352	-50.9186
DZ	31/10/2014 22:06	-48.827	-51.5015
EA	1/11/2014 11:50	-49.9144	-53.7821
EB	1/11/2014 18:37	-50.3785	-54.7853

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Atmospheric Optics and Operational Oceanography

Tim Smyth (TS)

Plymouth Marine Laboratory

Atmospheric Optics

Sun photometry
Measurements of the aerosol optical thickness were taken at varying weather and sky state frequency throughout the AMT transect. The aerosol optical thickness was determined at 380, 440, 500, 675 and 870 using a handheld Microtops II sunphotometer (Solar Light Co., Inc., S/N 19750: last calibration 14/10/2013) on loan from the NASA AERONET project. Measurements taken by TS were sent directly to the Maritime Aerosol Network (MAN) throughout the duration of the cruise via email and the data then posted on the internet. The overall aim of the MAN component of AERONET is to complement the widespread land-based measurements of aerosols with measurements in the remote ocean which are sparsely (temporally and spatially) sampled. The data collected on AMT24 can be accessed directly from the NASA AERONET website at:

http://aeronet.gsfc.nasa.gov/new_web/maritime_aerosol_network.html

In total over 650 measurements were taken between the UK and Punta Arenas.

Total and Diffuse irradiance
As part of an industrial partnership between PML and Peak Design (Delta-T instruments), two separate instrument packages were mounted on the forward meteorological mast, secured to the "bird table". These instruments are currently being developed by Peak Design: AMT offered a unique opportunity to robustly field test the instrument design and to collect data over an extended period of time. The instruments are ideal for marine applications as they determine the diffuse and total irradiance without moving parts (which would become quickly seized). It may also offer an alternative method (to handheld equipment which require an operator) for determining the aerosol optical thickness autonomously in the marine environment.

The first instrument package was a Zeiss MMS1 spectrometer which measures total and diffuse irradiance at approximately 3.5 nm resolution between 0.3 and 1.1 µm. This is logged every 60 s along with necessary ancillary data such as GPS position (every 5 minutes) and orientation (pitch, roll, yaw: at 3 Hz). The orientation information is important for correcting the signal for motion – a problem which has been highlighted on two seasons of deployments on PML's L4 buoy. This package also included a standard SPN1 detector, which is already commercially available. This was also logged every 60 s.

The second instrument package was an AS161 spectrometer. This again measures total and diffuse irradiance every 60 s at 5 nm resolution between 0.350 and 1.1 µm, but in short bursts (every 0.5 s for 10 acquisitions). Again, ancillary measurements are logged with the sensor. The two different packages will be compared back in the laboratory to determine the most effective sampling strategy for marine applications.

Both instruments were controlled locally by onboard embedded PCs running Windows. The instruments collected data for the entire duration of the transect (> 40 days) and were remotely monitored using TightVNC which also allowed the data to be periodically downloaded. It is hoped that these data will form part of a peer-reviewed technology paper, highlighting the uniqueness of AMT as a platform for technological development.

Operational Oceanography

Automated send of CTD data

During the cruise, software was refined and developed for the automated send of coarse resolution CTD data via email to the UK Met Office. This had previously been developed by TS for use on the RRS Discovery in 2009 and it was hoped that it could be used in "stand-alone" mode by every subsequent cruise. Where this failed was the lack of an integrated system between the computer controlling the CTD and the (linux) system which could handle the higher level processing and automated data send. AMT-24 offered a unique opportunity to develop this integrated system. The CTD controlling PC on JCR had a script which processed the CTD using SeaSave: a line was inserted in this code to allow a separate .cnv file to be produced with the correct format and put in the correct directory. Every hour an automated script on the linux system looks for a new file in that directory, and if it finds one, runs an executable to coarsen the resolution of the CTD file and emails it to the UK Met Office (ocean.data@metoffice.gov.uk). Below is an example file:

```
H.HHHH, DD, MM, YYYY, DDD.DDDD, DDD.DDDD, STN, PPPP.P, TT.TTT, SS.SSS
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,    2.0,  9.260, 34.451
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,    4.0,  9.259, 34.451
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,    6.0,  9.262, 34.451
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,    8.0,  9.267, 34.452
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,   10.0,  9.276, 34.428
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,   15.0,  9.251, 34.452
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,   20.0,  9.253, 34.451
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,   25.0,  9.254, 34.452
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,   30.0,  9.234, 34.452
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,   35.0,  9.177, 34.456
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,   40.0,  9.180, 34.453
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,   45.0,  9.030, 34.458
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,   50.0,  8.987, 34.458
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,   60.0,  8.981, 34.458
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,   70.0,  8.958, 34.456
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,   80.0,  8.941, 34.457
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,   90.0,  8.921, 34.458
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,  100.0,  8.876, 34.460
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,  120.0,  8.462, 34.483
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,  140.0,  8.103, 34.491
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,  160.0,  7.534, 34.444
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,  180.0,  6.919, 34.375
```

```
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,  200.0,  6.374, 34.317
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,  250.0,  5.047, 34.184
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,  300.0,  4.579, 34.146
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,  350.0,  4.339, 34.137
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,  400.0,  4.118, 34.139
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,  450.0,  3.860, 34.144
5.9572, 30, 10, 2014, -46.0723, -44.2095, 999,  500.0,  3.684, 34.155
```

where H.HHHH is the decimal time (GMT), DD the day, MM the month, YYYY the year, DDD.DDDD the decimal latitude and longitude, STN the station number, PPPP.P the pressure in db, TT.TTT the temperature (°C) and SS.SSS the salinity (PSU).

This system should now work for all subsequent cruises on the JCR, once necessary permission has been gained from the individual cruise's PSO.

Launch of Apex Argo floats

Apex-Argo floats were launched at request of the UK Met Office. Table 1 gives the dates and positions of the deployments.

Date	Time	Log Identifier	Lat (degrees)	Lon (degrees)	Float ID
17/10/2014	15:17	MAF_JR303_001	-16.1316	-25.08405	#6998
20/10/2014	15:13	MAF_JR303_002	-22.3162	-25.05981	#6999
21/10/2014	15:13	MAF_JR303_003	-25.5945	-25.03587	#7000
25/10/2014	16:06	MAF_JR303_004	-38.9613	-29.16873	#7031
27/10/2014	16:23	MAF_JR303_005	-42.0804	-35.10262	#7032
29/10/2014	16:12	MAF_JR303_006	-45.287	-42.1989	#7017
31/10/2014	16:03	MAF_JR303_007	-48.2465	-50.34104	#7016
01/11/2014	08:02	MAF_JR303_008	-49.5799	-53.07075	#7015

Table 1: Apex Argo Float deployments for the UK Met Office

Chemistry

Nutrients

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Objectives

To investigate the spatial and temporal variations of the micro-molar nutrient species Nitrate, Nitrite, Phosphate, and Silicate during the research cruise along the Atlantic Meridional Transect (AMT) cruise track, departing the from Immingham, UK and sailing through the North Atlantic Gyre (NAG), south to the equator, through the South Atlantic Gyre (SAG), before turning south-west to end the cruise at Port Stanley Falkland Islands.

Sampling and methodology

Micro-molar nutrient analysis was carried out using a 4 channel (nitrate (Brewer & Riley, 1965), nitrite (Grasshoff,K., 1976), phosphate, silicate (Kirkwood, D.S., 1989) (Mantoura, R.F.C. & Woodward, E.M. S., 1983) Bran & Luebbe AAIII segmented flow, colourimetric, auto-analyser. Established, proven analytical protocols were used.

Water samples were taken from a 24 x 20 litre bottle stainless steel framed CTD / Rosette system (Seabird). These were sub-sampled into clean (acid-washed) 60ml HDPE (Nalgene) sample bottles. Subsequent nutrient analysis was complete within 3-4 hours of sampling.

CTD samples analysed

A total of 70 vertical profiles were analysed along the axis of the AMT and are listed in the table below, (CTD geographic positions and corrected bottle firing depths being available from the CTD Log.) :-

Table : AMT 24 - Nutrient Analysis - Station & CTD Sampling Summary

Date	Time (GMT)	Ship Stn.	CTD ID	Niskin sampled
25.09.2014	10:00	JCR303 001	S 001	23, 22, 19, 15, 10, 8, 4, 1
26.09.2014	03.17	JCR303 002	S 001	23,22,21,19,17,16,11,9,8,6,5,4,3,1
26.09.2014	12:46	JCR303 003	S 003	23,22,21,19,18,15,13,10,9,7,6,4,3,2,1
27.09.2014	12:04	JCR303 004	S 004	23,22,21,19,18,15,14,11,8,6,5,4,3,2,1
28.09.2014	04:12	JCR303 005	S 005	24,22,20,19,18,16,15,14,10,9,8,6,5,4,2
28.09.2014	13:02	JCR303 006	S 006	23,22,21,19,18,15,14,11,8,7,5,4,3,2,1
29.09.2014	04:12	JCR303 007	S 007	22,20,19,18,17,15,14,13,12,8,7,5,4,3,2
29.09.2014	13:05	JCR303 008	S 008	23,22,21,20,17,16,14,11,8,7,5,4,3,2,1
30.09.2014	04:00	JCR303 009	S 009	24,21,20,19,18,16,15,14,9,8,7,5,4,3,2

30.09.2014	13:04	JCR303 010	S 010	23,22,21,20,19,16,14,11,8,7,5,4,3,2,1
01.10.2014	04:04	JCR303 011	S 011	24,21,20,18,16,15,14,13,12,8,7,5,4,3,2
01.10.2014	13:04	JCR303 012	S 012	23,22,21,20,19,16,15,14,10,7,6,4,3,2,1
02.10.2014	13:04	JCR303 013	S 013	23,22,21,20,16,15,14,10,7,6,4,3,2,1
03.10.2014	04:04	JCR303 014	S 014	24,21,20,17,16,15,14,13,12,8,7,5,4,3,2
03.10.2014	13:04	JCR303 015	S 015	23,22,21,20,17,16,15,13,10,7,6,4,3,2,1
04.10.2014	04:04	JCR303 017	S 016	24,21,20,19,17,16,14,13,12,8,7,5,4,3,2
04.10.2014	13:03	JCR303 018	S 017	23,22,21,20,17,16,15,13,10,7,6,4,3,2,1
05.10.2014	05:04	JCR303 019	S 018	24,21,20,19,17,16,15,14,13,11,7,6,4,3,2
05.10.2014	14:04	JCR303 020	S 019	23,22,21,20,17,16,14,13,9,6,5,3,2,1
06.10.2014	05:05	JCR303 022	S 020	24,21,20,19,17,16,15,14,13,11,7,6,4,3,2
06.10.2014	14:04	JCR303 023	S 021	23,22,21,20,17,16,15,13,9,6,5,3,2,1
07.10.2014	05:05	JCR303 024	S 022	24,21,20,19,17,16,14,13,12,8,7,6,4,3,2
07.10.2014	14:06	JCR303 025	S 024	23,22,21,20,16,15,13,10,7,6,5,3,2,1
08.10.2014	05:11	JCR303 027	S 025	24,21,20,19,16,15,14,13,12,8,7,4,2,1,
08.10.2014	14:02	JCR303 028	S 026	23,22,21,20,17,16,15,13,10,7,6,5,3,2,1
09.10.2014	05:11	JCR303 029	S 027	23,22,20,19,18,16,15,14,13,10,8,5,4,3,2
09.10.2014	14:05	JCR303 030	S 028	23,22,21,19,18,16,14,11,8,7,6,4,3,2,1
10.10.2014	05:17	JCR303 032	S 029	24,21,20,19,18,16,15,14,9,8,5,4,3,2
10.10.2014	14:04	JCR303 033	S 030	23,22,21,20,19,16,15,14,10,7,6,4,3,2,1
11.10.2014	05:09	JCR303 034	S 031	23,21,20,19,18,16,15,14,13,10,7,6,4,3,2
11.10.2014	04:04	JCR303 035	S 032	23,22,21,18,16,15,14,9,7,6,5,3,2
12.10.2014	05:04	JCR303 037	S 033	24,21,20,17,16,15,14,13,11,8,7,6,4,3,2
12.10.2014	14:05	JCR303 038	S 034	23,22,21,18,17,15,14,10,8,6,5,3,2,1
13.10.2014	05:35	JCR303 040	S 035	22,20,19,18,17,15,14,12,11,8,7,6,4,3,2
14.10.2014	05:05	JCR303 041	S 036	22,20,19,18,15,14,13,11,8,7,6,4,3,2
14.10.2014	14:07	JCR303 042	S 037	23,22,21,18,17,16,14,10,8,6,4,3,2,1
15.10.2014	05:03	JCR303 044	S 038	22,20,19,18,16,15,14,13,11,8,7,6,4,3,2
15.10.2014	14:04	JCR303 045	S 039	22,21,20,18,17,15,14,10,8,6,5,3,2,1

16.10.2014	05:05	JCR303 047	S 040	22,20,19,18,16,15,14,13,11,8,7,6,4,3,2
16.10.2014	14:03	JCR303 048	S 041	23,22,21,20,18,17,15,14,12,8,6,5,3,2,1
17.10.2014	05:05	JCR303 050	S 042	22,20,19,18,16,15,13,12,11,8,7,6,4,3,2
17.10.2014	14:04	JCR303 051	S 043	23,21,20,18,17,15,13,11,8,6,5,3,2,1,
18.10.2014	05:05	JCR303 053	S 044	22,20,19,17,16,15,14,13,8,7,6,5,3,2
18.10.2014	14:04	JCR303 054	S 045	20,19,18,16,15,14,13,12,8,6,5,4,3,2,1
20.10.2014	05:02	JCR303 055	S 047	22,20,18,16,15,14,13,9,7,6,5,3,1
20.10.2014	14:04	JCR303 056	S 048	23,22,20,18,17,16,14,11,9,6,5,3,2,1
21.10.2014	05:01	JCR303 058	S 049	22,20,19,16,15,14,12,8,7,6,4,3,2
21.10.2014	14:02	JCR303 059	S 050	23,22,21,20,18,17,16,15,9,8,5,3,2,1
22.10.2014	05:04	JCR303 061	S 051	22,20,19,18,15,14,13,8,7,4,3,2
22.10.2014	14:04	JCR303 062	S 052	23,22,21,20,18,16,15,14,11,8,6,4,3,2,1
23.10.2014	06:04	JCR303 064	S 053	22,20,19,18,16,15,14,13,8,7,5,4,3,2
23.10.2014	15:01	JCR303 065	S 054	23,22,21,20,18,16,15,13,10,7,6,4,3,2,1
24.10.2014	06:04	JCR303 067	S 055	22,20,19,18,16,15,14,13,12,8,7,5,4,3,2
24.10.2014	15:02	JCR303 068	S 056	23,22,21,20,19,16,15,12,9,8,6,4,3,2,1
25.10.2014	06:06	JCR303 070	S 057	24,20,18,15,14,13,10,7,6,5,4,3,2
25.10.2014	15:06	JCR303 071	S 058	23,22,21,20,19,17,11,8,7,4,3,2,1
26.10.2014	06:08	JCR303 072	S 059	24,21,20,19,18,15,14,11,9,8,6,5,4,3,2
26.10.2014	15:06	JCR303 073	S 060	23,21,20,19,17,16,13,10,9,8,6,5,4,3,2,1
27.10.2014	06:05	JCR303 075	S 061	22,20,19,18,17,15,14,12,9,8,7,5,4,3,2
27.10.2014	15:30	JCR303 076	S 062	22,21,20,18,17,13,10,9,8,7,6,5,4,3,2,1
28.10.2014	06:26	JCR303 077	S 063	22,20,19,18,17,15,14,13,12,8,7,5,4,3,2
28.10.2014	15:03	JCR303 078	S 064	23,22,21,20,19,17,16,13,10,9,7,4,3,2,1
29.10.2014	06:08	JCR303 079	S 065	22,20,19,18,17,15,14,12,9,7,5,4,3,2
29.10.2014	15:05	JCR303 080	S 066	23,22,21,20,19,17,16,13,10,9,8,7,4,3,2,1
30.10.2014	06:01	JCR303 082	S 067	24,21,20,19,17,16,14,11,10,9,7,6,5,4,3,2
31.10.2014	15:30	JCR303 083	S 068	22,21,19,18,15,13,12,11,10,8,7,5,4,3,2,1
01.11.2014	07:08	JCR303 084	S 069	23,22,20,19,18,17,16,15,13,10,8,7,6,4,3,2,1

01.11.2014	16:05	JCR303 085	S 070	22,20,19,18,17,16,13,12,11,10,9,8,7,5,4,3,2,1

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Carbonate System: Total Alkalinity (A_T) and pH

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Rationale and Method

Dissolved CO_2 reacts with water to form carbonic acid (H_2CO_3). H_2CO_3 dissociates to bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) with the concomitant release of H^+, causing a reduction in pH. Total alkalinity (A_T) of seawater describes the sum of all ionic charges in seawater, including HCO_3^-, CO_3^{2-}, H^+, inorganic and organic ions. Samples for the determination of A_T and pH_T (measured on the total scale) were collected in order to constrain the carbonate system along the cruise track. These samples are complemented by underway surface measurements of CO_2 partial pressure (pCO_2) measured with the PML, *Live-pCO_2* system. These measurements will contribute to our understanding of the distribution of C sources and sinks in the Atlantic Ocean and the capacity of the ocean to take up anthropogenic CO_2.

Table 1 lists cast numbers and Niskin bottle numbers for all samples collected. A_T samples were collected in 250 mL borosilicate glass bottles with glass stoppers (Schott, Duran) and preserved with $HgCl_2$ until analysis at PML (100 µL of saturated $HgCl_2$ added). The glass stoppers were greased with Apiezon-M grease.

The pH_T method employed here has typical precision in the low 10^{-3} to 10^{-4} pH-unit range. Samples were collected in 500 mL amber glass bottles and placed in a water bath at 25 ^oC. pH_T was determined spectrophotometrically using the m-cresol-purple dye (Dickson et al., 2007). The dye has two absorbance maxima at 434 nm and 578 nm, the ratio of which is pH-, T- and salinity-dependent. Absorbance measurements of the seawater blank, and following addition of dye (100 µL of a 2 mmol L^{-1} solution), were carried out on a Perkin Elmer, lamda 35 spectrophotometer, using 10 cm cells. The temperature of the sample was recorded in the spectrophotometer cell with a NIST-traceable thermometer. pH_T measurements were corrected for the pH_T change due to the addition of dye according to Dickson et al. (2007). Figure 1 shows preliminary data for pH_T along-track for AMT 24 (JR303) (stations 1-70). Final quality controlled A_T and pH_T data will be submitted to BODC within 12 months.

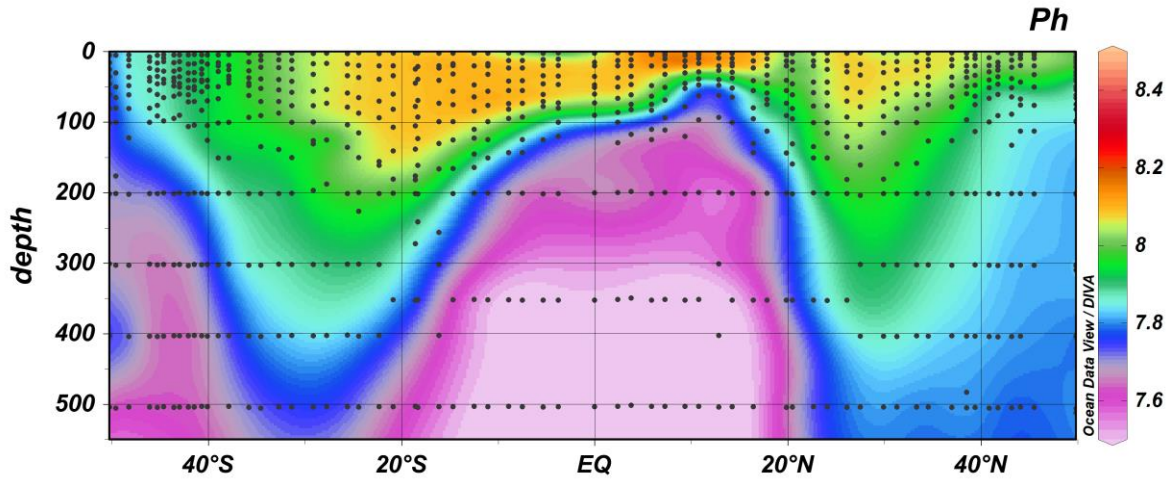

Figure 1: Preliminary pH_T data along-track for AMT 24 (JR303). Dots show samples location.

Table 1: Samples collected from CTD hydrocast.

CTD	DATE	LAT	LONG	NISKINS	DEPTH
1	25/09/2014	49.829	4.7564	1 4 7 10 14 19 22 23	70 60 50 40 30 20 10 2
2	26/09/2014	49.829	7.937167	1 3 4 5 6 8 9 11 16 19 21 23	400 300 200 100 75 50 39 29 22 13 7 2
3	27/09/2014	49.829	8.8255	1 3 6 7 9 10 13 15 18 19 21 23	500 300 98 65 50 38 30 28 20 16 9 2
4	27/09/2014	49.829	8.504883	0 2 3 4 5 6 8 11 15 18 21 23	499 400 300 200 98 65 50 44 28 20 9 1
5	28/09/2014	49.829	10.98317	1 2 3 4 5 6 8 11 15 18 21 23	500 400 300 200 98 65 50 44 28 20 9 1
7	29/09/2014	44.093	14.92077	3 4 5 6 8 9 10 14 16 19 20 24	500 400 300 200 82 55 42 35 23 13 7 1
8	29/09/2014	43.170	16.42683	1 3 4 5 7 11 15 18 21 22 23	500 300 200 112 75 49 32 20 10 5 2
9	30/09/2014	41.772	18.75718	2 3 4 5 7 8 12 14 17 19 20 24	500 400 300 200 112 75 67 43 20 10 5 2
10	30/09/2014	40.842	20.21483	1 3 4 5 6 8 9 11 16 19 21 23	400 300 200 100 75 50 39 29 22 13 7 2
11	01/10/2014	39.399	22.4553	1 3 4 5 6 8 9 11 16 19 21 23	400 300 200 100 75 50 39 29 22 13 7 2
12	01/10/2014	38.496	23.89175	1 3 4 5 6 8 9 11 16 19 21 23	400 300 200 100 75 50 39 29 22 13 7 2
13	02/10/2014	36.963	25.91077	2 3 4 5 7 8 12 14 16 18 20 21	500 400 300 200 113 75 63 48 33 20 10 2
14	03/10/2014	34.556	26.60888	1 2 3 4 6 10 14 15 16 19 21 23	500 480 400 200 96 60 49 37 28 20 9 2
15	03/10/2014	33.354	27.096	1 2 3 4 6 10 14 15 16 20 21 23	500 400 300 200 125 78 64 48 36 20 11 2
16	04/10/2014	31.295	27.70427	2 3 4 5 7 12 14 15 16 17 20 24	500 400 300 200 125 75 60 48 36 20 11 2
17	04/10/2014	29.899	28.16515	1 2 3 4 6 10 13 15 16 17 21 23	500 400 300 200 158 100 80 61 45 26 14 2
18	05/10/2014	27.512	28.86398	2 3 4 5 7 12 13 14 16 17 20 24	500 400 300 200 158 100 80 60 45 26 14 2

19	05/10/2014	26.109	29.30567	1 2 3 4 6 10 13 15 16 17 21 23	500 400 300 200 180 115 92 70 52 29 16 2
20	06/10/2014	24.060	29.8828	2 3 4 6 7 11 13 14 16 17 20 24	500 400 300 203 160 135 103 78 58 33 18 2
21	06/10/2014	22.659	29.86642	1 2 3 5 6 9 13 14 16 17 20 24	500 350 200 180 135 120 92 70 52 29 20 2
22	07/10/2014	20.453	29.24782	2 3 4 6 7 11 13 15 16 17 20 24	500 350 200 150 115 100 77 58 43 25 13 2
24	07/10/2014	19.855	29.1406	1 2 3 5 6 9 13 15 16 20 21 23	500 350 200 150 135 100 77 58 43 20 13 2
25	08/10/2014	17.832	28.68115	2 3 4 6 7 12 13 14 16 17 20 24	500 350 200 158 130 95 80 61 45 26 14 2
26	08/10/2014	16.436	28.40481	1 2 3 5 10 13 15 16 20 21 22 23	500 350 200 143 90 73 55 41 20 13 5 2
27	09/10/2014	14.220	27.9077	2 3 4 5 8 12 13 15 16 18 20 24	500 350 200 113 75 67 58 44 33 20 10 2
28	09/10/2014	12.844	27.6471	1 2 3 5 6 7 10 15 16 17 21 24	500 350 200 143 130 95 79 55 41 23 13 2
29	10/10/2014	10.760	27.1955	2 3 4 6 8 10 14 15 18 19 20 23	500 350 200 100 65 52 38 30 16 20 9 2
30	10/10/2014	9.368	26.92083	1 2 3 4 6 7 8 11 16 18 21 23	500 400 300 200 93 62 48 40 27 20 9 2
31	11/10/2014	7.279	26.51277	2 3 4 5 8 13 14 15 19 20 21 24	500 350 200 98 65 50 38 28 16 9 5 2
32	11/10/2014	5.899	26.20462	1 2 3 4 6 7 10 15 19 20 22 23	500 350 200 120 98 52 45 30 20 13 5 2
33	12/10/2014	3.781	25.77475	2 3 4 6 7 10 14 16 18 20 21 23	500 350 200 111 94 70 50 32 20 10 5 2
34	12/10/2014	2.376	25.48623	1 2 3 5 6 7 9 14 15 20 22 23	500 350 200 124 110 83 75 63 48 20 5 2
35	13/10/2014	0.000	25	2 3 4 6 8 11 14 15 16 19 20 24	500 350 200 120 82 74 61 47 35 20 11 2
36	14/10/2014	3.753	24.99648	1 2 3 5 6 8 10 15 17 18 21 23	500 350 200 129 100 86 66 50 37 20 12 2
37	14/10/2014	5.322	25.02622	2 3 4 6 7 8 11 12 14 17 18 24	500 350 200 90 70 60 50 46 35 20 15 2
38	15/10/2014	7.478	25.01358	2 3 4 6 7 8 11 14 15 16 19 24	500 350 200 120 100 80 72 47 35 20 11 2
39	15/10/2014	8.911	25.04267	1 2 3 4 8 10 14 16 17 18 21 23	500 350 200 125 78 70 60 45 34 20 11 2
40	16/10/2014	11.048	25.0223	2 3 4 6 7 11 13 14 15 16 19 22	500 350 200 143 125 92 73 55 41 23 13 2
41	16/10/2014	12.495	25.06532	1 2 3 5 8 10 14 15 17 18 21 23	500 350 200 143 95 82 73 55 41 23 13 2
42	17/10/2014	14.671	25.05118	2 3 4 7 11 13 14 15 16 18 19 22	500 350 200 150 125 99 76 56 32 20 17 2
43	17/10/2014	16.132	25.09483	1 2 3 5 6 8 12 14 15 17 20 23	500 350 200 164 145 122 110 84 64 47 20 2
44	18/10/2014	18.315	25.06468	2 3 4 7 11 12 13 15 16 18 19 22	500 350 200 165 125 99 75 56 32 20 17 2
45	18/10/2014	18.556	25.07115	1 2 3 5 8 11 13 15 17 18 20 23	500 400 300 255 165 130 99 73 41 23 20 2
47	20/10/2014	20.856	25.06633	2 3 5 6 8 13 14 15 16 17 24	500 350 240 200 160 122 93 69 39 21 2
48	20/10/2014	22.316	25.0602	1 3 4 5 6 8 9 11 16 19 21 23	400 300 200 100 75 50 39 29 22 13 7 2
49	21/10/2014	24.433	25.03717	1 2 3 5 6 7 12 13 14 15 16 20	500 350 270 200 180 175 138 104 77 44 24 2
50	21/10/2014	25.595	25.0358	1 3 4 5 6 8 9 11 16 19 21 23	400 300 200 100 75 50 39 29 22 13 7 2
51	22/10/140500	27.747	25.03055	1 2 3 4 8 9 10 13 16 17 20 22	500 400 300 200 90 75 60 46 35 26 15 2
52	22/10/2014	29.154	25.27562	1 2 3 6 9 10 11 16 17 18 20 23	500 400 300 200 160 155 122 93 69 20 5 2
53	23/10/2014	31.365	26.09642	2 3 4 6 7 8 12 14 15 16 17 22	500 400 300 225 200 150 115 87 65 37 20 2

54	23/10/2014	32.717	26.63187	1 2 3 5 9 15 16 17 18 21 23	500 400 300 200 135 103 78 58 33 18 2
55	24/10/2014	34.573	27.21877	1 3 4 5 6 8 9 11 16 19 21 23	400 300 200 100 75 50 39 29 22 13 7 2
56	24/10/2014	35.796	27.87497	1 2 3 6 8 11 14 15 16 18 21 23	500 400 300 195 130 125 99 76 56 32 17 2
57	25/10/2014	37.893	28.77883	2 3 4 5 7 8 13 14 15 16 19 22	500 400 300 200 150 100 77 58 43 25 13 2
58	25/10/2014	38.961	29.17417	1 2 3 4 6 10 13 15 16 18 21 23	500 400 300 200 138 87 71 54 40 23 12 2
59	26/101/14	40.119	30.94208	2 3 4 5 7 8 12 14 15 16 19 20	500 400 300 200 135 90 70 52 39 22 12 2
60	26/10/2014	40.685	32.10328	1 2 3 4 6 7 9 12 15 16 20 23	500 400 300 200 93 62 48 44 36 27 15 2
61	27/101/14	41.471	33.88257	2 3 4 5 6 7 10 13 14 15 18 20	500 400 300 200 150 100 45 40 35 26 20 5
62	27/10/2014	42.081	35.10188	2 3 4 5 7 8 11 17 19 20 22	500 400 300 200 100 66 50 28 20 16 5
62	27/10/2014	43.587	38.38917	1 2 3 4 8 9 10 13 16 17 20 22	500 400 300 200 83 56 43 40 32 24 14 5
63	28/10/2014	43.003	37.14133	2 3 4 5 6 8 9 14 15 19 21	500 400 300 200 125 105 70 50 41 17 5
65	29/10/2014	44.626	40.72605	2 3 4 5 7 8 9 12 14 15 18 20	500 400 300 200 105 70 54 50 41 30 17 5
66	29/10/2014	45.287	42.19837	1 2 3 4 7 8 9 10 13 17 20 22	500 400 300 200 105 70 60 50 40 30 17 5
67	30/10/2014	46.072	44.20942	2 3 4 5 6 8 9 14 15 19 21	500 400 300 200 125 105 70 50 41 17 5
68	31/101/14	48.245	50.34083	1 2 3 4 7 9 10 13 16 17 20 22	500 400 300 200 95 63 48 42 37 27 16 5
69	01/11/2014	49.580	53.07065	2 3 4 5 7 8 12 14 15 18 19 20	500 400 300 200 98 65 45 40 28 15 10 2
70	01/11/2014	50.2593	54.52943	1 2 3 4 7 9 11 12 13 17 19 21	500 400 300 200 100 80 60 45 35 25 15 2

Reference

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Nitrous Oxide & Methane

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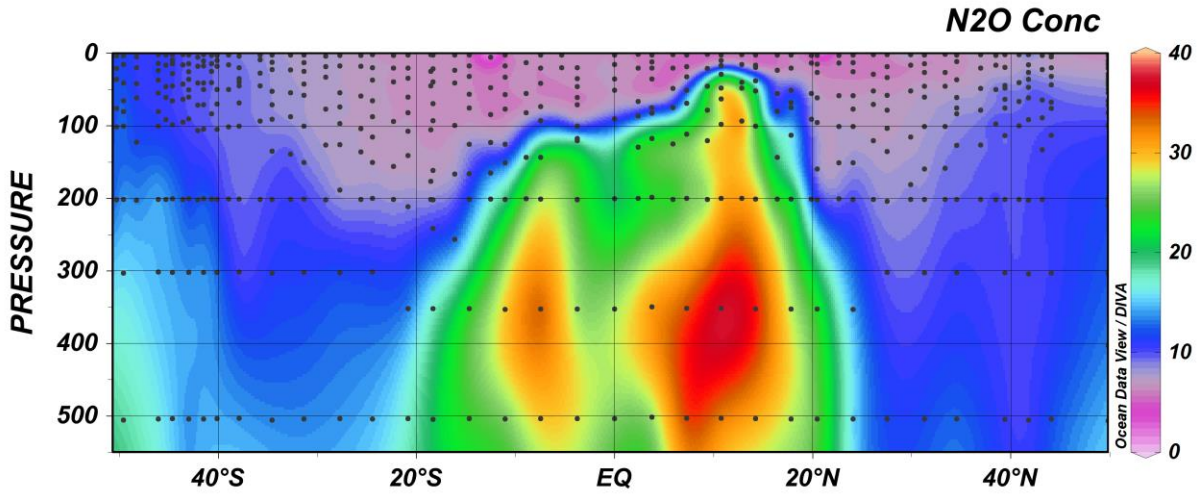
Nitrous oxide and methane are biogenically produced trace gases whose atmospheric concentrations are increasing at a rate in the order of 0.7 ppbv y-1. Both gases are radiatively active, contributing approximately 6% and 15% of “greenhouse effect” respectively, whilst N2O contributes to stratospheric ozone depletion and CH4 limits tropospheric oxidation capacity.

The oceans are generally considered to be close to equilibrium relative to the atmosphere for both gases, however oceanic source/sink distributions are largely influenced by oxygen and nutrient status and regulatory processes are complicated and are currently not well understood. Ocean areas overlying sub-oxic waters and upwelling areas dominate the ocean source and saturations of up to 300% have been reported.

Aim:- To perform vertical profiles of N2O and CH4 concentration in order to assess variability in the source-sink strength and exchange with the atmosphere along the AMT transect

Methods

Samples were collected from CTD bottles at stations identified below. 1 litre samples were equilibrated with compressed air and headspace analysis performed onboard using FID-gas chromatography and ECD-gas chromatography1 for CH4 and N2O respectively. Atmospheric concentrations were determined by the same methods using samples collected from the ship’s bow into a sealed Tedlar bag.



N_2O concentration (nmol L^{-1}) during AMT24, September-November 2013

[1] *Upstill-Goddard R.C., A.P. Rees & N.J.P. Owens (1996) Simultaneous high-precision measurements of methane and nitrous oxide in water and seawater by single phase equilibration gas chromatography Deep-Sea Research I. Vol. 43, No. 10, PP. 1669-1682*

N_2O, CH_4 Sampling Date and position – AMT24

CTD	DATE	LATITUDE	LONGITUDE	NISKINS	DEPTH
1	25/09/2014	49.829	4.756	1 10 19 22 23	70 40 20 10 2
2	26/09/2014	49.829	7.937	1 3 4 5 8 9 11 19 22 23	400 300 200 100 50 39 29 13 5 2
3	27/09/2014	49.829	8.826	4 6 13 18 21 23	200 98 30 20 9 2
4	27/09/2014	49.829	8.505	4 5 6 11 19 23	200 98 60 44 46 1
5	28/09/2014	49.829	10.983	3 5 6 8 9 10 14 18 19 24	500 300 200 82 55 42 35 20 13 1
7	29/09/2014	44.093	14.921	2 4 7 8 12 14 15 17 20 22	500 300 112 75 67 43 32 20 10 2
8	29/09/2014	43.170	16.427	4 5 7 11 17 23	200 132 88 64 22 2
9	30/09/2014	41.772	18.757	2 4 5 7 8 9 13 16 19 23	500 300 200 90 60 46 35 26 15 2
10	30/09/2014	40.842	20.215	4 5 7 11 20 23	200 99 66 40 16 2
11	01/10/2014	39.399	22.455	2 4 5 7 8 12 14 15 19 24	500 300 200 113 75 63 48 44 19 2
12	01/10/2014	38.496	23.892	4 6 14 20 23	200 96 49 16 2
13	02/10/2014	36.963	25.911	4 6 10 15 20 23	200 125 78 48 20 2
14	03/10/2014	34.556	26.609	2 4 5 7 8 12 14 16 20 24	500 300 200 125 83 75 60 36 20 2
15	03/10/2014	33.354	27.096	4 6 10 16 17 23	200 158 100 45 26 2
16	04/10/2014	31.295	27.704	2 4 5 7 12 14 16 17 20 24	500 300 200 158 100 60 45 26 14 2
17	04/10/2014	29.899	28.165	4 6 10 16 21 23	200 180 115 52 16 2
18	05/10/2014	27.512	28.864	2 4 6 11 13 14 16 17 20 24	500 300 203 135 103 78 58 33 18 2
19	05/10/2014	26.109	29.306	3 9 14 16 17 23	200 120 70 52 29 2
20	06/10/2014	24.060	29.883	2 3 4 6 11 13 15 17 20 24	500 350 200 150 100 77 58 25 13 2
21	06/10/2014	22.659	29.866	3 5 9 15 21 23	200 150 100 58 13 2
22	07/10/2014	20.453	29.248	2 3 4 6 12 14 17 20 23	500 350 200 158 95 61 26 14 2
24	07/10/2014	19.855	29.141	3 10 15 21 23	200 90 55 13 2
25	08/10/2014	17.832	28.681	2 3 4 7 8 12 14 19 23	500 350 200 113 75 67 50 20 2
26	08/10/2014	16.436	28.405	3 5 10 15 17 23	200 143 79 55 23 2
27	09/10/2014	14.220	27.908	2 3 4 5 10 14 16 18 23	500 350 200 100 52 38 28 16 2
28	09/10/2014	12.844	27.647	4 6 8 11 19 23	200 93 48 40 15 2
29	10/10/2014	10.760	27.196	2 3 4 7 8 9 15 19 20 23	500 350 200 98 65 50 28 16 9 2
30	10/10/2014	9.368	26.921	3 4 6 10 17 23	200 120 78 52 45 2

31	11/10/2014	7.279	26.513	2 3 4 6 10 14 16 19 23	500 350 200 111 70 50 32 18 2
32	11/10/2014	5.899	26.205	3 5 9 15 18 23	200 124 75 48 20 2
33	12/10/2014	3.781	25.775	2 3 4 6 8 11 16 18 20 24	500 350 200 120 82 74 35 20 11 2
34	12/10/2014	2.376	25.486	3 5 8 10 18 24	200 129 86 66 20 2
35	13/10/2014	0.000	25.000	2 3 4 6 11 14 18 24	500 350 200 90 50 35 15 2
36	14/10/2014	3.753	24.996	2 3 4 6 7 13 15 18	500 350 200 120 72 61 35 20
37	14/10/2014	5.322	25.026	3 6 10 16 20 23	200 117 70 45 20 2
38	15/10/2014	7.478	25.014	2 3 4 6 11 13 15 17 24	500 350 200 143 94 73 41 20 2
39	15/10/2014	8.911	25.043	3 5 10 15 21	200 143 82 55 13
40	16/10/2014	11.048	25.022	2 3 4 7 11 14 15 16 19 22	500 350 200 150 125 76 56 32 17 2
41	16/10/2014	12.495	25.065	3 5 8 15 18 23	200 164 122 64 27 2
42	17/10/2014	14.671	25.051	2 3 4 7 11 13 15 16 19 24	500 350 200 165 125 75 56 32 17 2
43	17/10/2014	16.132	25.095	5 8 13 17 18 22	255 165 99 41 23 2
44	18/10/2014	18.315	25.065	2 3 5 6 8 14 15 16 17 24	500 350 240 200 160 93 69 39 21 2
45	18/10/2014	18.556	25.071	5 7 13 15 16 20	200 175 104 44 24 2
47	20/10/2014	20.856	25.066	1 3 5 9 13 14 15 16 18 22	500 350 210 140 107 81 60 34 20 2
48	20/10/2014	22.316	25.060	6 11 16 18 21 23 2 4 7	200 155 93 39 20 2 500 300 200
49	21/10/2014	24.433	25.037	2 4 7 8 12 14 15 16 19 22	500 300 200 150 115 87 65 37 20 2
50	21/10/2014	25.595	25.036	5 9 15 17 21 23 2 4	200 135 103 58 18 2 500 300
51	22/10/2014	27.747	25.031	2 4 6 8 13 14 15 19 22	500 300 188 125 96 73 54 17 2
52	22/10/2014	29.154	25.276	4 11 15 18 21 23 2 4 5	200 125 76 32 17 2 500 300 200
53	23/10/2014	31.365	26.096	2 4 5 7 8 14 15 16 19 22	500 300 200 150 100 58 43 25 13 2
54	23/10/2014	32.717	26.632	4 6 10 14 18 23 2 4 5	200 138 87 54 23 2 500 300 200
55	24/10/2014	34.573	27.219	2 4 5 7 8 12 14 16 19 22	500 300 200 135 90 70 52 22 12 2
56	24/10/2014	35.796	27.875	4 6 12 16 21 23 2 4 5	200 93 44 27 9 2 500 300 200
57	25/10/2014	37.893	28.779	2 4 5 7 8 10 13 14 18 23	500 300 200 100 68 45 40 35 20 2
58	25/10/2014	38.961	29.174	4 7 11 20 23 2 4 5 8	200 100 50 16 2 500 300 200 105
59	26/101/14	40.119	30.942	2 4 5 8 9 14 19 20 24	500 300 200 105 70 50 17 10 2
60	26/10/2014	40.685	32.103	4 8 13 17 20 23 2 4 5	200 83 40 24 14 2 500 300 200
61	27/101/14	41.471	33.883	2 4 5 7 8 12 14 18 19 22	500 300 200 105 70 50 30 17 10 2
62	27/10/2014	42.081	35.102	4 7 8 13 20 23	200 105 70 40 17 2
62	27/10/2014	43.587	38.389	4 7 9 13 20 23	200 94 63 42 16 2

63	28/10/2014	43.003	37.141	2 4 5 7 8 12 14 15 18 22	500 300 200 90 60 50 35 26 15 2
65	29/10/2014	44.626	40.726	2 4 5 7 8 12 15 18 19 22	500 300 200 98 65 45 28 15 10 2
66	29/10/2014	45.287	42.198	4 8 10 13 20 23	200 90 60 46 15 2
67	30/10/2014	46.072	44.209	2 4 5 7 9 10 14 17 19 24	500 300 200 100 80 55 37 24 14 2
68	31/101/14	48.245	50.341	4 7 12 15 20 22	200 120 61 41 20 5
69	01/11/2014	49.580	53.071	1 3 4 8 10 14 16 19 23	500 300 200 100 80 65 40 15 2
70	01/11/2014	50.259	54.529	4 7 10 13 18 22	200 100 75 35 20 5

Surfactants

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Introduction

The overall aim of the Atlantic Meridional Transect (AMT) programme is to quantify key biogeochemical and ecosystem processes and their inherent variability over extended time and spatial scales in the Atlantic Ocean. One key objective of the AMT is to quantify the effects of this variability on air-sea exchange of climate active gases. This objective directly aligns with the aim of NERC's RAGNARoCC programme where Newcastle University is measuring the rate of gas exchange of the North Atlantic Ocean as a function of across the sea-surface micro-layer (SML). The SML covers more than 70% of the Earth's surface (Cunliffe et al., 2013) and is the boundary across which all gas exchange between the ocean and the atmosphere occurs (Liss and Duce, 2005). It is geochemically distinct from underlying water (Cunliffe et al., 2013) and importantly contains organic matter (OM) that is both soluble and insoluble; these components are surfactants that lower the water surface tension and they are ubiquitous in the marine environment (Frew et al., 1990; Goldman et al., 1988). This lowering of surface tension can dramatically decrease the exchange rates of gases like CO_2 and has been demonstrated in the laboratory with artificial surfactants (Bock et al., 1999; Goldman et al., 1988) and through purposeful surfactant releases in coastal waters (Brockmann et al., 1982) and in the open ocean (Salter et al., 2011). However, the role of natural surfactants in gas exchange of climate active gases in the Atlantic Ocean is unknown.

Methods

Gas Exchange

On AMT24 the rate of gas exchange is measured on water samples collected from the underway water at each daytime CTD location. This is coupled to measurements of total surfactant activity normalised to a standard (Triton X-100; See below). Measurements of gas transfer velocities in natural seawater samples are measured using an automated gas exchange tank as fully described by Schneider-Zapp et al. (2014). Briefly, about 90 L of seawater are transferred into a 180 L gas exchange tank. A 1 L aliquot of sample is charged with sulphur hexafluoride (SF_6) and methane (CH_4) tracer gases, added to the tank and sealed to create a fully closed system that is coupled to two gas chromatographs to continuously measure the concentrations of SF_6 and CH_4 in the air phase and water phase (via an integrated equilibrator) over time. During a sample run a baffle is used to precisely perturb the water at two different speeds for approximately one hour each. The use of the two gases and two turbulence settings allows the transfer velocity (k_w) for each gas and turbulence setting to be determined. All values are post-processes and scaled using a constant Schmidt number to allow for direct comparison. As a control, sea water samples are compared to calculated transfer velocities of surfactant-free "MilliQ" water that are run prior to each sea water sample. This also allows for the ship's movement during a sample run to be considered.

Surfactant Activity (SA) and Coloured Dissolved Organic Matter (CDOM)

Sampling

SML samples from the upper 400 µm were collected using in-house constructed Garrett Screen (GS) (60 cm^2). The GS is pre-rinsed 10 times in sea water prior to sampling and then allowed to drain for 5 seconds before collecting the sample.

The thickness of the SML may vary depending on both the oceanographic and meteorological conditions at the time the samples are taken. So, the thickness of the SML was measured in two ways at every sample station. The first approach is to dip the GS five times in one place with water samples

collected each time and the total volume of the samples was recorded. The second approach is to dip the GS five times in five different places around the ship and record the total volume. In order to minimise the disturbance to SML from the ship's discharge at the sample stations, the ship went to full attention (i.e. no discharge to the sea).

The vertical profile of water samples were collected during pre-dawn and midday hydrocasts from a 24 x 20 L water-bottle rosette fitted with a CTD probe (Sea-Bird Electronics, SBE09). The samples were taken from the following depths below sea level: 500 m, Chl maximum, O_2 maximum, 14% and 55% light penetration and 2 m. In addition, the underway water supply was sampled at each CTD location (~6 meter depth).

To investigate the long-term storage protocol for SA measurements, batches of the samples were frozen and kept at -80˚C and -20˚C for later analysis. Another batch of the samples was frozen using liquid nitrogen. The samples will be analysed upon returning to Newcastle and assist in developing a standard operating procedure for storing samples for surfactant activity measurements.

Samples for CDOM analyses were filtered through 0.22µm surfactant-free, single use syringe filters (MILLEX GP, Millipore). In order to avoid contamination during the filtration process, the syringes and containers were pre-rinsed with MilliQ water (18.2 Ohm) and a small aliquot of sample prior to usage.

SA measurement

SA measurements were carried out by 797 VA Computerace Voltammetry (Metrohm) with a hanging mercury drop electrode as described be Schneider-Zapp et al., (2013). Briefly, SA measurements of samples are calibrated using a 10-point linear regression of electrode potential response against increasing Triton-X-100 concentration in a 0.55 mol l^{-1} NaCl solution. The SA of the samples was measured from the reduction of the capacity current over a range of potentials after 15 and 60s accumulation of surfactants on the hanging mercury drop. An example of data collected from CTD_024 is shown in Figure 2 It has been noticed from the capacity current during the last cruise (JCR302) that the ship movement is a potential problem for analyses. In order to minimize the vibration effect, the instrument was placed on a bespoke gimbal table.

CDOM determination

CDOM measurements were conducted by high-performance spectrophotometer (UltraPath). Absorbance spectra (250-730 nm) of filtered samples were measured using a 50 cm pathlength, providing greater sensitivity compared to conventional 10 cm pathlength spectrophotometer.

The single scan mode with an average number of 10 scans was applied to record the CDOM spectrum. In order to minimize the refractive index effect due to the salinity difference between seawater samples and MilliQ water an NaCl solution standard with the same salinity as the samples were used. The solutions were prepared using analytical grade NaCl dissolved in MilliQ water. To remove any organic contaminants, the salt was baked at 400˚C in advance. The absorbance of the salt solution was measured at the same time as the samples. The integration time was set to maximize the signal measured for the applied pathlength while avoiding oversaturation of the detector. Between the sample runs the UltraPath was flushed with MilliQ. water. The data require calibration in Newcastle and available in the New Year.

Initial Results

Gas Exchange

Sea water sample collected from the James Clark Ross underway water supply are shown in Table 1. All samples were run immediately after sampling and preliminarily interpreted. Whilst further work is required to fully evaluate the calculated gas transfer velocities of water from various geographical locations and compare these to the respective surfactant activities, an example gas transfer velocities of water from CTD_S024 is shown in Figure 1. In this particular example k_w ranges from 6-10 cm/h and 14-20 cm/h for the 0.6 and 0.75 Hz baffle conditions, respectively. Schmidt number scaling to K660 after Wanninkhof (1992) does not adequately compensate for the relative difference in gas solubility and/or reactivity. This may be due to difference in the mass balance of SF_6 and CH_4 throughout the experiment or that a more appropriate Schmidt number must be considered.

Table 1: Samples collected from underway water supply for gas exchange measurements

Date	CTD Number
25/09/2014	CTD_JR303_S001
26/09/2014	CTD_JR303_S003
27/09/2014	CTD_JR303_S004
28/09/2014	CTD_JR303_S006
29/09/2014	CTD_JR303_S008
30/09/2014	CTD_JR303_S010
01/10/2014	CTD_JR303_S012
02/10/2014	CTD_JR303_S013
03/10/2014	CTD_JR303_S015
04/10/2014	CTD_JR303_S017
05/10/2014	CTD_JR303_S019
06/10/2014	CTD_JR303_S021
07/10/2014	CTD_JR303_S024
08/10/2014	CTD_JR303_S026
09/10/2014	CTD_JR303_S028
10/10/2014	CTD_JR303_S030
11/10/2014	CTD_JR303_S032
12/10/2014	CTD_JR303_S034
14/10/2014	CTD_JR303_S037
15/10/2014	CTD_JR303_S039
16/10/2014	CTD_JR303_S041
17/10/2014	CTD_JR303_S043
18/10/2014	CTD_JR303_S045
20/10/2014	CTD_JR303_S048
21/10/2014	CTD_JR303_S050
22/10/2014	CTD_JR303_S052
23/10/2014	CTD_JR303_S054
25/10/2014	CTD_JR303_S058
26/10/2014	CTD_JR303_S060
27/10/2014	CTD_JR303_S062
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01/11/2014	CTD_JR303_S068

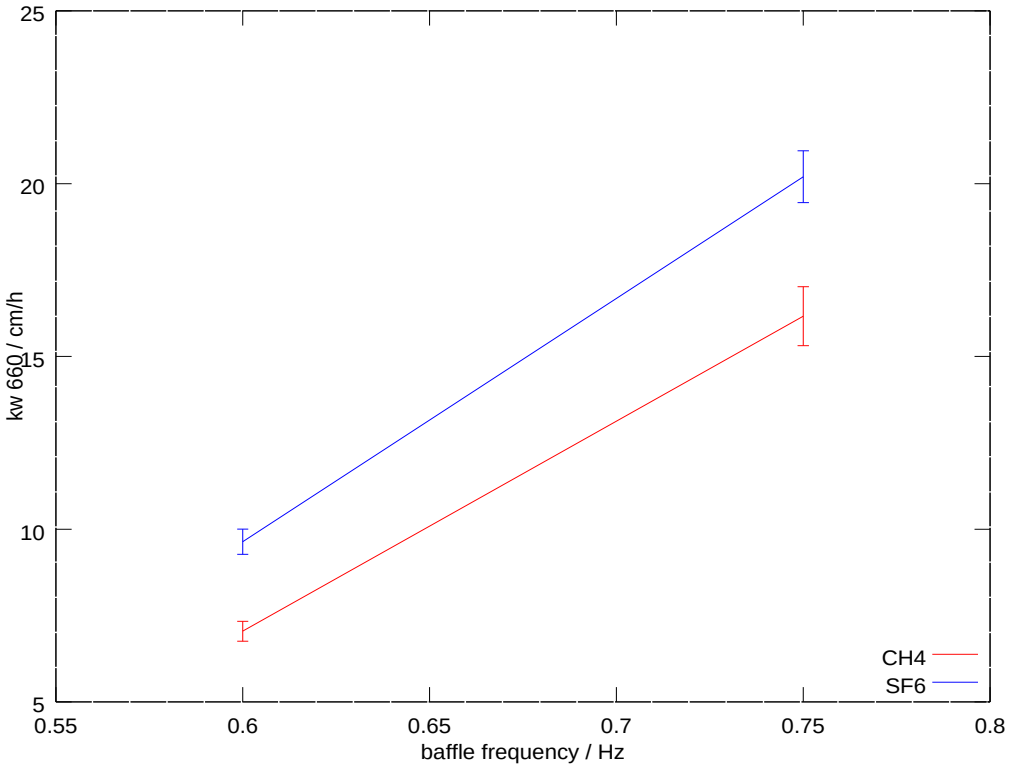

Figure 1: Gas transfer velocities (k_w) of CH4 and SF6 normalised to 660 Schmidt number for two baffle speeds (0.6 and 0.75 Hz) derived from water samples collected from the underway system at CTD_S024. Error bars (better than 5%) are calculated from GC standards run before and after a sample run.

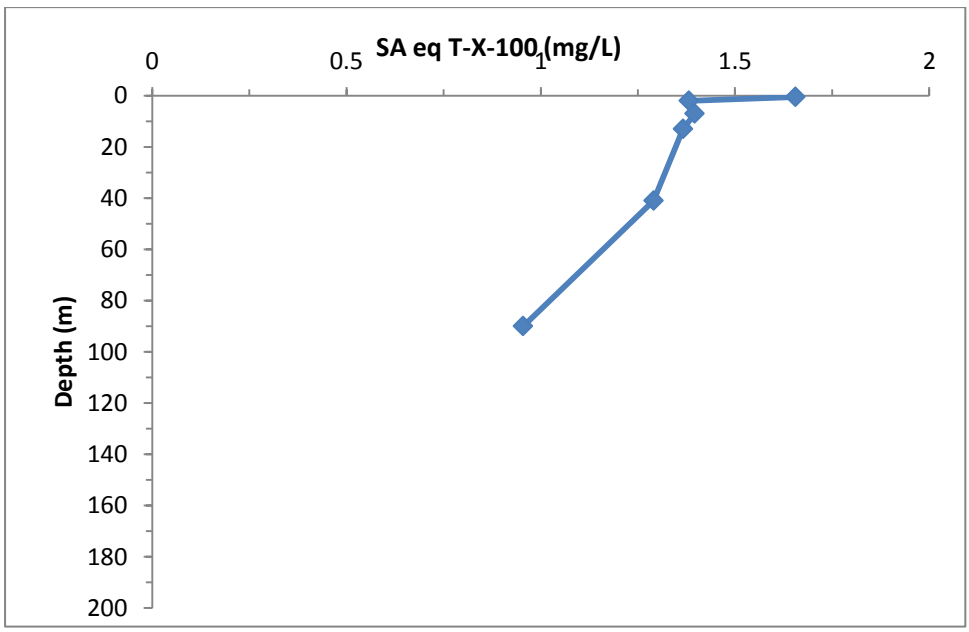

Figure 2: Surfactant Activity (SA) measurements at 60s deposition time at different depths for CTD024.

Further Work

All gas exchange, surfactant activity and CDOM data will be quality controlled and checked upon return to Newcastle. This dataset will contribute to the aims of the RAGNARoCC programme. It is anticipated that this novel dataset will be published in 2015 and will be the focus of a PhD thesis by Bita.

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Biology

Composition and dynamics of microbial plankton

Staff:

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Overarching aim: To examine morphology, composition and metabolic activities of dominant microbes within planktonic communities, inhabiting the euphotic zone of temperate, tropical and equatorial regions of the North and South Atlantic Ocean.

1. Community composition of microplankton protist communities (size range 20-200 µm) using tandem microplankton net hauls and FlowCAM flow cytometer (Cregeen, Kennaway, Zubkov)

Methods

Microplankton samples were collected using an in-situ size-fractioning microplankton net (Micronet) with a double net frame deployed at the noon station to 200 m depth (when weather conditions were favourable; windspeed less than Beafourt force 6). The size fractions were as follows: >180 um, 100-180 um and 20-100 um. Samples from the 100-180 um and 20-100 um fraction were collected in 500 ml acid washed bottles and imaged live using a FlowCAM.

The two fractions from each net were combined according to size and filtered onto GF/F glass fibre filters for elemental and stable isotope analysis at the National Oceanography Centre, Southampton. Analysis will be done within the next 12 months.

Table 1: Micronet deployments.

Date	Station (station no._micronet no.)	Latitude (+=N, -=S)	Longitude (W)
27/09/14	JR303-004_MPV-001	47.57216667	-8.504883333
28/09/14	JR303-006_MPV-002	45.501935	-12.485275
29/09/14	JR303-008_MPV-003	43.17023333	-16.42683333
30/09/14	JR303-010_MPV-004	40.84221667	-20.21483333

01/10/14	JR303-012_MPV-005	38.49598333	-23.89175
02/10/14	JR303-013_MPV-006	36.95048333	-25.91076667
03/10/14	JR303-015_MPV-007	33.35388333	-27.08458333
04/10/14	JR303-018_MPV-008	29.89866667	-28.16521667
05/10/14	JR303-020_MPV-009	26.30518333	-29.30518333
06/10/14	JR303-023_MPV-010	22.65881667	-29.86641667
07/10/14	JR303-025_MPV-011	19.8554	-29.1406
08/10/14	JR303-028_MPV-012	16.43606667	-28.40483333
09/10/14	JR303-030_MPV-013	12.84401667	-27.64711667
10/10/14	JR303-033_MPV-014	9.36835	-26.92098333
11/10/14	JR303-035_MPV-015	5.899133333	-26.20463333
12/10/14	JR303-038_MPV-016	2.375816667	-25.48623333
14/10/14	JR303-042_MPV-017	-5.322333333	-25.02625
15/10/14	JR303-045_MPV-018	-8.911183333	-25.04266667
16/10/14	JR303-048_MPV-019	-12.49476667	-25.0653
20/10/14	JR303-056_MPV-021	-22.31641667	-25.0602
21/10/14	JR303-059_MPV-022	-25.59473	-25.03573
22/10/14	JR303-062_MPV-023	-29.15394	-25.2756
23/10/14	JR303-065_MPV-024	-32.71655	-26.63186667
26/10/14	JR303-073_MPV-025	-40.68543333	-32.10326667
29/10/14	JR303-080_MPV-026	-45.28749	-42.19837

2. Morphology and composition of microbes dominant in the surface mixed layer (Kamennaya, Kennaway, Zubkov)

Microbial samples were collected at the depth of 20 m or DCM in the surface mixed layer. Microbes were fixed with paraformaldehyde at 2% final concentration and pre-concentrated using 0.2, 0.8 and 2.0 um nuclepore filters. Concentrated samples were analysed and flow sorted using a fast speed flow cytometer (MoFlo). Sorted cells were deposited in sterile 1.5 ml microcentrifuge tubes for microscopic analyses at the Natural History Museum and National Oceanography Centre. Analysis will be done within the next 15 months.

Table 2: CTD casts sampled for fast speed flow sorting of microbes.

CTD	Date	Bottles
18	05/10/2014	18
19	05/10/2014	8
24	07/10/2014	9
26	08/10/2014	9
28	09/10/2014	9
31	10/10/2014	12
34	12/10/2014	14
40	16/10/2014	12
42	17/10/2014	14
44	18/10/2014	12
47	20/10/2014	8
49	21/10/2014	13
51	22/10/2014	12
53	22/10/2014	12
59	26/10/2014	17
61	27/10/2014	16
63	28/10/2014	16
66	29/10/2014	18
67	30/10/2014	18

3. Metabolic activities of dominant microbial groups (Burd, Kamennaya, Machelett, Zubkov)

Aim:

Assess metabolic activities of dominant microbial groups within the planktonic communities and to evaluate the effect of light on microbial activity in the oligotrophic North Atlantic gyre and South Atlantic gyre.

3.1. To assess the effect of light on the uptake of dissolved organic and inorganic phosphorus by dominant microbes using adenosine tri-phosphate and phosphate radiotracers.

Ambient concentrations as well as uptake rates of the amino acids leucine and methionine, phosphate and ATP by total microbial plankton were measured using isotopic dilution time-series incubations. Their uptake rates were compared under light and dark conditions. Microbial inorganic phosphorus uptake was determined in the phosphate-depleted North Atlantic gyre (Table 3) to estimate ambient concentrations and turnover rates of the bioavailable fraction. The relative contributions of the dominant prokaryotic and eukaryotic groups to the ATP and phosphate cycle were determined using flow cytometric cell sorting. Flow cytometric sorting showed light stimulated uptake of phosphate by *Prochlorococcus* cells. Sample analyses will be completed within the next 12 months.

Table 3: CTD casts sampled for determining phosphate dynamics at the depth of 20 m or DCM.

CTD	Date	Bottles
7	29/09/2014	11,16
9	30/09/2014	17
11	01/10/2014	17
14	03/10/2014	18
17	04/10/2014	18
18	05/10/2014	18
20	06/10/2014	18
22	07/10/2014	18
25	08/10/2014	17
27	09/10/2014	17
31	11/10/2014	17

33 12/10/2014 18

3.2. Comparison of microbial uptake of leucine in the surface mixed and twilight layers.

Ambient concentrations as well as uptake rates of the amino acid leucine by total microbial plankton were measured and compared between different depths using isotopic dilution time-series incubations. Microbial uptake of leucine was determined in the oligotrophic South Atlantic gyre and productive eutrophic provinces of the South Atlantic Ocean (Table 4). Ambient concentrations and turnover rates have then been estimated.

Preliminary results

Initial scintillation counts were carried out on board the ship using Packard Tri-Carb 3100 counter. Bioassayed concentrations of leucine ranged between 0.006-0.138 nM for 20 m, 0.023-0.23 nM for depths between 50-155 m, and 0.008-0.05 nM for 300-400m. The estimated turnover of this amino acid ranged between 0.3-39, 0.125-18 and 4.8-53.9 hours, respectively. Further analyses will be completed within the next 12 months.

Table 4: CTD casts sampled for leucine uptake experiments.

CTD	Date	Time	Latitude [S]	Longitude [W]	Depth	Bottle
38	15/10/2014	05:46	7.47749	25.01359	20, 87	17, 12
40	16/10/2014	05:46	11.04767	25.0223	20, 120	17, 12
42	17/10/2014	05:48	14.67062	25.05149	20, 75, 350	17, 14, 3
44	18/10/2014	05:50	18.31644	25.06468	20, 140, 350	18, 12, 3
47	20/10/2014	05:46	20.85603	25.05164	20, 155, 350	17, 8, 3
49	21/10/2014	05:45	24.43312	25.03713	20, 90, 400	18, 13, 3
51	22/10/2014	05:49	27.74683	25.03055	20, 125, 300	18, 12, 4

52	22/10/2014	14:49	29.15393	25.27557	20	18
53	23/10/2014	06:44	31.3649	26.09642	20, 100, 400	17, 12, 3
54	23/10/2014	15:46	32.71656	26.63186	20	19
55	24/10/2014	06:44	35.0438	27.57977	20, 75, 400	17, 9, 3
56	24/10/2014	15:51	35.79698	27.87492	20	18
57	25/10/2014	06:50	37.89306	28.76781	20, 60, 400	17, 9, 3
58	25/10/2014	15:57	38.96127	29.16743	20	18
59	26/10/2014	07:00	40.37073	31.42994	20, 70, 300	17, 10, 4
60	26/10/2014	15:51	40.6863	32.1032	20	18
61	27/10/2014	06:47	41.46858	33.87643	20, 50, 400	16, 13, 3
62	27/10/2014	16:16	42.0805	35.10189	20	18
63	28/10/2014	07:02	43.00508	37.13768	20, 60, 400	16, 9, 3
64	28/10/2014	15:48	43.5872	38.38915	20	18

3.3. The effect of ambient iron concentration on microbial dynamics

Aims:

- Collection of trace metal clean seawater samples. Samples will undergo post-cruise analysis in order to determine seawater iron concentration.
- Enumeration and determination of microbial populations within the sample collected using flow cytometry.
- Assessing uptake rates of the amino acid leucine by the microbial community in each sample. An estimate of ambient concentrations of leucine will also be determined using this data.
- Examination of cellular iron adsorption in each sample collected.

Seawater sample collection:

In order to minimise iron contamination, seawater samples were collected using a Go Flo (OceanTest Equipment, Inc.), provided by the National Marine Facilities (NMF). The Go Flo and associated parts were acid cleaned in 10% hydrochloric acid prior to use. Deployment of the Go Flo was conducted on the fore deck to a depth of 20 m, in conjunction with the solar noon CTD cast. The times and locations of these deployments are shown in Table 5, below.

Table 5: Time and location of Go Flo deployments, all to a depth of 20 m. All deployments were assisted by John Wynar (NMF), whose help is gratefully acknowledged.

Go Flo ID	Date	Time Recovered (GMT)	Latitude	Longitude
001	28-Sept-2014	13:16	45.50	-12.49
002	29-Sept-2014	13:08	43.17	-16.43
003	30-Sept-2014	13:08	40.84	-20.22
004	01-Oct-2014	13:09	38.50	-23.89
005	02-Oct-2014	13:06	36.95	-25.91
006	03-Oct-2014	13:08	33.35	-27.08
007	04-Oct-2014	13:10	29.90	-28.17
008	05-Oct-2014	14:11	26.11	-29.31
009	06-Oct-2014	14:10	22.66	-29.87
010	07-Oct-2014	14:11	19.86	-29.14
011	08-Oct-2014	14:09	16.44	-28.40
012	09-Oct-2014	14:10	12.84	-27.65
013	10-Oct-2014	14:16	09.37	-26.92
014	11-Oct-2014	14:16	05.90	-26.20
015	12-Oct-2014	14:04	02.38	-25.49
016	14-Oct-2014	14:07	-05.32	-25.03
017	15-Oct-2014	14:13	-08.91	-25.04
018	16-Oct-2014	14:08	-12.49	-25.07
019	17-Oct-2014	14:07	-16.13	-25.08
020	20-Oct-2014	14:08	-22.32	-25.06
021	21-Oct-2014	14:08	-25.59	-25.04
022	22-Oct-2014	14:07	-29.15	-25.28
023	23-Oct-2014	15:05	-32.72	-26.63
024	24-Oct-2014	15:07	-35.80	-27.87
025	25-Oct-2014	15:11	-38.96	-29.17
026	26-Oct-2014	15:09	-40.69	-32.10

027	28-Oct-2014	15:05	-43.59	-38.39

Once the Go Flo was recovered, it was immediately taken to a clean area where seawater samples could be collected inside a laminar flow hood (also provided by NMF). An initial trace metal clean sample was filtered through a Sartobran 300 Sterile Capsule (Sartorius Stedim Biotech), collected in an acid cleaned LDPE bottle, and stored at –20ºC. Additional samples were collected in either glass or LDPE bottles for analysis of microbial population and activity, as described below.

Analysis of samples using flow cytometry.
Microbial samples were fixed using paraformaldehyde at 1% final concentration and stained for nucleic acids with SYBR Green I dye, within 60-90 mins of collection. Within 12 hrs, the samples were analysed using a FACSCalibur (Becton Dickinson), to assess size, DNA and photosynthetic pigment of individual microbial cells. Data was stored electronically and awaits analysis.

Microbial uptake of leucine.
Known concentrations of tritium labeled leucine were added to samples of the seawater within 4 hrs of collection. They were then incubated for set time periods before fixation with paraformaldehyde. Samples were filtered, onto a 0.2µm PC filter, which was counted using a liquid scintillation counter. Data analysis will be conducted post-cruise within the next 12 months, which will allow determination of leucine uptake rate, as well as an estimation of ambient leucine concentration[1].

Cellular adsorption of dissolved iron.
Titanium chloride buffer was prepared as described by Hudson and Morel (1989)[2]. Samples were spiked with 0.8-1.4 kBq of ^{55}FeCl and incubated in acid cleaned PFTE bottles for 3-24 hrs. At the selected time points, samples were filtered onto a 0.2 µm PC filter and washed with either seawater or titanium chloride buffer to determine adsorption of iron to cell surfaces. Filters were then counted in a liquid scintillation counter. This technique is based upon the method described in Zubkov et al, 2007[3]. Further analysis of data will be conducted after the cruise.

References:

1 Zubkov, M. V., Tarran, G. A., Mary, I. & Fuchs, B. M. Differential microbial uptake of dissoled amino acids and amino sugars in surface waters of the Atlantic Ocean. *Journal of Plankton Research* **30**, 211-220 (2008).
2 Hudson, R. J. M. & Morel, F. M. M. Distinguishing between extra- and intracellular iron in marine phytoplankton. *Limnology and Oceanography* **34**, 1113-1120 (1989).
3 Zubkov, M. V., Holland, R. J., Burkill, P. H., Croudace, I. W. & Warwick, P. E. Microbial abundance, activity and iron uptake in vicinity of the Crozet Isles in November 2004-January 2005. *Deep-Sea Research II* **54**, 2126-2137 (2007).

Culturing Synechococcus strains and picoeukaryotes

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Culturing *Synechococcus* strains and picoeukaryotes

The central aim of this project is to collect and isolate Synechococcus and picoeukaryotes which have not yet been successfully put into culture. In parallel, we would like to understand several factors that contribute to variability of populations in the environment by performing grazer experiments and phage infection experiments.

Objectives:

To collect sea water from different depths and enrich it with different combinations and concentrations of nutrients with the expectation of isolating strains and organisms not yet put into culture.

Sampling strategy:

Core sampling (pre-dawn and noon CTD) – 1 litre from 4 depths (0.1% light, DCM, 20 m and surface). 1 Litre vol from each depth was pre-filtered through 5 µm polycarbonate (PC) filters and added to flasks previously filled with PCR-SII Fe¨-, ASW or ASW with NH4, SOW and Pro99 for *Synechococcus* and PCRS11 and L1 for Picoeucaryotes. Different ratios were tried for the cyanobacteria and a 1 to 25 ratio was used with the picoeukaryotes. Sorted synechoccus were also plated from a few stations (Table 1). For a few selected stations samples (Table 2) (1.5ml x3) from six depths (the ones above mentioned plus two spaced in-between) were also collected for preservation in DMSO and glutareldehyde and pluronic.

Proposed analysis:

Single cell isolations either by cell flow sorting or by plating will be performed to establish monoclonal cultures. These will be identified by the amplification and sequencing of petB for Synechococcus strains and 18S and rbcL for picoeukaryotes.

The samples preserved with DMSO and kept at -80 are going to be used for culturing. The others are going to be used for flow cytometry in order to have an idea of the numbers of *synechoccus* and picoeukaryotes present in those depths in those stations.

Table 1 Collection log for samples collected for plating in agarose after sorting

Station number	CTD number	Lattitude	Longitude
37	33	3º46.866'N	25º46.486'W
38	34	2º21.550'N	25º29.174'W
42	37	5º19.340'S	29º01.573'W
71	58	38º57.675'S	29º10.45'W

73	60	40º41.126´S	32º6.197'W

Table 2 Sample collection log for samples collected and preserved with DMSO and glutaraldehyde.

Station	CTD	Latitude	Longitude
8	8	43º10.217'N	16º25.610'W
15	15	33º21.233'N	27º05.76'W
23	21	22º39.527'N	29º51.985'W
30	28	12º50.637'N	27º38.826'W
35	32	5º53.947'N	26º12.277'W
45	39	8º54.675'S	25º2.560´W
53	44	18º18.897'S	25º03.881'W
59	50	25º35,684'S	25º02.143'W
68	56	35º47.733'S	27º52.498'W
78	64	43º39,232'S	38º23,35'W

Cyanophages

Objectives:

Isolation and purification of cyanophages from water samples collected along the AMT.

Assess the diversity of auxiliary metabolic genes (AMGs) carried by cyanophages isolated from different oceanic provinces

Sampling strategy:

Core sampling (pre-dawn and noon CTD): 15 ml collected from 4 depths from all CTD casts (same as above) and kept in a fridge (<10ºC).

Proposed Analysis:

Sequencing of cyanophage isolates.

Identification of AMGs.

Phylogenetic analysis of *Synechococcus* spp. diversity and distribution along the Atlantic meridional transect: size fractionated single membrane water filtration

Objectives:

To determine the distribution and abundance of marine *Synechococcus* from predawn and solar noon CTD casts using a targeted next generation sequencing approach to determine fine scale community structure.

Sampling strategy:

Bulk community DNA was collected from all predawn CTD casts from 4 light depths (97 - 0.1%, same as above). Up to 10 l vol from each depth was pre-filtered through 100 µm mesh and 10.0 µm polycarbonate (PC) filters while the 0.45 µm (Supor) fractions were retained and flash frozen (in liquid nitrogen) in 3.0 mL of lysis buffer and stored at -80˚C.

Proposed analysis:

DNA will be extracted from filters using established techniques and analysed by a variety of methods in the laboratory. Quantitative estimates of the abundance of *Synechococcus* (Syn) genotypes will be carried out via pyrosequencing using selected multi-locus markers such as petB (Mazard et al., 2011.). Estimates of species/ribotype abundance will complement the flow cytometric analsyses of underway and CTD samples (Glen Tarran Core AMT measurement) as well as allow for direct comparison with similar data obtained on AMT18,19, 22 and 23.

Abundance and Composition of Microbial Plankton Communities by flow cytometry

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Objective

To determine the distribution, abundance and community structure of nano- and picophytoplankton, heterotrophic bacteria and heterotrophic nano- and picoplankton from CTD casts by flow cytometry.

Phytoplankton community structure and abundance by flow cytometry.

Fresh seawater samples from 200 m to the surface were collected in clean 250 mL polycarbonate bottles from a Seabird CTD system containing a 24 bottle rosette of 20 L Niskin bottles from predawn and solar noon CTD casts. Samples were stored in a refrigerator and analysed within 3 hours of collection. Fresh samples were measured using a Becton Dickinson FACSort flow cytometer which characterised and enumerated *Prochlorococcus* sp. and *Synechococcus* sp. (cyanobacteria) and pico- and eucaryote phytoplankton, based on their light scattering and autofluorescence properties. Data were saved in listmode format and analysed onboard. Table 1 summarises the CTD casts sampled and analysed during the cruise.

Bacteria and heterotrophic flagellate community structure and abundance by flow cytometry.
Samples for bacteria and heterotrophic flagellate enumeration were collected from all depths of predawn and solar noon CTD casts in clean 50 mL centrifuge tubes and fixed with paraformaldehyde within half an hour of surfacing. Samples (see below) were stained with the DNA stain SYBR Green I (Sigma) in order to separate particles in suspension based on DNA content and light scattering properties. Samples were generally analysed flow cytometrically within 4 hours of surfacing. Each stained sample was run twice through a Becton Dickinson FACSCalibur flow cytometer: once to analyse sub-micron sized particles and once to analyse particles greater than 1 µm in diameter. Data were saved in listmode format and will be analysed ashore.

***Table 1*: CTD casts sampled for phytoplankton, heterotrophic bacteria and heterotrophic flagellate community structure & abundance.**

DATE	STATION	CTD	TIME on deck (GMT)	LAT +N, -S	LONG E	Depths sampled
25-Sep	1	1	12:47	49.83	-4.76	2 10 20 30 40 50 60 70
26-Sep	2	2	03:59	47.87	-7.94	2 5 7 13 20 22 29 39 50 75 100 200
26-Sep	3	3	13:12	47.19	-8.82	1 5 9 16 20 28 30 38 50 65 98 200
27-Sep	4	4	12:46	47.57	-8.50	1 5 9 16 20 28 38 44 50 60 65 98 200
28-Sep	5	5	05:09	46.39	-10.98	1 5 7 13 20 23 32 35 42 55 82 200

28-Sep	6	6	13:50	45.50	-12.49	2 5 10 18 20 32 43 49 57 75 90 112 200
29-Sep	7	7	04:51	44.09	-14.92	2 5 10 18 20 32 43 57 67 75 112 200
29-Sep	8	8	13:50	43.17	-16.43	2 5 12 20 22 38 51 64 67 88 132 200
30-Sep	9	9	04:46	41.77	-18.76	2 5 8 15 20 26 30 35 46 60 90 200
30-Sep	10	10	13:47	40.84	-20.21	2 5 9 16 20 29 32 38 40 51 66 90 99 200
01-Oct	11	11	04:42	39.40	-22.46	2 10 20 33 44 48 58 63 75 113 200
01-Oct	12	12	13:46	38.50	-23.89	2 5 9 16 20 28 37 49 60 64 96 200
02-Oct	13	13	13:43	36.95	-25.91	2 5 11 20 36 48 64 78 83 125 200
03-Oct	14	14	04:43	34.56	-26.61	3 5 11 20 36 48 60 64 75 83 125 200
03-Oct	15	15	13:47	33.35	-27.10	2 5 14 20 26 45 61 80 100 105 158 200
04-Oct	17	16	04:47	31.30	-27.70	2 5 14 20 26 45 60 80 100 105 158 200
04-Oct	18	17	13:52	29.90	-28.17	5 16 20 29 52 70 92 115 120 180 200
05-Oct	19	18	05:47	27.50	-28.86	2 5 18 20 33 58 75 78 103 135 160 200
05-Oct	20	19	14:50	26.11	-29.31	2 5 16 20 29 52 70 92 120 135 180 200
06-Oct	22	20	05:53	24.06	-29.88	2 13 20 25 43 58 62 77 100 115 180 200
06-Oct	23	21	14:49	22.66	-29.87	2 5 13 20 25 43 58 77 100 135 180 200
07-Oct	24	22	05:51	20.45	-29.25	2 14 20 26 45 61 80 95 105 130 158 200
07-Oct	25	24	14:51	19.86	-29.14	2 13 20 41 55 73 90 95 140 143 200
08-Oct	27	25	05:54	17.83	-28.68	2 5 10 20 33 44 50 58 67 75 113 200
08-Oct	28	26	14:48	16.44	-28.40	2 13 20 23 41 55 73 79 95 130 143 200
09-Oct	29	27	05:55	14.22	-27.91	2 9 16 20 28 30 38 50 52 65 100 200
09-Oct	30	28	14:49	12.84	-27.65	2 5 9 15 20 27 36 40 48 62 93 200
10-Oct	32	29	05:59	10.76	-27.20	2 5 9 16 20 25 28 38 50 65 98 200
10-Oct	33	30	14:49	9.37	-26.92	2 7 13 20 23 30 40 45 52 78 120 200
11-Oct	34	31	05:52	7.28	-26.51	2 5 10 18 32 43 50 57 65 70 94 111 200
11-Oct	35	32	14:42	5.90	-26.20	2 11 20 36 48 63 70 75 83 110 124 200
12-Oct	37	33	05:52	3.78	-25.77	2 11 20 35 47 61 69 74 82 110 120 200
12-Oct	38	34	14:55	2.38	-25.49	2 5 12 20 37 50 61 66 86 100 129 200
13-Oct	40	35	06:17	0.00	-25.00	2 8 15 20 26 35 41 46 50 60 70 90 200
14-Oct	41	36	05:45	-3.90	-25.00	2 11 20 35 47 61 67 72 80 100 120 200
14-Oct	42	37	14:45	-5.32	-25.03	2 11 20 34 45 60 65 70 78 90 117 125 200
15-Oct	44	38	05:45	-7.48	-25.01	2 13 20 23 41 55 73 87 92 94 125 143 200
15-Oct	45	39	14:41	-8.91	-25.04	5 13 20 23 41 55 73 77 82 95 110 140 200

16-Oct	47	40	05:45	-11.00	-25.02	2 17 20 32 56 76 99 120 125 130 150 195 200
16-Oct	48	41	14:46	-12.49	-25.07	2 15 20 27 47 64 84 110 117 122 145 164 200
17-Oct	50	42	05:45	-14.67	-25.07	2 5 17 20 32 56 75 99 125 130 165 195 200
17-Oct	51	43	14:44	-16.13	-25.09	2 5 20 23 41 73 95 99 130 165 170
18-Oct	53	44	05:50	-18.32	-25.06	2 20 21 39 69 93 122 140 160 190 200
18-Oct	54	45	14:47	-18.56	-25.07	2 20 24 44 77 104 138 175 180 200
20-Oct	55	47	05:45	-20.86	-25.05	2 5 20 34 60 81 107 140 155 180 200
20-Oct	56	48	14:48	-22.32	-25.06	2 5 20 39 69 93 122 155 160 175 180 200
21-Oct	58	49	05:46	-24.43	-25.04	2 5 20 37 65 87 90 115 150 200
21-Oct	59	50	14:41	-25.59	-25.04	2 5 18 20 33 58 78 103 135 175 200
22-Oct	61	51	05:47	-27.75	-25.03	2 5 17 20 54 73 96 125 188
22-Oct	62	52	14:49	-29.15	-25.28	2 17 20 32 56 76 99 125 130 195 200
23-Oct	64	53	06:44	-31.36	-26.10	2 5 13 20 25 43 58 77 100 150 200
23-Oct	65	54	15:45	-32.72	-26.63	2 12 20 23 40 54 71 87 93 138 200
24-Oct	67	55	06:43	-34.69	-27.43	5 12 20 22 39 52 65 70 75 90 138 200
24-Oct	68	56	15:50	-35.80	-27.87	2 9 15 20 27 36 44 48 62 93 200
25-Oct	70	57	06:49	-37.98	-28.78	2 5 20 26 35 40 45 60 68 100 150 200
25-Oct	71	58	15:54	-38.96	-29.17	2 5 9 16 20 28 38 50 66 100 150 200
26-Oct	72	59	06:58	-40.12	-30.94	2 10 17 20 30 41 50 54 70 105 125 200
26-Oct	73	60	05:51	-40.69	-32.10	2 8 14 20 20 32 40 43 56 83 125 160 200
27-Oct	75	61	06:46	-41.47	-33.87	2 5 10 17 20 30 41 50 54 70 105 200
27-Oct	76	62	16:13	-42.16	-35.10	5 10 17 20 30 40 50 60 70 105 130 175 200
28-Oct	77	63	07:01	-43.00	-37.14	3 5 8 15 20 26 35 45 50 60 90 200
28-Oct	78	64	15:47	-43.59	-38.39	2 9 16 20 27 37 42 48 63 94 200
29-Oct	79	65	06:45	-44.63	-40.73	2 5 10 15 20 28 40 45 50 98 200
29-Oct	80	66	15:45	-45.29	-42.20	2 8 15 20 26 35 46 60 75 90 105 150 200
30-Oct	82	67	06:41	-46.07	-44.21	2 8 14 20 24 32 37 42 55 80 100 150 200
31-Oct	83	68	15:53	-48.25	-50.34	2 11 20 35 41 47 61 70 80 100 120 150 200
01-Nov	84	69	07:48	-49.58	-53.07	2 10 15 20 30 40 50 65 70 80 100 125 150 200
01-Nov	85	70	16:52	-50.26	-54.53	5 10 15 20 25 30 35 45 60 75 80 100 150 200

Phytoplankton Photosynthesis and Primary Production

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Objectives

During AMT24 integrated Primary production measurements were made at 32 stations on three size classes of phytoplankton from measurements taken from five to six depths in the water column. Photosynthesis-irradiance curves were made at 31 stations at one to two depths in the water column. These measurements aim to fulfil the following objectives within:

- *The main deliverable is to provide an unique time series of spatially extensive and internally consistent observations on the structure and biogeochemical properties of planktonic ecosystems in the Atlantic Ocean that are required to validate models addressing questions related to the global carbon cycle. One of the key parameters is phytoplankton production. To this end a continuous long track series of primary production measurements have been made on AMT24 using methods synonymous to those used in previous AMT cruises.*
- *We also assessed the variation in photosynthesis in phytoplankton communities along the Atlantic Meridional transect.*

Methods

Primary production. Simulated in situ primary production was measured at 32 stations. Water samples were taken from pre-dawn (03:15-05:15 GMT) deployments of 21 x 10 + 3 x 20l SeaBird CTD rosette sampler on a stainless steel frame from 6 depths in the euphoic zone following the methods described in Tilstone et al. (2009). The samples were transferred from Niskin bottles to black carboys to prevent shock to the photosynthetic lamellae of the phytoplankton cells. Water from each sample was sub sampled into three 75 ml clear polycarbonate bottles and three black polycarbonate bottle; all bottles were pre cleaned following JGOFS protocols (IOC, 1994), to reduce trace metal contamination. Each sample was inoculated with between 185 and 740 kBq (5 - 15 µCi) $NaH^{14}CO_3$ according to the biomass of phytoplankton. The polycarbonate bottles were transferred to an on deck (simulated in situ) incubation system using neutral density and blue filters to simulate subsurface irradiance over depth to 97%, 55%, 33%, 20%, 14%, 7%, 3%, 1% or 0.1% of the surface value and incubated from local dawn to dusk (10 – 16 h). The incubators were maintained at surface temperature by pumping sea water from a depth of ~7 m through the upper light level incubators (97, 55, 33, 14, & 7 %) and from a chiller maintained at ±1°C of in situ temperature for the lower light level incubators (3, 1 & 0.1%). To terminate the incubations, suspended material were filtered sequentially through 0.2µm, 2µm and 10 µm polycarbonate filters to measure the pico, nano and micro-phytoplankton production respectively. The filters were exposed to concentrated HCl fumes for 8-12 h immersed in scintillation cocktail and then frozen. Since the ships liquid scintillation counter failed during the first week of the cruise, ^{14}C disintegration time per minute (DPM) will be measured at PML using a Perkin Elmer, Tricarb liquid scintillation counter and the external standard and the channel ratio methods will be applied to correct for quenching.

Photosynthesis-Irradiance Curves.

Photosynthesis-Irradiance experiments were conducted at 36 stations at two depths in the water column; surface and Chla maxima. The experiments were run in photosynthetrons illuminated by 50 W, 12 V tungsten halogen lamps for the surface waters and LEDs for the Chla maxima following the methods described in Tilstone et al. (2003). Each incubator houses 15 sub-samples in 60 ml polycarbonate bottles which were inoculated with between 185k Bq (5 µCi) and 370 kBq (15 µCi) of ^{14}C labelled bicarbonate. The samples were maintained at *in situ* temperature using the ships non-toxic supply for the surface samples and at ambient temperature at the Chla maxima with a Polyscience chiller. After 1 to 2 h of incubation, the suspended material were filtered onto 0.2µm polycarbonate filters to measure phytoplankton photosynthetic rates. The filters were exposed to concentrated HCl fumes for 8-12 h immersed in scintillation cocktail and and then frozen. Since the ships liquid scintillation counter failed during the first week of the cruise, ^{14}C disintegration time per minute (DPM) will be measured at PML using a Perkin Elmer, Tricarb liquid scintillation counter and the external standard and the channel ratio methods will be applied to correct for quenching. The broadband light-saturated Chla-specific rate of photosynthesis P_m^B [mg C (mg chl a)$^{-1}$ h^{-1}] and the light limited slope α^B [mg C (mg chl a)$^{-1}$ h^{-1} (µmol m^{-2} s^{-1})$^{-1}$] was estimated by fitting the data to the model of Platt *et al.* (Platt et al., 1980).

References:

Platt, T., Gallegos, C.L. and Harrison, W.G., 1980. Photoinhibition of photosynthesis in natural assemblage of marine phytoplankton. J Mar Res, 38: 687-701.

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Table 1. Stations at which size fractionated primary production (PP) and phytoplankton photosynthesis (PE curves) were measured from 25-Sept to 31-Oct-2014.

Latitude	Longitude	Date	JD	Time	CTD No.	Measurement
47.87	-7.94	26-Sep-14	269	03:17	2	SIS PP
47.19	-8.82	26-Sep-14	269	10:07	3	PE Curves
47.57	-8.50	27-Sep-14	270	12:05	4	PE Curves
46.39	-10.98	28-Sep-14	271	04:24	5	SIS PP
44.09	-14.92	29-Sep-14	272	04:12	7	SIS PP
43.17	-16.43	29-Sep-14	272	13:02	8	PE Curves
41.77	-18.76	30-Sep-14	273	04:02	9	SIS PP
40.84	-20.21	30-Sep-14	273	13:03	10	PE Curves
39.40	-22.46	01-Oct-14	274	04:02	11	SIS PP
38.50	-23.90	01-Oct-14	274	13:07	12	PE Curves
36.95	-25.91	02-Oct-14	275	13:03	13	PE Curves
34.74	-26.94	03-Oct-14	276	04:04	14	SIS PP
33.35	-27.10	03-Oct-14	276	13:05	15	PE Curves
31.30	-27.70	04-Oct-14	277	04:04	16	SIS PP
29.90	-28.17	04-Oct-14	277	13:03	17	PE Curves
27.50	-28.86	05-Oct-14	278	05:06	18	SIS PP
26.11	-29.31	05-Oct-14	278	14:04	19	PE Curves
24.14	-29.88	06-Oct-14	279	05:07	20	SIS PP
22.66	-29.87	06-Oct-14	279	13:00	21	PE Curves
20.45	-29.25	07-Oct-14	280	05:07	22	SIS PP
19.86	-29.14	07-Oct-14	280	13:03	24	PE Curves
17.83	-28.68	08-Oct-14	281	05:07	25	SIS PP
16.44	-28.40	08-Oct-14	281	14:02	26	PE Curves
14.22	-27.91	09-Oct-14	282	05:04	27	SIS PP

12.84	-27.65	09-Oct-14	282	14:04	28	PE Curves
10.76	-27.20	10-Oct-14	283	05:01	29	SIS PP
9.37	-26.92	10-Oct-14	283	14:00	30	PE Curves
7.28	-26.51	11-Oct-14	284	05:09	31	SIS PP
5.90	-26.20	11-Oct-14	284	14:03	32	PE Curves
3.78	-25.77	12-Oct-14	285	15:07	33	SIS PP
2.38	-25.49	12-Oct-14	285	14:03	34	PE Curves
0.00	-25.00	13-Oct-14	286	05:33	35	SIS PP
-3.90	-25.00	14-Oct-14	286	05:02	36	SIS PP
-5.32	-25.03	14-Oct-14	287	14:05	37	PE Curves
-7.48	-25.01	15-Oct-14	287	05:03	38	SIS PP
-8.91	-25.04	15-Oct-14	288	14:02	39	PE Curves
-11.05	-25.02	16-Oct-14	288	05:06	40	SIS PP
-12.49	-25.07	16-Oct-14	289	14:03	41	PE Curves
-14.67	-25.07	17-Oct-14	290	05:03	42	SIS PP
-16.13	-25.09	17-Oct-14	290	14:03	43	PE Curves
-18.32	-25.06	18-Oct-14	291	05:06	44	SIS PP
-18.56	-25.07	18-Oct-14	291	14:00	45	PE Curves
-20.86	-25.05	20-Oct-14	293	05:04	47	SIS PP
-22.32	-25.06	20-Oct-14	293	14:04	48	PE Curves
-24.43	-25.04	21-Oct-14	294	05:04	49	SIS PP
-25.59	-25.04	21-Oct-14	294	14:01	50	PE Curves
-27.75	-25.03	22-Oct-14	295	05:06	51	SIS PP
-29.15	-25.28	22-Oct-14	295	14:00	52	PE Curves
-31.36	-26.10	23-Oct-14	296	06:04	53	SIS PP
-32.72	-26.63	23-Oct-14	296	15:01	54	PE Curves
-34.69	-27.43	24-Oct-14	297	06:02	55	SIS PP

-35.80	-27.87	24-Oct-14	297	15:02	56	PE Curves
-37.89	-28.78	25-Oct-14	298	06:01	57	SIS PP
-38.96	-29.17	25-Oct-14	298	15:06	58	PE Curves
-40.12	-30.94	26-Oct-14	299	06:18	59	SIS PP
-40.69	-32.10	26-Oct-14	299	15:04	60	PE Curves
-41.47	-33.88	27-Oct-14	300	06:07	61	SIS PP
-42.16	-35.10	27-Oct-14	300	15:30	62	PE Curves
-43.00	-37.14	28-Oct-14	301	06:26	63	SIS PP
-43.59	-38.39	28-Oct-14	301	15:06	64	PE Curves
-44.63	-40.73	29-Oct-14	302	06:05	65	SIS PP
-45.29	-42.20	29-Oct-14	302	15:04	66	PE Curves
-46.07	-44.21	30-Oct-14	303	06:01	67	SIS PP
-48.25	-50.34	31-Oct-14	304	13:55	68	PE Curves

Gross Primary Production (GPP), Dark Community Respiration (DCR) and Net Community Production. Dissolved oxygen concentration in seawater

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Objectives

To determine the depth and spatial distribution of net community production (NCP), i.e., the balance of gross primary production (GPP) and dark community respiration (DCR), and to relate it to community structure and nutrient supply.

To determine the plankton NCP along the track of the Atlantic Meridional Transect 24: Portsmouth (UK) to Stanley (Falkland Islands) between September and November 2014.

To measure experimentally the impact of the nutrient enrichment on the metabolic state in both the Northern and the Southern Gyre of the Atlantic. The hypothesis is that the impact will be the same in both gyres, and that it will result in a higher increase of the GPP compared to the DCR, and therefore it will enhance the autotrophy. The difference of NCP between the two regions could be caused by differences of DCR and not in differences of GPP.

To test and refine system-specific empirical models to predict the GPP:CR balance in each province from remote estimations of primary production.

To measure dissolved oxygen concentration in order to calibrate the oxygen sensors of the two CTDs used during the cruise.

Methods

Measurements of dissolved oxygen were made using an automated Winkler titration system with photometric end point detection (Williams and Jenkinson 1982). Oxygen saturation was calculated from the equations for solubility in seawater of Benson and Krause (1984).

5 depths CTD profiles

GPP, NCP and dark CR of 5 depths at dawn CTD stations were determined from *in vitro* changes in dissolved oxygen concentration after 24 hours light and dark incubations. Water was collected from depths equivalent to ca. 97%, 33%, 14%, 3% and 1% of surface irradiance. In some stations, it was preferable to sample the deep chlorophyll maximum (DCM) instead of the 3% or 1%. At relatively autotrophic areas, water was collected from the Niskin bottles into polypropylene carboys before it was finally siphoned into 125 ml borosilicate glass bottles. However, in relatively oligotrophic areas, water was collected directly from the Niskin bottles into the 125 ml borosilicate glass bottles. In both cases four zero time replicates were fixed immediately, and two further sets of replicates were incubated for 24 hours in surface water cooled deck incubators (Gavin Tilstone) or in temperature controlled water baths at *in situ* temperatures. One set was incubated in the dark, the other set in light of equivalent irradiance to that found at the *in situ* depth.

Experiment Northern and Southern Gyre

0% (Control), 10%, 15%, 20% addition of deep water (220-250m) rich in inorganic nutrients (>5 mmolNO_3^- m^{-3}) to the surface waters (0-10m), impoverished in inorganic nutrients.

An extra CTD cast was necessary for the collecting the water in both Gyres of the Atlantic, and it was performed a day later a thermocline and a DCM lower than 100m depth were observed.

In each of the two experiments, 5x 20 l polycarbonate carboys were incubated in a tank on deck during almost 10 days. The tank had a continuous supply of underway surface water, which ranged from 13 to 29 ºC, depending mainly of the latitudinal position of the ship, with a smaller variation due to the sunlight and time of the day.

Subsamples of 1.5 ml, 50 ml and 250 ml were collected daily for flow cytometry (Mike Zubkov, Priscilla Kienteka Lange), nutrient flow analysis (Carolyn Harris) and fractionated 20, 2, 0.2 µm Chlorophyll a (Rob Thomas) respectively. Subsamples were collected from the 20 l carboys.

Every 2-3 days, the 5x 20 l carboys were sub-sampled for performing 24 h incubations (following the method of the light and dark bottle described above) in order to determine the GPP, NCP, and the DCR by the dissolved O_2 concentration.

Samples Collected

A total of 27 CTD stations were sampled for the calibration of the O_2 sensor. 20 CTD stations were sampled for analysing 5 depths Production/Respiration O_2 profiles. Plus 2 CTD stations (marked in bold) were sampled for performing the experiment in both Atlantic gyres.

Date	CTD station	Latitude	Longitude
26-09-2014	002	47º 52.0639´ N	7º 56.23´ W
28-09-2014	005	46º 23.256´ N	10º 58.990´ W
29-09-2014	007	44º 05.61´ N	14º 55.25´W
30-09-2014	009	41º 46.292´ N	18º 45.431´ W
01-10-2014	011	39º 23.910´ N	22º 27.318´W
03-10-2014	014	34º 33.339´ N	26º 36.533´W
04-10-2014	016	31º 17.711´ N	27º 48.254´W
06-10-2014	020	24º 03.628 N	29º 52.968 W
07-10-2014	023	19º 51.320 N	29º 08.434 W
09-10-2014	027	14º 13.222´N	27º 54.462´ W

12-10-2014	033	3º 46.866´N	25º 46.485´ W
14-10-2014	036	3º 54.15´S	24º 59.789´ W
15-10-2014	038	7º 28.650´S	25º 0.815´ W
18-10-2014	044	18º 18.897´S	25º 03.881´ W
18-10-2014	046	18º 33.36 S	25º 04.268 W
21-10-2014	049	24º 25.987´S	25º 02.230´ W
24-10-2014	055	34º 34.408´S	27º 25.728´ W
26-10-2014	059	40º 7.129´ S	30º 56.525´ W
27-10-2014	061	41º 28.269´ S	33º 52.590´W
28-10-2014	063	43º 0.137´ S	37º 8.48´ W
29-10-2014	065	44º 37.554´ S	40º 43.563´ W
30-10-2014	067	46º 4.344´ S	44º 12.565´ W

Extracted chlorophyll-a sampling for calibration of CTD and underway fluorometers

Rob Thomas
British Oceanographic Data Centre

Samples of seawater from CTD niskin bottles and the ship's non-toxic supply were taken to calibrate the CTD and underway system fluorometers following Welschmeyer (1994). Samples of 250 ml were filtered through 47mm 0.2 um polycarbonate filters. The filters were then placed in a vial with 10 ml 90% acetone and left in a freezer for 24 hours. The samples were then analysed on a Turner Designs Trilogy fluorometer with a non-acidified chl module (CHL NA #046) fitted. Not all the equipment needed to carry out a calibration against known standards was available during the cruise and this will be verified after the cruise when the fluorometer is returned to PML.

Underway samples
A total of 106 samples were collected from the underway supply. A list of date, time and position for the underway samples can be found in the appendices.

CTD samples
Samples were collected at 68 stations from 9 depths including light depths from 97, 55, 33, 14, 7, 1 & 0.1%.
A total of 604 samples were collected from the CTD casts. The depths and stations sampled are listed in Table 1.

See the CTD and SCS processing and calibrations section for details of the calibrations.

Data submission
The dataset will be submitted to BODC once the bench fluorometer has been calibrated using a known standard back at PML after the end of the cruise.

References:
Welschmeyer N.A., 1994. Fluorometric analysis of chlorophyll-a in the presence of chlorophyll-b and phaeopigments. *Limnology and Oceanography*, 39:1985-1992

Table 1: List of stations and depths sampled for extracted chlorophyll-a measurement

Date and Time (GMT)	Lat (+ve N)	Lon (+ve E)	CTD	Niskin Bottle	Depth (m)
2014-09-25T10:00:00	49.8290	-4.7564	CTD001	4, 7, 10, 14, 19, 22, 23	70, 60, 50, 40, 30, 20, 10, 2
2014-09-26T03:17:00	47.8677	-7.9372	CTD002	4, 5, 6, 8, 9, 11, 19,23	200, 100, 75, 59, 39, 29, 13, 2
2014-09-26T10:07:00	47.1863	-8.8175	CTD003	7, 9, 10, 13, 15, 18, 21, 23	65, 50, 38, 30, 28, 20, 9, 2
2014-09-27T12:04:00	47.5720	-8.5049	CTD004	4, 5, 6, 11, 15, 18, 21, 23	200,98, 65, 44, 28, 20, 9, 1
2014-09-28T04:23:00	46.3876	-10.9832	CTD005	6, 8, 9, 14, 16, 19, 20, 24	200, 82, 55, 35, 23, 13, 7, 1
2014-09-28T13:02:00	45.5021	-12.4895	CTD006	3, 5, 7, 11, 15, 18, 21, 23	300, 112, 75, 49, 32, 20, 10, 2
2014-09-29T04:12:00	44.0935	-14.9208	CTD007	4, 7, 8, 12, 14, 17, 19, 20	300, 112, 75, 67, 43, 20, 10, 5
2014-09-29T13:05:00	43.1703	-16.4268	CTD008	3, 5, 7, 11, 14, 16, 17, 21, 22	300, 132, 88, 64, 51, 38, 22, 12, 5
2014-09-30T04:00:00	41.7715	-18.7572	CTD009	4, 5, 7, 8, 9, 13, 16, 19, 21	300, 200, 90, 60, 46, 35, 26, 15, 5
2014-09-30T13:04:00	40.8422	-20.2148	CTD010	3, 5, 7, 8, 11, 16, 17, 21, 22	200, 99, 66, 51, 40, 29, 20, 9, 5
2014-10-01T04:04:00	39.3985	-22.4553	CTD011	4, 7, 8, 12, 14, 16, 18, 20, 21	300, 113, 75, 63, 48, 33, 20, 10, 5
2014-10-01T13:04:00	38.4960	-23.8918	CTD012	4, 6, 10, 14, 15, 16, 19, 21, 22	200, 96, 60, 49, 37, 28, 20, 9, 5
2014-10-02T13:03:00	36.9547	-25.9083	CTD013	3, 6, 10, 14, 15, 16, 20, 21, 22	300, 125, 78, 64, 48, 36, 20, 11, 5
2014-10-03T04:04:00	34.5557	-26.6089	CTD014	4, 7, 12, 14, 15, 16, 17, 20, 21	300, 125, 75, 60, 48, 36, 20, 11, 5
2014-10-03T13:04:00	33.3539	-27.0960	CTD015	3, 6, 10, 13, 15, 16, 17, 21, 22	300, 158, 100, 80, 61, 45, 26, 14, 5
2014-10-04T04:04:00	31.2952	-27.7043	CTD016	4, 7, 12, 13, 14, 16, 17, 20, 21	200, 158, 100, 80, 60, 45, 26, 14, 5

2014-10-04T13:03:00	29.8987	-28.1652	CTD017	3, 6, 10, 13, 15, 16, 17, 21, 22	300, 180, 115, 92, 70, 52, 29, 16, 5
2014-10-05T05:04:00	27.5117	-28.8640	CTD018	4, 7, 11, 13, 14, 16, 17, 20, 21	300, 160, 135, 103, 78, 58, 33, 18, 5
2014-10-05T14:04:00	26.1058	-29.3052	CTD019	2, 6, 9, 13, 14, 16, 17, 20, 22	350, 135, 120, 92, 70, 52, 29, 20, 5
2014-10-06T05:05:00	24.0605	-29.8828	CTD020	3, 6, 7, 11, 13, 16, 17, 20, 21	350, 150, 115, 100, 77, 43, 25, 13, 5
2014-10-06T14:02:00	22.6588	-29.8664	CTD021	2, 5, 6, 9, 13, 15, 16, 21, 22	350, 150, 135, 100, 77, 58, 43, 13, 5
2014-10-07T05:05:00	20.4533	-29.2478	CTD022	3, 6, 7, 12, 13, 14, 16, 17, 21	350, 158, 130, 95, 80, 61, 45, 26, 5
2014-10-07T14:06:00	19.8554	-29.1406	CTD024	2, 5, 10, 13, 15, 16, 20, 21, 22	350, 143, 90, 73, 55, 41, 20, 13, 5
2014-10-08T05:11:00	17.8317	-28.6812	CTD025	3, 7, 8, 12, 13, 15, 16, 18, 21	350, 113, 75, 67, 58, 44, 33, 20, 5
2014-10-08T14:02:00	16.4354	-28.4048	CTD026	2, 5, 6, 7, 10, 15, 16, 17, 22	350, 143, 130, 95, 79, 55, 41, 23, 5
2014-10-09T05:11:00	14.2204	-27.9077	CTD027	3, 5, 8, 10, 14, 15, 18, 20, 22	350, 100, 65, 52, 38, 30, 20, 16, 5
2014-10-09T14:04:00	12.8440	-27.6471	CTD028	3, 4, 6, 7, 8, 11, 18, 21, 22	300, 200, 93, 62, 48, 40, 20, 9, 5
2014-10-10T05:17:00	10.7605	-27.1957	CTD029	3, 4, 7, 8, 9, 14, 15, 19, 21	350, 200, 98, 65, 50, 38, 28, 16, 5
2014-10-10T14:04:00	9.3684	-26.9210	CTD030	2, 3, 4, 6, 7, 10, 15, 19, 22	350, 200, 120, 98, 52, 45, 30, 20, 5
2014-10-11T05:04:00	7.2792	-26.5128	CTD031	3, 4, 6, 7, 10, 14, 18, 20, 23	350, 200, 111, 94, 70, 50, 20, 10, 5
2014-10-11T14:04:00	5.8991	-26.2046	CTD032	2, 3, 5, 6, 7, 14, 15, 20, 22	350, 200, 124, 110, 83, 63, 48, 20, 5
2014-10-12T05:04:00	3.7811	-25.7748	CTD033	3, 6, 8, 11, 14, 15, 16, 19, 21	350, 120, 82, 74, 61, 47, 35, 20, 5
2014-10-12T14:05:00	2.3758	-25.4862	CTD034	2, 3, 6, 8, 10, 15, 17, 18, 22	350, 200, 100, 86, 66, 50, 37, 20, 5
2014-10-13T05:34:00	0.0033	-25.0033	CTD035	4, 6, 7, 8, 11, 14, 17, 18, 20	200, 90, 70, 60, 50, 35, 20, 15, 5
2014-10-14T05:05:00	-3.9025	-24.9965	CTD036	3, 6, 7, 8, 11, 14, 15, 16, 20	350, 120, 100, 80, 72, 47, 35, 20, 5
2014-10-14T14:07:00	-5.3223	-25.0262	CTD037	3, 4, 8, 10, 14, 16, 17, 18, 22	200, 125, 78, 70, 60, 45, 34, 20, 5
2014-10-15T05:03:00	-7.4775	-25.0136	CTD038	4, 6, 7, 11, 13, 14, 15, 16, 20	200, 143, 125, 92, 73, 55, 41, 23, 5
2014-10-15T14:04:00	-8.9112	-25.0427	CTD039	3, 5, 8, 10, 14, 15, 17, 18, 22	200, 143, 95, 82, 73, 55, 41, 23, 5
2014-10-16T05:05:00	-11.0476	-25.0223	CTD040	4, 7, 11, 13, 14, 15, 16, 18, 20	200, 150, 125, 99, 76, 56, 32, 20, 5
2014-10-16T14:03:00	-12.4948	-25.0653	CTD041	3, 5, 6, 8, 12, 14, 15, 17, 22	200, 164, 145, 122, 110, 84, 64, 47, 5
2014-10-17T05:02:00	-14.6706	-25.0652	CTD042	4, 7, 11, 12, 13, 15, 16, 18, 20	200, 165, 125, 99, 75, 56, 32, 20, 5
2014-10-17T14:04:00	-16.1315	-25.0845	CTD043	3, 5, 8, 11, 13, 15, 17, 18, 21	300, 255, 165, 130, 99, 73, 41, 23, 5
2014-10-18T05:05:00	-18.3150	-25.0647	CTD044	5, 6, 8, , 13, 14, 15, 16, 20	240, 200, 160, , 122, 93, 69, 39, 5
2014-10-18T14:04:00	-18.5558	-25.0712	CTD045	3, 5, 6, 7, 12, 13, 14, 15, 19	270, 200, 180, 175, 138, 104, 77, 44, 5
2014-10-20T05:02:00	-20.8561	-25.0663	CTD047	6, 7, 9, 12, 13, 14, 15, 16, 20	200, 180, 140, 140, 107, 81, 60, 34, 5
2014-10-20T14:04:00	-22.3164	-25.0602	CTD048	3, 6, 9, 10, 11, 16, 17, 18, 22	300, 200, 160, 155, 122, 93, 69, 39, 5
2014-10-21T05:04:00	-24.4331	-25.0372	CTD049	4, 6, 7, 8, 12, 14, 15, 16, 19	300, 225, 200, 150, 115, 87, 65, 37, 5
2014-10-21T14:02:00	-25.5947	-25.0357	CTD050	3, 4, 5, 9, 15, 16, 17, 18, 22	300, 240, 200, 135, 103, 78, 58, 33, 5
2014-10-22T05:04:00	-27.7469	-25.0306	CTD051	4, 5, 7, 8, 13, 14, 15, 16, 22	300, 200, 188, 125, 96, 73, 54, 31, 5
2014-10-22T14:04:00	-29.1540	-25.2756	CTD052	3, 6, 8, 11, 14, 15, 16, 18, 22	300, 195, 130, 125, 99, 76, 56, 32, 5
2014-10-23T06:04:00	-31.3649	-26.0965	CTD053	4, 5, 7, 8, 13, 14, 15, 16, 20	300, 200, 150, 100, 77, 58, 43, 25, 2
2014-10-23T15:01:00	-32.7165	-26.6319	CTD054	3, 4, 6, 10, 13, 15, 16, 18, 22	300, 200, 138, 87, 71, 54, 40, 23, 5
2014-10-24T06:04:00	-34.6901	-27.4288	CTD055	4, 5, 7, 8, 12, 14, 15, 16, 20	300, 200, 135, 90, 70, 52, 39, 22, 5
2014-10-24T15:02:00	-35.7956	-27.8750	CTD056	3, 4, 6, 7, 9, 12, 15, 16, 23	300, 200, 93, 62, 48, 44, 36, 27, 5
2014-10-25T06:08:00	-37.8931	-28.7788	CTD057	4, 5, 6, 7, 10, 13, 14, 15, 20	300, 200, 150, 100, 45, 40, 35, 26, 5
2014-10-25T15:06:00	-38.9613	-29.1742	CTD058	3, 4, 7, 8, 11, 16, 17, 19, 22	300, 200, 100, 66, 50, 38, 28, 20, 5
2014-10-26T06:08:00	-40.1188	-30.9421	CTD059	4, 5, 6, 8, 9, 14, 15, 16, 21	300, 200, 125, 105, 70, 50, 41, 30, 5
2014-10-26T15:06:00	-40.6854	-32.1033	CTD060	4, 8, 9, 10, 13, 16, 17, 20, 22	200, 83, 56, 43, 40, 32, 24, 14, 5
2014-10-27T06:05:00	-41.4711	-33.8826	CTD061	5, 7, 8, 9, 12, 14, 15, 18, 20	200, 105, 70, 54, 50, 41, 30, 17, 5
2014-10-27T15:30:00	-42.0806	-35.1019	CTD062	4, 7, 8, 9, 10, 13, 17, 20, 22	200, 105, 70, 60, 50, 40, 30, 17, 5
2014-10-28T06:26:00	-43.0026	-37.1413	CTD063	5, 7, 8, 12, 13, 14, 15, 18, 20	200, 90, 70, 50, 45, 35, 26, 15, 5
2014-10-28T15:03:00	-43.5872	-38.3892	CTD064	4, 7, 9, 10, 13, 16, 17, 20, 22	200, 94, 63, 48, 42, 37, 27, 16, 5

2014-10-29T06:08:00	-44.6259	-40.7261	CTD065	5, 7, 8, 12, 14, 15, 18, 18, 20	200, 98, 65, 45, 40, 28, 15, 10, 5
2014-10-29T15:05:00	-45.2875	-42.1984	CTD066	4, 8, 9, 10, 13, 16, 17, 20, 22	200, 90, 75, 60, 46, 35, 26, 15, 5
2014-10-30T06:01:00	-46.0724	-44.2094	CTD067	4, 7, 9, 10, 11, 14, 17, 19, 21	300, 100, 80, 55, 42, 37, 24, 14, 5
2014-10-31T15:13:00	-48.2451	-50.3408	CTD068	4, 7, 10, 12, 13, 18, 19, 21, 22	200, 120, 80, 61, 47, 35, 20, 11, 5
2014-11-01T07:08:00	-49.5799	-53.0707	CTD069	4, 5, 8, 10, 14, 15, 17, 19, 21	200, 175, 100, 80, 65, 40, 30, 15, 5
2014-11-01T16:05:00	-50.2593	-54.5294	CTD070	4, 7, 9, 11, 12, 13, 17, 19, 21	200, 100, 80, 60, 45, 35, 25, 15, 5

Mesoplankton Community Size Structure and abundance

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Methods:

Vertical net hauls were conducted each day at the pre-dawn stations for the collection of mesozooplankton samples (Table 1). A bongo (double) net frame was deployed from the JCR's forward Effer crane by Martin Bowing (Thanks Martin). The nets used had 0.57m diameter openings and carried 2 WP-2 nets with 200 µm nylon mesh, fitted with cod ends with 200 µm mesh windows. Nets were deployed to a depth of 200 m and then hauled at a rate of 12.5 m min^{-1}, providing duplicate samples, integrated between 200m and the surface. The samples were collected into buckets and the cod ends were also rinsed into the buckets. Each duplicate sample was then passed through a 200 µm sieve and the material retained on the sieve was then washed into a 100 mL plastic bottle containing 10 mL of 37% borax-buffered formaldehyde (4% final concentration) using Milli-Q water. Samples were then stored at 4^{o}C for analysis on return to the UK. Back in the UK, samples will be analysed using a Line scanning Zooplankton Analyser (LiZA) to provide information on taxonomic composition, size distribution and abundance.

Table 1: Details of bongo WP-2 net vertical deployments

DATE	Day of year	STATION	TIME on deck (GMT)	LAT +N, -S	LONG E	Preserved sample name
28-Sep	271	5	04:59	46.39	-10.98	ZPV_JR303_001_271A/B
29-Sep	272	7	04:41	44.09	-14.92	ZPV_JR303_002_272A/B
30-Sep	273	9	04:31	41.77	-18.76	ZPV_JR303_003_273A/B
01-Oct	274	11	04:31	39.40	-22.46	ZPV_JR303_004_274A/B
03-Oct	276	14	04:33	34.56	-26.61	ZPV_JR303_005_276A/B
04-Oct	277	17	04:32	31.30	-27.70	ZPV_JR303_006_277A/B
05-Oct	278	19	05:36	27.50	-28.86	ZPV_JR303_007_278A/B
06-Oct	279	22	05:32	24.06	-29.88	ZPV_JR303_008_279A/B
07-Oct	280	24	05:32	20.45	-29.25	ZPV_JR303_009_280A/B
08-Oct	281	27	05:35	17.83	-28.68	ZPV_JR303_010_281A/B
09-Oct	282	29	05:36	14.22	-27.91	ZPV_JR303_011_282A/B
10-Oct	283	32	05:43	10.76	-27.20	ZPV_JR303_012_283A/B

11-Oct	284	34	05:34	7.28	-26.51	ZPV_JR303_013_284A/B
12-Oct	285	37	05:33	3.78	-25.77	ZPV_JR303_014_285A/B
13-Oct	286	40	06:05	0.00	-25.00	ZPV_JR303_015_286A/B
14-Oct	287	41	05:32	-3.90	-25.00	ZPV_JR303_016_287A/B
15-Oct	288	44	05:29	-7.48	-25.01	ZPV_JR303_017_288A/B
16-Oct	289	47	05:32	-11.00	-25.02	ZPV_JR303_018_289A/B
17-Oct	290	50	05:29	-14.67	-25.07	ZPV_JR303_019_290A/B
18-Oct	291	53	05:32	-18.32	-25.06	ZPV_JR303_020_291A/B
20-Oct	293	55	05:30	-20.86	-25.05	ZPV_JR303_021_293A/B
21-Oct	294	58	05:30	-24.43	-25.04	ZPV_JR303_022_294A/B
22-Oct	295	61	05:33	-27.75	-25.03	ZPV_JR303_023_295A/B
23-Oct	296	64	06:31	-31.36	-26.10	ZPV_JR303_024_296A/B
25-Oct	298	70	06:21	-37.98	-28.78	ZPV_JR303_025_298A/B
29-Oct	302	79	06:34	-44.63	-40.73	ZPV_JR303_026_302A/B
01-Nov	305	84	07:27	-49.58	-53.07	ZPV_JR303_027_305A/B

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Zooplankton Ecology

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Several teams on board were collaborating on research in zooplankton ecology, with three distinct projects ongoing. We include information on all related projects here.

(1) Evolutionary Ecology: Introduction and Objectives. [Goetze, Burridge]

A few of the primary goals of the AMT programme are to provide a means to assess biodiversity trends in relation to environmental change, improve our understanding of the structure and functioning of marine ecosystems, and understand the impact of climate change on the ocean. Our research is related to these efforts in that 1) we aim to assess biodiversity (both at specific and genetic levels) of several important components of pelagic foodwebs (copepods, chaetognaths and pteropods), and 2) the ability of zooplankton to respond to future changes in the ocean depends on the genetic structure of populations over space and time.

Our primary research objectives on this cruise were to obtain material for studies in:

1. Population genetic structure and gene flow at basin spatial scales in key zooplankton taxa,
2. Assess temporal stability in spatial genetic patterns by repeat transect sampling on AMT,
3. Test hypotheses about mechanisms that underlie genetic breaks known to occur across the equatorial upwelling zone in a number of key zooplankton species,
4. Assess species boundaries and adaptive potential of pteropods, with regards to ocean acidification
5. Determine if there are community-wide patterns in the spatial distribution of genetic variation in the holozooplankton, through comparative community-wide genetic studies.

We also collected material for community metagenetic sequencing of the adult mesozooplankton community.

(2) Copepod Gut Microflora Analysis: Introduction and Objectives. [Cregeen, Zubkov]

Microbial populations in the pelagic environment are pivotal to global biogeochemical cycling as major producers and degraders of organic matter in the oceans. Copepods modify organic matter in the water column through feeding, which makes it more accessible to other organisms. Additionally, they are pronounced vertical migrators and can thus aid in the transfer of organic matter from the surface to deeper waters. The usually nutrient-poor, open ocean pelagic environments present an interesting

study site for microbial communities associated with nutrient rich habitats such as those found in copepod digestive tracts.

(3) Nauplii Diversity, Distribution, and Community Structure: Introduction and Objectives. [Jungbluth]

Copepods are often the most abundant zooplanktonic organisms in marine ecosystems around the world. Copepod nauplii alone contribute 30-70% of copepod abundance, while contributing up to 10% of biomass. Despite their low contribution to biomass, nauplii can be important components of pelagic food webs as both grazers and prey. To obtain better understanding of the role of copepod nauplii in oceanic ecosystems, we aim to determine 1) whether copepod nauplii have higher abundance in resource-rich features of the water column, which would increase the localized grazing impact of the naupliar community, 2) if certain species dominate in these regions of higher abundance, resulting in some species having a higher contribution to total grazing impact, and 3) how naupliar species composition, abundance, and depth distribution differ across a range of ocean ecosystems. To date, no work has been published describing both the species composition and depth distribution of nauplii in a diverse open ocean environment.

Methods

Sample collection. Mesozooplankton samples were collected with 0.71m- diameter bongo nets (200 µm), and with an RMT1 midwater trawl (333 µm) that has a nominal mouth area of $1m^2$. A total of 47 mesozooplankton tows were conducted along the cruise leg (Table 1), with 45 tows conducted using the bongo and 2 samples collected with the RMT net. The bongo tows were oblique tows that sampled from between 401 to 70 m depth and the surface: The average maximum depth of tow for quantitative bongo tows was 305 m (CalBOBL). The bongo samples will be used for quantitative estimates of animal abundance along the cruise leg (target species only); tows were conducted with a time-depth-recorder attached and a General Oceanics flowmeter mounted in the mouth of one net. The RMT tows also were oblique tows that sampled to between 1218 m maximum depth and the surface. All tows were conducted at night, in order to efficiently sample the migratory community.

Samples of naupliar abundance and vertical distribution were taken with 20 L CTD Niskin bottles at each noon station. The sampling targeted features in the water column including the deep chlorophyll maximum (DCM), the mixed layer (ML), points in between (e.g., base of the mixed layer), and plankton thin layers observed on the SimRad EK60 in real time. These samples will be used for estimates of abundance, stage distribution, and diversity of nauplii in each depth sampled. DNA barcoding of individual nauplii will be used to determine species composition of the community across depth and latitude. Every other day, additional samples were collected from the ML and DCM for autotrophic and heterotrophic nano- and microplankton, ciliate abundance, and picoplankton abundance. Nauplii also were collected by net tows at the noon stations with a 60 µm mesh, 1 m diameter plankton net (5m length) with a filtering cod end (60 µm mesh). Vertical tows sampled from 200 m to the surface, and a General Oceanics flowmeter also was mounted in the mouth of this net.

Sample handling and preservation.
Evolutionary Ecology. Zooplankton from one net was preserved immediately in 100% ethyl alcohol for use in molecular studies (quantitative split, 2 x 50%), including DNA sequencing and microsatellite genotyping (and possibly RAD tag sequencing), in addition to estimates of abundance of target species. A quantitative split of the second net material was size-fractionated at 0.2 mm, 0.5 mm, 1 mm, 2 mm, and > 5 mm and preserved in RNALater for community metagenetic or metagenomic sequencing. Another quantitative fraction of net 2 material was sorted live immediately following collection, and animals were individually identified, and preserved in RNALater or cryopreserved (copepods, pteropods, heteropods, chaetognaths). These animals will be used for molecular, genomic and transcriptomic analyses. In total, over 20,000 animals from > 40 target species were individually sorted and preserved. Following live sorting, the remaining plankton was preserved either in 5% buffered formalin or 100% ethyl alcohol for morphological studies. Alice Burridge also sorted all ETOH preserved material for pteropods while onboard, and leaves the ship with a complete dataset of pteropod species abundance and distribution across the entire AMT24 transect.

Copepod Gut Microflora. Copepods from the genus *Pleuromamma* and *Euchaeta* were picked from the bulk zooplankton net tow samples and sorted by species. Samples were then fixed either for

Fluorescence *in* situ hybridisation (FISH) or stable isotope analysis. For FISH samples for fixed in 2% paraformaldehyde in filtered seawater either overnight at 4 °C or for 6h at room temperature. They were then washed twice in filtered seawater water for 1h, once in 30% ethanol for 1h and finally transferred into 50% ethanol. The samples are stored at 4 °C until further processing. For stable isotope analysis samples were frozen at -80 °C and stored there until further analysis. Samples will be further analyzed at the National Oceanography Centre, Southampton, within the next 12 months.

Naupliar Community Structure. Nauplii were recovered from CTD seawater samples by filtering onto a 20 µm Nitex mesh sieve, with preservation in ETOH and storage at -80 °C. These samples will be analyzed for total abundance, stage distribution, and DNA barcoding to assess species composition across depth. Plankton recovered from tows of the 60 µm net was size-fractionated to remove > 200 µm organisms. This larger material was preserved in ETOH or quantitatively split and preserved in ETOH and RNALater (50% splits). The 60-200 µm fraction was quantitatively split, with 50% preserved in RNALater for metagenetic or metagenomic analysis, a 25% split also preserved in RNALater, and a 25% split analyzed by FlowCAM for naupliar abundance and biomass (Zubkov group instrument and protocols).
Experiments. Eleven egg production experiments were conducted on target copepod species *Haloptilus longicornis*, *Pleuromamma xiphias*, and *Pleuromamma abdominalis*. These experiments were conducted in 6-well sterile plates, with or without towers attached to extend seawater volume, depending on adult female body size. All dishes were checked for new eggs at 12 and/or 24-hours: At the end of each experiment, all females and nauplii were preserved for use in studies of mating dynamics in these species. Experiments also were conducted on pteropods to assess calcification rates. Different species of pteropods, mainly *Heliconoides inflata* and *Limacina helicina*, were used for shell growth experiments by culturing them under natural conditions in calcein-stained water for 26 – 48 hrs. Additional animals were preserved in RNALater for transcriptomic studies.

Science outreach. The zooplankton team ran an online blog about zooplankton ecology and the AMT24 cruise (www.atlanticplankton.wordpress.com). Erica, Michelle and Alice contributed posts about their work and experience, and Katja Peijnenburg and Pia Drent contributed as collaborators with illustrations and by posting for us while at sea (Katja was the administrator). The blog was posted on the Journal of Plankton Research facebook page (thanks to R. Harris), as well as the SOEST facebook page. Alice also wrote a personal blog (in Dutch) about her scientific activities and general experiences at the JCR (http://www.alicesadventuresunderwater.wordpress.com). In early 2015 she will give an interactive science talk at Naturalis Biodiversity Center, targeting a general audience including schoolchildren.

Table 1. List of all bongo and RMT tows conducted during AMT24. Time is local time, CalBOBL indicates bongo oblique tows (quantitative tows), and RMT1 tows used the midwater trawl. Live bongo tows were non-quantative tows used to collect animals for experiments and live sorting for other purposes (individual preservation). Latitude and longitude were recorded at the start of each tow.

	Station	Latitude	Longitude	Date	Tow Type	Start Time	End Time
1	ZPT_JR303_001	46° 22.683 N	10° 57.801 W	9/28/14	CALBOBL	2:58	3:54
2	ZPT_JR303_002	44° 05.228 N	14° 53.916 W	9/29/14	CALBOBL	3:00	3:53
3	ZPT_JR303_003	41° 46.1273 N	18° 44.2327 W	9/30/14	CALBOBL	2:56	3:45
4	ZPT_JR303_004	39° 24.6196 N	22° 28.6135 W	10/1/14	CALBOBL	2:55	3:43
5	ZPT_JR303_005	34° 44.991 N	26° 37.0633 W	10/3/14	CALBOBL	2:55	3:44
6	ZPT_JR303_006A	31° 52.2808 N	27° 33.1582 W	10/3/14	live bongo	22:58	23:22
7	ZPT_JR303_006	31° 17.998 N	27° 43.657 W	10/4/14	CALBOBL	2:56	3:44
8	ZPT_JR303_007	27° 29.951 N	28° 53.333 W	10/5/14	CALBOBL	2:58	3:46
9	ZPT_JR303_008A	24° 37.307 N	29° 44.774 W	10/6/14	live bongo	22:45	23:19
10	ZPT_JR303_008	24° 03.390 N	29° 54.489 W	10/6/14	CALBOBL	2:59	3:48
11	ZPT_JR303_009	20° 26.730 N	29° 16.250 W	10/7/14	CALBOBL	2:55	3:45
12	ZPT_JR303_010A	18° 19.88 N	28° 48.465 W	10/7/14	live bongo	23:07	23:32
13	ZPT_JR303_010	17° 49.3530 N	28° 41.9846 W	10/8/14	CALBOBL	2:59	3:48
14	ZPT_JR303_011	14° 12.3774 N	27° 55.7259 W	10/9/14	CALBOBL	2:59	3:48
15	ZPT_JR303_012A	11° 22.186 N	27° 19.942 W	10/9/14	live bongo	22:59	23:16
16	ZPT_JR303_012	10° 46.8399 N	27° 12.3512 W	10/10/14	CALBOBL	3:03	3:52
17	ZPT_JR303_013	7° 17.1336 N	26° 29.5001 W	10/11/14	CALBOBL	2:59	3:49
18	ZPT_JR303_014A	4° 24.6678 N	25° 54.2126 W	10/11/14	live bongo	22:58	23:17
19	ZPT_JR303_014	3° 48.233 N	25° 46.639 W	10/12/14	CALBOBL	2:58	3:48
20	ZPT_JR303_015	0° 04.8941 N	25° 00.9156 W	10/13/14	CALBOBL	2:57	3:47
21	ZPT_JR303_016	3° 53.199 S	25° 01.53 W	10/14/14	CALBOBL	3:00	3:50
22	ZPT_JR303_017A	6° 51.342 S	25° 01.6719 W	10/14/14	live bongo	22:56	23:17
23	ZPT_JR303_017	7° 28.2627 S	25° 07.2117 W	10/15/14	CALBOBL	2:55	3:45
24	ZPT_JR303_018A	10° 26.3 S	25° 02.836 W	10/15/14	live bongo	22:59	23:15
25	ZPT_JR303_018	11° 02.3303 S	25° 02.7162 W	10/16/14	CALBOBL	2:57	3:47

26	ZPT_JR303_019A	14° 02.5005 S	25° 04.0980 W	10/16/14	live bongo	22:57	23:19
27	ZPT_JR303_019	14° 39.544 S	25° 04.448 W	10/17/14	CALBOBL	2:56	3:46
28	ZPT_JR303_020A	17° 41.31 S	25° 05.523 W	10/17/14	live bongo	22:56	23:17
29	ZPT_JR303_020	18° 18.9835 S	25° 05.4257 W	10/18/14	CALBOBL	3:02	3:51
30	ZPT_JR303_021	20° 51.313 S	25° 04.677 W	10/20/14	CALBOBL	2:57	3:46
31	ZPT_JR303_022A	23° 51.240 S	25° 02.586 W	10/20/14	CALBOBL	22:55	n.r.
32	ZPT_JR303_022	24° 27.4443 S	25° 02.5063 W	10/21/14	CALBOBL	2:59	3:49
33	ZPT_JR303_023A	27° 08.0134 S	25° 00.0557 W	10/21/14	live bongo	22:59	23:21
34	ZPT_JR303_023	27° 45.660 S	25° 00.625 W	10/22/14	CALBOBL	3:01	3:51
35	ZPT_JR303_024A	30° 35.9 S	25° 48.311 W	10/22/14	live bongo	22:59	23:21
36	ZPT_JR303_024	31° 20.4147 S	26° 06.0235 W	10/23/14	CALBOBL	2:58	3:47
37	ZPT_JR303_025A	34° 11.0843 S	27° 12.4312 W	10/23/14	live bongo	22:58	23:20
38	ZPT_JR303_025	34° 10.857 S	27° 13.126 W	10/24/14	CALBOBL	2:57	3:32
39	ZPT_JR303_026A	37° 19.5333 S	28° 28.980 W	10/24/14	live bongo	23:02	n.r.
40	ZPT_JR303_026	37° 53.5626 S	28° 44.2004 W	10/25/14	CALBOBL	3:04	3:54
41	ZPT_JR303_027	40° 07.0035 S	30° 54.8200 W	10/26/14	CALBOBL	3:03	3:52
42	RMT1_JR303_01	41° 24.551 S	33° 38.292 W	10/26/14	RMT	23:04	1:38
43	ZPT_JR303_028	41° 28.648 S	33° 51.519 W	10/27/14	CALBOBL	2:59	3:48
44	ZPT_JR303_029	43° 01.199 S	37° 08.204 W	10/28/14	CALBOBL	3:00	3:49
45	ZPT_JR303_030	44° 37.427 S	40° 41.519 W	10/29/14	CALBOBL	3:00	3:49
46	RMT1_JR303_02	46° 05.413 S	44° 02.858 W	10/29/14	RMT	22:59	1:49
47	ZPT_JR303_031	46° 05.339 S	44° 11.762 W	10/30/14	CALBOBL	2:57	3:46

Table 2. List of all naupliar net tows conducted during AMT24. Time is local time, and latitude and longitude were recorded at the start of each tow.

	Station	Latitude	Longitude	Date	Start Time	End Time
1	NAU-JR303_001	47° 11.182 N	8° 49.53 W	9/26/14	12:06	12:39
2	NAU-JR303_002	47° 34.0311 N	8° 30.2926 W	9/27/14	13:10	13:30
3	NAU-JR303_003	45° 30.124 N	12° 29.371 W	9/28/14	13:24	13:50
4	NAU-JR303_004	43° 10.2156 N	16° 25.6105 W	9/29/14	13:15	13:40
5	NAU-JR303_005	40° 50.5337 N	20° 12.8915 W	9/30/14	13:17	13:36
6	NAU-JR303_006	38° 29.7579 N	23° 53.5054 W	10/1/14	13:14	13:35
7	NAU-JR303_007	36° 57.0277 N	25° 54.6441 W	10/2/14	13:10	13:31
8	NAU-JR303_008	33° 21.2313 N	27° 05.0728 W	10/3/14	13:14	13:35
9	NAU-JR303_009	29° 53.9194 N	28° 09.9120 W	10/4/14	13:17	13:33
10	NAU-JR303_010	26° 06.3498 N	29° 18.3141 W	10/5/14	13:17	13:38
11	NAU-JR303_011	22° 39.5260 N	29° 51.9854 W	10/6/14	13:15	13:35
12	NAU-JR303_012	19° 51.3242 N	29° 08.4371 W	10/7/14	13:16	13:37
13	NAU-JR303_013	16° 26.1649 N	28° 24.2905 W	10/8/14	13:12	13:33
14	NAU-JR303_014	12° 50.6365 N	27° 38.8267 W	10/9/14	13:15	13:36
15	NAU-JR303_015	9° 22.1016 N	26° 55.2588 W	10/10/14	13:20	13:40
16	NAU-JR303_016	5° 53.9474 N	26° 12.2774 W	10/11/14	13:22	13:46
17	NAU-JR303_017	2° 22.5491 N	25° 29.1733 W	10/12/14	13:32	13:53
18	NAU-JR303_018	5° 19.3411 S	25° 01.5730 W	10/14/14	13:14	13:37
19	NAU-JR303_019	8° 54.6725 S	25° 02.5586 W	10/15/14	13:21	13:43
20	NAU-JR303_020	12° 29.6856 S	25° 03.9180 W	10/16/14	13:14	13:35
21	NAU-JR303_021	16° 07.8922 S	25° 05.0685 W	10/17/14	13:10	13:31
22	NAU-JR303_022	22° 18.9844 S	25° 03.6114 W	10/20/14	13:13	13:34
23	NAU-JR303_023	25° 35.6842 S	25° 02.1444 W	10/21/14	13:12	13:34
24	NAU-JR303_024	29° 09.2390 S	25° 16.5373 W	10/22/14	13:10	13:33
25	NAU-JR303_025	32° 42.9935 S	26° 37.9111 W	10/23/14	13:11	13:32
26	NAU-JR303_026	35° 47.798 S	27° 52.496 W	10/24/14	13:12	Aborted

27	NAU-JR303_027	40° 41.126 S	32° 06.198 W	10/26/14	13:15	13:36
28	NAU-JR303_028	43° 35.233 S	38° 23.348 W	10/28/14	13:13	13:31
29	NAU-JR303_029	45° 17.248 S	42° 11.902 W	10/29/14	13:11	13:37

Appendices

NMFSS CTD Operations Report

JOHN WYNAR

Sensors & Moorings Group

National Marine Facilities Division

National Oceanography Centre, Southampton

CTD System Configuration

For the sensor configurations for both the stainless and titanium frames, see Sensor Information sheets.

CTD Operations

There were 70 individual CTD casts made including test casts. Cast 2 comprises of the down-cast (2) and the up-cast (2a) due to a technical problem. Only cast 23 was made with the Ti frame and that was a deep cast to over 4500m to test an acoustic release. Log sheets were scanned and included with the data from this cruise.

The pressure sensor was located 18cm below the bottom and approximately 70cm below the centre of the 20L water sampling bottles.

The configuration file used for the stainless frame was JR303_St_1.xmlcon (see Appendix 1) and for the Ti frame it was JR303_Ti_1.xmlcon.

Sensor Failures: Stainless Frame

After the first few casts it became apparent that the two conductivity sensors were not in agreement but it was impossible to know which one was malfunctioning. C2 (s/n: 3491) had some spiky data so was swopped out after cast 3 to s/n: 4090. However, this made no difference so after cast 4, C1 (s/n: 1913) was changed to s/n: 3491. The difference in conductivity readings between the two sensors was then within tolerance.

Two user-supplied BBRTD backscatter sensors were installed as part of the sensor package. One in channel V0 and the other was self-logging (see G Dall'Olmo, PML for more details).

Data Processing

CTD cast data was post-processed according to guidelines established with BODC (ref. Moncoiffe 7th July 2010) by the data manager Mr R. Thomas.

Salinity measurement

A Guildline Autosal 8400B salinometer, s/n: 65763, was used for salinity measurements. The salinometer was set up in the Bio lab. Due to wide variations in ambient temperature, the bath temperature was altered from 24C to 21C towards the end of the cruise. A bespoke program written in Labview called “Autosal” was used as the data recording program for salinity values.

TRDI LADCP Configuration

The TRDI WHM 300kHz LADCP was s/n: 14897 on the SS frame and s/n: 10607 on the Ti frame. In both cases they were deployed in a downward-looking orientation on the CTD frame. Battery voltage could be monitored as the cable was not diode protected. The instrument was configured to ping at intervals of 1.3 seconds; use 25 bins and a depth cell size of 8m thus yielding a range of approximately 200m in ideal conditions. The ambiguity velocity was set to 400 cms^{-1} and pings per ensemble to 1.

Built-in pre-deployment tests *(PA and PT200)* were run before each cast, and then the following command file sent *(F2)*:

Master command file (JCR303_ladcp)

>CR1

[Parameters set to FACTORY defaults]

>RN J303M

>WM15

>TC2

>LP1

>TB 00:00:02.80

>TP 00:00.00

>TE 00:00:01.30

>LN25

>LS0800

>LF0

>LW1

>LV400

>SM1

>SA011

>SB0 Writing Channel B Break State [DISABLED].

>SW5500

>SI0

>EZ0011101

>EX00100

>CF11101

>CK

[Parameters saved as USER defaults]

>CS

Deployment Comments

Each deployment BBtalk terminal session was logged to a file (*F3)* of the form: *jr303_XXX.txt*, where *XXX* is the CTD cast number. Downloaded data files were re-named to be of the form: *J303MXXX.000*.

The real-time clock of the LADCP was checked prior to deployment *(TS?)* and re-synchronised with the ship's GPS clock if it was more than a few seconds in error. The time difference was written on the log sheet.

Paper log sheets were used for all casts, the LADCP file number being defined by the CTD cast number.

APPENDIX 1

Instrument configuration file: D:\Data\JR303\JR303_St_1.xmlcon

Configuration report for SBE 911plus/917plus CTD

Frequency channels suppressed : 0

Voltage words suppressed : 0

Computer interface : RS-232C

Deck unit : SBE11plus Firmware Version >= 5.0

Scans to average : 1

NMEA position data added : Yes

NMEA depth data added : No

NMEA time added : No

NMEA device connected to : PC

Surface PAR voltage added : No

Scan time added : No

1) Frequency 0, Temperature

Serial number : 5043

Calibrated on : 08-May-14

G : 4.34458521e-003

H : 6.34941286e-004

I : 2.13222683e-005

J : 1.94237092e-006

F0 : 1000.000

Slope : 1.00000000

Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 3491

Calibrated on : 23-Apr-14

G : -1.01229136e+001

H : 1.55948723e+000

I : -2.33469883e-003

J : 2.71941333e-004

CTcor : 3.2500e-006

CPcor : -9.57000000e-008

Slope : 1.00000000

Offset : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

Serial number : 0541

Calibrated on : 21-May-14

C1 : -4.398881e+004

C2 : -5.551403e-001

C3 : 1.279490e-002

D1 : 3.603000e-002

D2 : 0.000000e+000

T1 : 2.986716e+001

T2 : -5.274889e-004

T3 : 4.092900e-006

T4 : 1.616590e-009

T5 : 0.000000e+000

Slope : 0.99996543

Offset : -0.76726

AD590M : 1.288420e-002

AD590B : -8.230170e+000

4) Frequency 3, Temperature, 2

Serial number : 2307

Calibrated on : 07-May-14

G : 4.33439390e-003

H : 6.44457095e-004

I : 2.36511672e-005

J : 2.28085783e-006

F0 : 1000.000

Slope : 1.00000000

Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 4090

Calibrated on : 23-Apr-14

G : -1.00147173e+001

H : 1.25631897e+000

I : -2.13449312e-003

J : 2.10297733e-004

CTcor : 3.2500e-006

CPcor : -9.57000000e-008

Slope : 1.00000000

Offset : 0.00000

6) A/D voltage 0, Free

7) A/D voltage 1, Turbidity Meter, WET Labs, ECO-BB

Serial number : 849

Calibrated on :

ScaleFactor : 0.002218

Dark output : 0.063000

8) A/D voltage 2, Transmissometer, WET Labs C-Star

Serial number : CST1497DR

Calibrated on : 24-May-2014

M : 19.1957

B : -1.7276

Path length : 0.250

9) A/D voltage 3, Fluorometer, Chelsea Aqua 3

Serial number : 12-8513-001

Calibrated on : 9-5-2014

VB : 0.264700

V1 : 2.109100

Vacetone : 0.342200

Scale factor : 1.000000

Slope : 1.000000

Offset : 0.000000

10) A/D voltage 4, Free

11) A/D voltage 5, PAR/Irradiance, Biospherical/Licor

Serial number : 03

Calibrated on :

M : 0.44064700

B : 1.76388700

Calibration constant : 100000000000.00000000

Multiplier : 1.00000000

Offset : 0.00000000

12) A/D voltage 6, Oxygen, SBE 43

Serial number : 0620

Calibrated on : 02-May-14

Equation : Sea-Bird

Soc : 4.69050e-001

Offset : -5.27500e-001

A : -4.41680e-003

B : 2.35180e-004

C : -3.43040e-006

E : 3.60000e-002

Tau20 : 1.26000e+000

D1 : 1.92634e-004

D2 : -4.64803e-002

H1 : -3.30000e-002

H2 : 5.00000e+003

H3 : 1.45000e+003

13) A/D voltage 7, Altimeter

Serial number :

Calibrated on :

Scale factor : 15.000

Offset : 0.000

Scan length : 37

Instrument configuration file: D:\Data\JR303\JR303_Ti_1.xmlcon

Configuration report for SBE 911plus/917plus CTD

Frequency channels suppressed : 0

Voltage words suppressed : 0

Computer interface : RS-232C

Deck unit : SBE11plus Firmware Version >= 5.0

Scans to average : 1

NMEA position data added : Yes

NMEA depth data added : No

NMEA time added : No

NMEA device connected to : PC

Surface PAR voltage added : No

Scan time added : No

1) Frequency 0, Temperature

Serial number : 03P-4380

Calibrated on : 25 March 2014

G : 4.37240399e-003

H : 6.55676075e-004

I : 2.42393669e-005

J : 1.97966481e-006

F0 : 1000.000

Slope : 1.00000000

Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 04C-2165

Calibrated on : 15 May 2013

G : -9.76531600e+000

H : 1.34297701e+000

I : -2.31011748e-003

J : 2.22603230e-004

CTcor : 3.2500e-006

CPcor : -9.57000000e-008

Slope : 1.00000000

Offset : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

Serial number : 90074

Calibrated on : 21 May 2012

C1 : -6.571123e+004

C2 : 2.050504e-001

C3 : 1.612220e-002

D1 : 2.883800e-002

D2 : 0.000000e+000

T1 : 2.986693e+001

T2 : -2.678465e-004

T3 : 3.986390e-006

T4 : 7.472100e-010

T5 : 0.000000e+000

Slope : 0.99995000

Offset : 0.50600

AD590M : 1.283700e-002

AD590B : -8.642460e+000

4) Frequency 3, Temperature, 2

Serial number : 3P-4383

Calibrated on : 8 May 2013

G : 4.39870849e-003

H : 6.55464640e-004

I : 2.42630172e-005

J : 2.01809706e-006

F0 : 1000.000

Slope : 1.00000000

Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 04C-3272

Calibrated on : 15 May 2013

G : -9.77430177e+000

H : 1.27252533e+000

I : 8.30660812e-006

J : 6.12551325e-005

CTcor : 3.2500e-006

CPcor : -9.57000000e-008

Slope : 1.00000000

Offset : 0.00000

6) A/D voltage 0, Oxygen, SBE 43

Serial number : 43-2818

Calibrated on : 25 Feb 2014

Equation : Sea-Bird

Soc : 4.62400e-001

Offset : -5.02700e-001

A : -3.50950e-003

B : 1.87260e-004

C : -3.33720e-006

E : 3.60000e-002

Tau20 : 1.36000e+000

D1 : 1.92634e-004

D2 : -4.64803e-002

H1 : -3.30000e-002

H2 : 5.00000e+003

H3 : 1.45000e+003

7) A/D voltage 1, Free

8) A/D voltage 2, Transmissometer, Chelsea/Seatech

Serial number : 09-7107-001

Calibrated on : 11 June 2012

M : 23.6890

B : -0.1421

Path length : 0.250

9) A/D voltage 3, Fluorometer, Chelsea Aqua 3

Serial number : 088-163

Calibrated on : 6 Aug 2014

VB : 0.230300

V1 : 2.115100

Vacetone : 0.343000

Scale factor : 1.000000

Slope : 1.000000

Offset : 0.000000

10) A/D voltage 4, PAR/Irradiance, Biospherical/Licor

Serial number : 04

Calibrated on : 21 Nov 2013

M : 0.43427300

B : 1.61542400

Calibration constant : 1000000000000.00000000

Multiplier : 0.99950000

Offset : 0.00000000

11) A/D voltage 5, PAR/Irradiance, Biospherical/Licor, 2

Serial number : 02

Calibrated on : 7 May 2013

M : 0.47913900

B : 1.05925300

Calibration constant : 1000000000000.00000000

Multiplier : 0.99960000

Offset : 0.00000000

12) A/D voltage 6, Altimeter

Serial number :

Calibrated on :

Scale factor : 15.000

Offset : 0.000

13) A/D voltage 7, Free

Scan length : 37

Sensor Information

SHIP: RRS JAMES CLARK ROSS	CRUISE: JR303 (AMT24)

FORWARDING INSTRUCTIONS / ADDITIONAL INFORMATION: Titanium CTD (Spare frame for JR303)

Checked By: J Wynar	DATE: 1ST November 2014

Instrument / Sensor	Manufacturer/ Model	Serial Number	Channel	Casts Used
Primary CTD deck unit	SBE 11plus	11P	n/a	Primary CTD deck unit
Secondary CTD deck unit	SBE 11plus	11P-24680-0587	n/a	Secondary CTD deck unit
CTD Underwater Unit	SBE 9plus	09P-34173-0758T	n/a	23
Titanium 24-way frame	NOCS	SBE CTD TITA2	n/a	23
Digiquartz Pressure sensor	Paroscientific	79501	F2	23
Primary Temperature Sensor	SBE 3P	3P-4380T	F0	23
Secondary Temperature Sensor	SBE 3P	3P-4383T	F3	23
Primary Conductivity Sensor	SBE 4C	4C-2165T	F1	23
Secondary Conductivity Sensor	SBE 4C	4C-3272 T	F4	23

24-way Carousel	SBE 32	32-34173-0493T	n/a	23
Primary Pump	SBE 5T	5T-7371	n/a	23
Secondary Pump	SBE 5T	5T-7514	n/a	23
Dissolved Oxygen Sensor	SBE 43	43-2818	V0	23
Free			V1	n/a
Transmissometer	CTG Alphatracka	09-7107-001	V2	23
Fluorimeter	CTG Aquatracka MKlll	088-163	V3	23
PAR (UWIRR)	Chelsea	04	V4	n/a
PAR (DWIRR)	Chelsea	02	V5	n/a
Free			V6	n/a
Altimeter	Benthos	47597	V7	23
LADCP battery pack (Titanium)	NOCS	WH008T	n/a	23
10L TMF Water Samplers	OTE	1 through 29	n/a	23
LADCP (Titanium)	TRDI WHM 300kHz	10607	n/a	23

Underway Sample Log

ID	Julian Day	Date and time (UT)	Lat (+ve N)	Lon (+ve E)	Flow rate (l)	TSG salinity	SST – hull (deg. C	Trans (volts)	Fluor (volts)	Bench Salinity		Chl-a (ug/l)	Comments
	268	25/09/2014 07:45											Underway switched on
AA	268	25/09/2014 18:11	48.9657	-6.1945	0.3455	35.4807	18.1510	0.86	0.98	-	-	0.13	
AB	269	26/09/2014 08:08	47.4299	-8.5738	0.5459	35.6893	19.5186	0.87	0.96	-	-	0.13	
AC	269	26/09/2014 16:01	47.3109	-8.6912	0.5404	35.6757	20.5533	0.87	0.95	-	-	0.12	
AD	269	26/09/2014 20:06	47.2172	-8.8146	0.5110	35.6868	19.8364	0.86	0.94	-	-	0.11	
AE	270	27/09/2014 03:21	47.3044	-8.7672	0.5038	35.6549	19.6567	0.87	0.95	500	35.6349	0.13	
AF	270	27/09/2014 08:17	47.5017	-8.6120	0.4793	35.6934	19.5773	0.87	0.95	501	35.6758	0.14	
AG	270	27/09/2014 15:56	47.5680	-8.7517	0.4678	35.6928	19.5762	0.86	0.94	502	35.6738	0.20	
AH	270	27/09/2014 20:09	47.1803	-9.5739	0.4492	35.5951	19.4179	0.87	0.94	503	35.5721	0.12	
AI	271	28/09/2014 09:05	45.9443	-11.7202	0.5394	35.5543	19.7992	0.87	0.93	504	35.5396	0.16	
AJ	271	28/09/2014 17:06	45.2310	-12.9516	0.5654	35.5980	19.8471	0.86	0.93	505	35.5776	0.13	
AK	271	28/09/2014 20:18	44.8631	-13.5852	0.5496	35.7322	20.3821	0.87	0.93	506	35.7390	-	
AL	272	29/09/2014 09:03	43.6237	-15.6766	0.4692	35.8087	20.3897	0.87	0.95	507	35.7908	0.09	
AM	272	29/09/2014 17:08	42.8884	-16.9042	0.6401	35.6544	20.3953	0.87	0.93	508	35.6378	0.10	
AN	272	29/09/2014 20:10	42.5322	-17.4851	0.5646	35.8727	20.7299	0.87	0.92	509	35.8541	0.08	
AO	273	30/09/2014 09:11	41.2761	-19.5273	0.5037	35.8400	20.4954	0.87	0.92	510	35.8190	0.10	
AP	273	30/09/2014 17:08	40.5504	-20.6903	0.5189	35.8810	20.8818	0.87	0.92	511	35.8646	0.07	
AQ	273	30/09/2014 20:10	40.1918	-21.2513	0.5155	35.8289	20.3767	0.87	0.92	512	35.8008	0.10	
AR	274	01/10/2014 09:11	38.9298	-23.2280	0.5193	36.1010	21.5067	0.87	0.91	513	36.0962	0.09	
AS	274	01/10/2014 17:08	38.2645	-24.2472	0.4809	36.0831	21.6105	0.87	0.91	514	36.0541	0.09	
AT	275	02/10/2014 17:12	36.4617	-26.0747	0.4013	36.3700	22.4867	0.88	0.91	515	36.3546	0.08	
AU	275	02/10/2014 20:21	35.9044	-26.2607	0.3953	36.3758	22.7650	0.88	0.91	516	36.3560	0.07	
AV	276	03/10/2014 09:11	34.0110	-26.8753	0.3278	36.8245	23.9649	0.88	0.92	517	36.7989	0.06	
AW	276	03/10/2014 17:01	32.9106	-27.2251	0.5716	36.7386	24.2953	0.88	0.91	518	36.7164	0.07	
AX	276	03/10/2014 20:09	32.3552	-27.4004	0.5775	36.8131	24.2354	0.88	0.91	519	36.7910	0.07	
AY	277	04/10/2014 09:06	30.5743	-27.9546	0.5835	37.0764	24.8229	0.88	0.91	520	37.0557	0.07	
AZ	277	04/10/2014 17:02	29.4340	-28.3012	0.5858	37.0755	25.7532	0.88	0.91	521	37.0521	0.05	
BA	277	04/10/2014 19:56	28.9164	-28.4667	0.6077	37.2392	26.4006	0.88	0.91	522	37.2154	0.05	
BB	278	05/10/2014 10:06	26.7848	-29.1072	0.5554	37.4992	26.6266	0.88	0.92	523	37.4735	0.05	
BC	278	05/10/2014 18:07	25.6445	-29.4449	0.5916	37.5069	26.7376	0.88	0.92	-	-	0.05	
BD	278	05/10/2014 21:12	25.0956	-29.6070	0.2829	37.3853	26.7748	0.70	0.91	-	-	0.06	
BE	279	06/10/2014 10:00	23.3664	-29.9532	0.5645	37.3401	26.4747	0.88	0.91	356	37.3597	0.07	
BF	279	06/10/2014 18:11	22.1712	-29.7340	0.5713	36.7893	26.7072	0.88	0.91	357	36.7660	0.08	
BG	279	06/10/2014 20:58	21.6777	-29.5804	0.5720	36.9065	26.8042	0.88	0.91	358	36.8841	0.08	
BH	280	07/10/2014 10:01	19.8553	-29.1406	0.5512	36.6197	26.8625	0.88	0.92	359	36.5960	0.09	
BI	280	07/10/2014 18:08	19.3776	-29.0374	0.5489	36.6264	27.1362	0.88	0.92	360	36.6018	0.08	
BJ	280	07/10/2014 21:03	18.8470	-28.9230	0.5742	36.5850	27.1561	0.88	0.93	361	36.5585	0.12	
BK	281	08/10/2014 10:06	17.1123	-28.5486	0.4800	36.6661	26.7974	0.88	0.93	362	36.6414	0.11	
BL	281	08/10/2014 18:07	15.9662	-28.3030	0.4846	36.3975	27.8098	0.87	0.92	363	36.3710	0.18	
BM	281	08/10/2014 21:10	15.4174	-28.1894	0.5696	36.3423	28.1258	0.87	0.92	364	36.3216	0.13	
BN	282	09/10/2014 10:04	13.5294	-27.7887	0.2402	36.1360	28.2033	0.87	0.92	365	36.1135	0.18	

BO	282	09/10/2014 18:09	12.3869	-27.5491	0.4458	35.8485	27.6603	0.87	0.93	366	35.8240	0.24
BP	282	09/10/2014 21:04	11.8774	-27.4436	0.3386	35.6481	27.2748	0.87	0.93	367	35.6273	0.17
BQ	283	10/10/2014 10:08	10.0582	-27.0631	0.4805	35.7266	28.4907	0.87	0.94	368	35.7021	0.19
BR	283	10/10/2014 18:12	9.0411	-26.8450	0.5251	35.5427	29.1763	0.87	0.93	369	35.5196	0.12
BS	283	10/10/2014 21:11	8.5038	-26.7427	0.5965	35.3772	28.9904	0.87	0.94	370	35.4262	0.05
BT	284	11/10/2014 10:09	6.5734	-26.3566	0.6276	35.4133	28.4944	0.88	0.94	371	35.2996	0.13
BU	284	11/10/2014 18:11	5.4320	-26.1235	0.4044	35.3198	28.2135	0.87	0.94	372	34.5325	0.13
BV	284	11/10/2014 21:08	4.9124	-26.0035	0.2126	35.4564	28.2732	0.83	0.95	373	35.4278	0.11
BW	285	12/10/2014 10:09	3.0532	-25.6213	0.5553	35.9844	27.1730	0.87	1.03	374	35.9641	0.13
BX	285	12/10/2014 18:14	1.9257	-25.3936	0.2826	35.9096	26.8263	0.87	0.95	375	35.9882	0.10
BY	285	12/10/2014 21:16	1.3391	-25.2727	0.4746	36.2253	26.3057	0.86	0.97	376	36.2045	0.11
BZ	286	13/10/2014 10:13	-0.6549	-25.0055	0.5601	36.1862	26.0603	0.86	0.97	377	36.1610	0.15
CA	287	14/10/2014 10:38	-4.7263	-25.0222	0.4445	36.2820	26.1307	0.86	0.98	378	36.2553	0.23
CB	287	14/10/2014 18:17	-5.8345	-25.0325	0.4224	36.2589	26.0892	0.86	0.99	379	36.2359	0.24
CC	287	14/10/2014 21:13	-6.3736	-25.0343	0.4212	36.2173	26.0220	0.86	1.00	956	36.1933	-
CD	288	15/10/2014 10:08	-8.2213	-25.0450	0.5835	36.4161	25.5786	0.86	0.98	957	36.3958	0.09
CE	288	15/10/2014 18:08	-9.3823	-25.0520	0.5585	36.3046	25.5330	0.86	0.98	958	36.2825	0.07
CF	288	15/10/2014 21:04	-9.9220	-25.0529	0.5050	36.5030	25.3589	0.86	0.98	959	36.4780	0.06
CG	289	16/10/2014 10:06	-11.7942	-25.0594	0.6267	36.5498	25.4345	0.86	0.97	960	36.5261	0.08
CH	289	16/10/2014 18:18	-13.0095	-25.0700	0.5000	36.6482	25.3125	0.86	0.97	961	36.6265	0.07
CI	289	16/10/2014 21:08	-13.5349	-25.0721	0.5359	36.7410	24.9799	0.86	0.97	962	36.7189	0.06
CJ	290	17/10/2014 10:08	-15.4277	-25.0823	0.5971	37.0622	24.4982	0.86	1.06	963	37.0407	0.05
CK	290	17/10/2014 18:10	-16.6428	-25.0904	0.5458	37.0589	23.7678	0.86	0.98	964	37.0363	0.03
CL	290	17/10/2014 21:01	-17.1649	-25.0923	0.5805	37.0692	23.6167	0.86	0.97	971	37.0480	0.02
CM	291	18/10/2014 10:12	-18.5503	-25.0970	0.5537	37.1247	23.4631	0.86	0.97	970	37.1022	0.04
CN	291	18/10/2014 18:07	-18.5624	-25.1296	0.5079	37.1300	23.6246	0.86	0.96	969	37.1071	0.03
CO	292	19/10/2014 09:38	-18.5500	-25.0954	0.5533	37.1125	23.4091	0.86	0.97	968	37.0913	0.05
CP	292	19/10/2014 19:46	-19.3603	-25.0895	0.5936	37.1620	23.4787	0.86	0.97	967	37.1405	0.04
CQ	293	20/10/2014 10:11	-21.6324	-25.0732	0.6480	36.9900	22.7205	0.86	0.97	966	36.9741	0.05
CR	293	20/10/2014 18:04	-22.7949	-25.0595	0.5144	36.9258	22.7730	0.86	0.97	965	36.9043	0.03
CS	293	20/10/2014 20:31	-23.2504	-25.0525	0.5712	36.9186	22.6702	0.86	0.96	972	36.8916	0.04
CT	294	21/10/2014 10:02	-25.1384	-25.0379	0.5010	36.6799	22.0670	0.86	0.96	973	36.6574	0.04
CU	294	21/10/2014 18:20	-26.1137	-25.0286	0.6198	36.6512	21.9324	0.86	0.95	974	36.6227	0.04
CV	294	21/10/2014 21:25	-26.6797	-25.0203	0.6171	36.4635	21.4332	0.86	0.95	975	36.4357	0.04
CW	295	22/10/2014 10:01	-28.4793	-25.0288	0.6099	36.1206	19.7404	0.86	0.96	976	36.0977	0.05
CX	295	22/10/2014 18:07	-29.5957	-25.4401	0.5223	35.9743	19.2927	0.86	0.96	977	35.9555	0.06
CY	295	22/10/2014 21:07	-30.1030	-25.6267	0.6130	35.9884	18.9124	0.86	0.96	978	35.9638	0.05
CZ	296	23/10/2014 11:05	-32.0565	-26.3750	0.5343	35.6974	17.7014	0.86	0.96	644	35.6773	0.07
DA	296	23/10/2014 19:08	-33.1944	-26.8161	0.5142	35.7518	17.5061	0.86	0.96	645	35.7363	0.06
DB	296	23/10/2014 22:18	-33.7501	-27.0329	0.5397	35.7491	17.1673	0.86	0.96	646	35.7290	0.09
DC	297	24/10/2014 11:17	-35.1735	-27.6465	0.4862	35.5489	16.0284	0.86	0.96	647	35.5282	0.20
DD	297	24/10/2014 19:02	-36.3078	-28.0764	0.4701	35.4157	14.8411	0.84	1.01	648	35.3963	0.40
DE	297	24/10/2014 22:10	-36.8650	-28.3030	0.4813	35.4771	14.2949	0.85	0.98	649	35.4532	0.55
DF	298	25/10/2014 11:03	-38.4687	-28.9715	0.5153	35.4496	13.9837	0.86	0.96	650	35.4304	0.22
DG	298	25/10/2014 19:02	-39.3820	-29.3637	0.4929	35.1515	13.0564	0.86	0.96	651	35.1315	0.29
DH	298	25/10/2014 21:58	-39.6111	-29.8414	0.4981	35.0842	12.7918	0.86	0.96	652	35.0666	0.33

DI	299	26/10/2014 11:08	-40.4081	-31.4918	0.4379	34.8697	12.0018	0.85	0.95	659	34.8523	0.38	
DJ	299	26/10/2014 19:04	-40.9142	-32.5804	0.5470	34.4291	9.3242	0.85	0.95	658	34.4134	0.33	
DK	299	26/10/2014 22:05	-41.1696	-33.1236	0.5903	34.8060	11.8576	0.85	0.96	657	34.7855	0.30	
DL	300	27/10/2014 11:12	-41.8110	-34.5081	0.6424	34.7740	11.8044	0.85	0.96	656	34.7554	0.45	
DM	300	27/10/2014 20:09	-42.3251	-35.6236	0.6706	34.4585	8.4654	0.85	0.94	655	34.7480	0.52	
DN	301	28/10/2014 11:04	-43.3067	-37.7543	0.5965	34.7714	10.7406	0.84	0.92	654	34.7487	0.45	
DO	301	28/10/2014 19:05	-43.8076	-38.8652	0.5568	34.6278	10.3549	0.83	0.97	660	34.6108	0.62	
DP	301	28/10/2014 21:57	-44.0400	-39.3846	0.5884	34.4671	8.7742	0.83	0.94	661	34.4511	0.52	
DQ	302	29/10/2014 11:05	-44.9685	-41.4708	0.4780	34.4858	9.4450	0.83	0.91	662	34.4747	0.34	
DR	302	29/10/2014 19:10	-45.5408	-42.7816	0.4783	34.4518	9.4005	0.82	0.93	663	34.4628	0.32	
DS	302	29/10/2014 22:01	-45.8211	-43.4119	0.2609	34.4571	9.3755	0.82	0.92	653	34.4427	0.33	
DT	303	30/10/2014 11:03	-46.3883	-44.8768	0.5423	34.4766	9.2612	0.83	0.90	664	34.4594	0.37	
DU	303	30/10/2014 18:58	-46.9551	-46.5007	0.5496	34.6617	9.3951	0.83	0.88	665	34.6390	0.47	
DV	303	30/10/2014 22:31	-47.2272	-47.2579	0.5452	34.5232	9.4359	0.83	0.90	666	34.5036	0.48	
DW	304	31/10/2014 05:49	-47.6236	-48.5851	0.5482	34.5077	9.2361	0.83	0.89	667	34.4907	0.48	
DX	304	31/10/2014 10:50	-47.9134	-49.4606	0.5808	34.5114	9.3494	0.82	0.86	-	-	0.43	
DY	304	31/10/2014 19:08	-48.5352	-50.9186	0.5649	34.0577	6.8360	0.82	0.87	-	-	0.40	
DZ	304	31/10/2014 22:06	-48.8270	-51.5015	0.5529	34.0311	6.1242	0.81	0.91	-	-	0.63	
EA	305	01/11/2014 11:50	-49.9144	-53.7821	0.5475	34.1143	5.1384	0.82	0.90	-	-	0.17	
EB	305	01/11/2014 18:37	-50.3785	-54.7853	0.5314	34.1212	5.3218	0.79	0.86	-	-	0.77	
	306	02/11/2014 11:00											Underway switched off

National Oceanography Centre

NATURAL ENVIRONMENT RESEARCH COUNCIL

SAG Mooring Servicing

Cruise JR303

RRS James Clark Ross

22nd September – 2nd November 2014

Technical Report

Compiled by: John Wynar

Sensors and Moorings

Technical Report No. 2014-JBWY

Sensors and Moorings Group

National Oceanography Centre

European Way

Southampton

SO14 3ZH

Mooring Operations Summary

Main objectives

a) To recover the mooring deployed on 9th May 2014 from the JCR (at position: 18° 33.387'S; 25° 05.456'W)
b) To deploy a sediment trap and current meter mooring to replace those mentioned in a) and b) above.
c) To recover the mooring deployed from JC079 (at position: 18° 31.785'S; 25° 06.133'W).

All times given below are local unless stated otherwise.

a) Recovery (18th October 2014)

Acoustic release, AR861; s/n: 283

Arm: 14BB

Diagnostic: Arm &1449

Release: Arm &1455

07:00 Arm and diagnostic command sent

Received range: 2565m; 5081m & vertical

07:07 Release command sent

Received release OK; range:1957m

Over the next hour or so inconsistent ranges were received. All sources of acoustic interference were turned off including periods when the thrusters were disabled but to no avail. Eventually a request was made for the vessel to re-position closer to the anchor release site.

08:47 Range: 3246m

08:50 Range: 3193m

08:54 Range: 3052m

These ranges were at least consistent and gave an ascent rate of around 30m/minute, considerably slower than expected.

09:00 Range: 2981m

09:08 Radio beacon transmission received

09:45 Billings float on deck

11:30 Recovery completed

On recovery it was observed that the lower buoyancy package had been damaged, probably imploded at depth. Six of the glass spheres were completely crushed and two more were shattered. This only left two remaining. This was the probable reason for the slow ascent rate of the mooring.

b) Deployment (19th October 2014)

Acoustic release, AR861; s/n: 1610

Arm: 0A67

Diagnostic: Arm & 0A49

Release: Arm & 0A55

Ping on: Arm & 0A47

Ping off: Arm & 0A48

06:44 Deployment start, recovery float away

09:03 850 kg anchor away

At position: 18° 33.35'S; 25° 05.54'W

Water depth: 5259m

Upper trap:	McLane 21 bottle; s/n: 12283-01
Upper current meter:	Nortek Aquadopp; s/n: 9972
Lower trap:	McLane 21 bottle; s/n: 12168-03
Lower current meter:	Nortek Aquadopp; s/n: 9979
CTD:	SeaBird 37SMP; s/n: 7300

The vessel moved off to position for the next mooring recovery before the anchor clump was settled on the sea floor. However, the ship did return later and triangulated the moorings position by taking ranges from three positions: (i) north-east, (ii) north-west, and (iii) south-west of the anchor release position. The final mooring position was calculated to be:

18° 32.70'S; 25° 05.75'W

c) Recovery (19th October 2014)

Acoustic release, AR861; s/n: 283

Arm:	14BB
Diagnostic:	Arm &1449
Release:	Arm &1455

09:54	Release command sent
	Received release OK; range: 5495m

Ranges received were consistent and gave an ascent rate of around 70m/minute.

10:39 Mooring observed on the surface

11:07 Mooring grappled

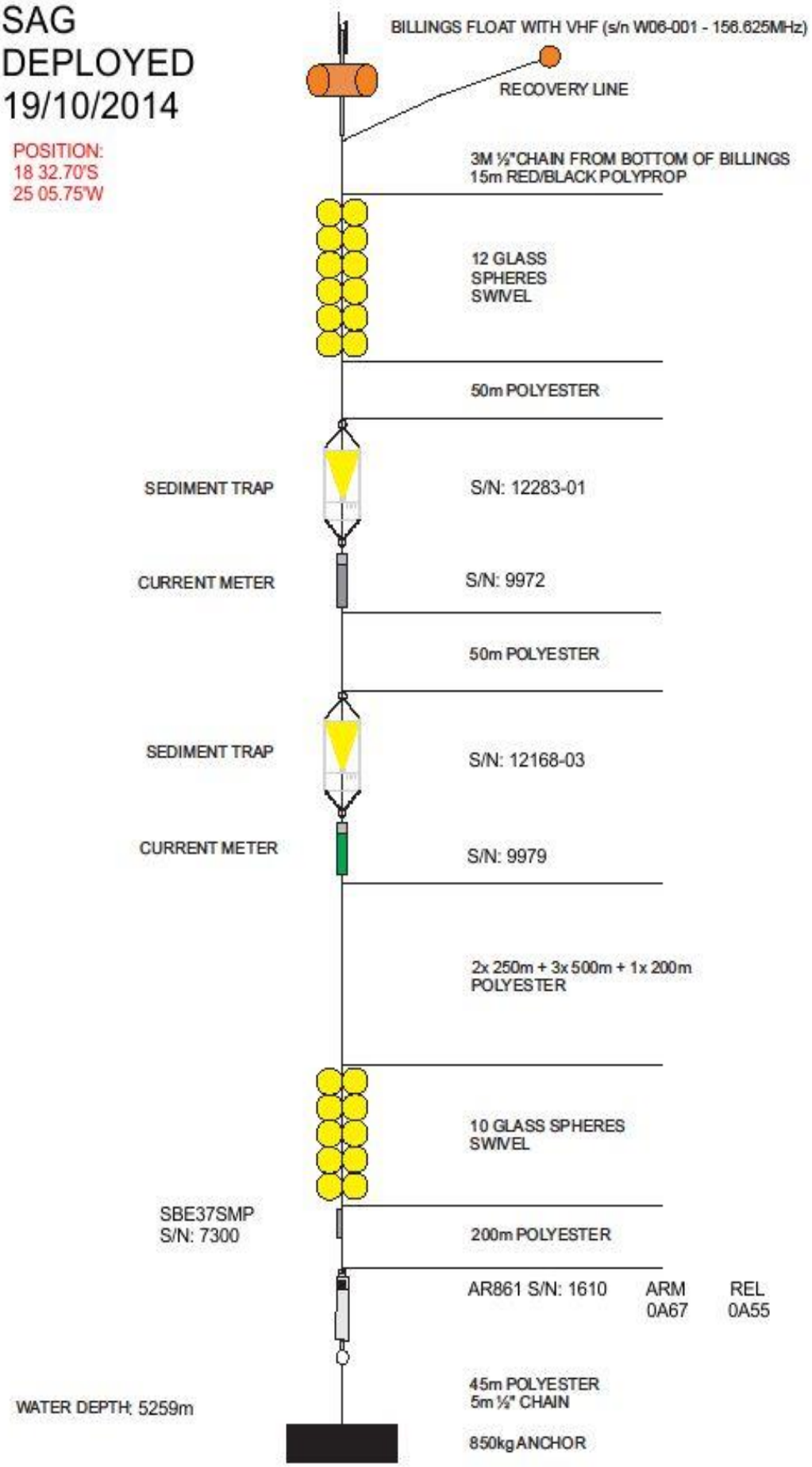
13:15 Recovery completed

Deck unit used throughout was Ixsea TT801, s/n: 010 and respective transducer; and acoustic module AM661, s/n: 054.

As no other winch was available, the starboard mooring winch was used for recovery and deployment.

SAG DEPLOYED 19/10/2014

POSITION:
18 32.70'S
25 05.75'W



JR303 AMT24 Event Log

Time	Event	Lat	Lon	Comment
25/09/2014 09:25	Station 1	49.83753	-4.7449	V/L man. onto DP
25/09/2014 09:32	Station 1	49.82897	-4.7564	V/L on DP in full auto pos hd 215
25/09/2014 09:40	GAR_JR303_001	49.82896	-4.7564	testing of garret screen commence
25/09/2014 09:55	GAR_JR303_001	49.829	-4.7565	testing of garret screen completed
25/09/2014 09:57	CTD_JR303_S001	49.829	-4.7565	CTD off deck
25/09/2014 09:59	CTD_JR303_S001	49.82896	-4.7564	CTD S001 deployed
25/09/2014 10:08	OPT_JR303_001	49.82898	-4.7564	Test Optic Rig off deck
25/09/2014 10:08	CTD_JR303_S001	49.82898	-4.7564	CTD S001 at depth 70m
25/09/2014 10:10	OPT_JR303_001	49.82898	-4.7564	Test Optic Rig deployed
25/09/2014 10:15	OPT_JR303_001	49.82898	-4.7564	Test Optic Rig at surface
25/09/2014 10:18	OPT_JR303_001	49.82898	-4.7564	Test Optic Rig on deck
25/09/2014 10:25	CTD_JR303_S001	49.82897	-4.7565	CTD at surface
25/09/2014 10:27	CTD_JR303_S001	49.82897	-4.7565	CTD S001 on deck
25/09/2014 13:08	Station 1	49.58649	-5.1631	V/l off DP
25/09/2014 13:13	Station 1	49.5763	-5.1804	V/l at passage speed
26/09/2014 02:49	Station 2	47.87333	-7.9278	Reducing speed for Station 2
26/09/2014 02:56	Station 2	47.86818	-7.9366	V/l on DP (Station 2) in full auto pos.
26/09/2014 03:06	OPT_JR303_002	47.86773	-7.9373	Optic Rig 002 off deck
26/09/2014 03:07	OPT_JR303_002	47.86773	-7.9372	Optic Rig 002 deployed
26/09/2014 03:15	CTD_JR303_S002	47.86775	-7.9372	CTD 002 off deck
26/09/2014 03:17	CTD_JR303_S002	47.86775	-7.9372	CTD 002 deployed
26/09/2014 03:25	GAR_JR303_002	47.86773	-7.9372	Commence Garrett Screen 002 sampling
26/09/2014 03:28	OPT_JR303_002	47.86773	-7.9372	Optic Rig 002 at the surface
26/09/2014 03:30	CTD_JR303_S002	47.86774	-7.9372	CTD 002 at depth. Wire out 400m. Commenced recovery.

26/09/2014 03:31	OPT_JR303_003	47.86775	-7.9372	Optic Rig 003 deployed
26/09/2014 03:49	GAR_JR303_002	47.86775	-7.9373	Completed Garrett Screen 002 sampling
26/09/2014 03:54	OPT_JR303_003	47.86774	-7.9373	Optic Rig 003 at the surface
26/09/2014 03:55	OPT_JR303_003	47.86774	-7.9373	Optic Rig 003 on deck
26/09/2014 03:57	CTD_JR303_S002	47.86773	-7.9372	CTD 002 at the surface
26/09/2014 03:59	CTD_JR303_S002	47.86773	-7.9372	CTD 002 on deck
26/09/2014 04:07	Station 2	47.86774	-7.9372	Gantry and deck secure
26/09/2014 04:14	Station 2	47.86149	-7.9483	Vessel at passage speed
26/09/2014 09:53	Station 3	47.18988	-8.8121	V/L man. onto DP station
26/09/2014 09:58	Station 3	47.18625	-8.8175	V/L on DP (Station 3) in full auto pos Hd 270
26/09/2014 10:07	CTD_JR303_S003	47.18633	-8.8175	CTD 003 off deck
26/09/2014 10:09	CTD_JR303_S003	47.18633	-8.8175	CTD 003 deployed
26/09/2014 10:25	GAR_JR303_003	47.18641	-8.8176	Commence Garrett Screen 003 sampling
26/09/2014 10:45	GAR_JR303_003	47.18637	-8.8176	Completed Garrett Screen 003 sampling
26/09/2014 11:04	NAU_JR303_001	47.18634	-8.8176	Nauplii net off the deck
26/09/2014 11:08	NAU_JR303_001	47.18637	-8.8176	Nauplii net 001 deployed
26/09/2014 11:17	NAU_JR303_001	47.18635	-8.8176	Nauplii net at depth 200m
26/09/2014 11:26	CTD_JR303_S003	47.18635	-8.8176	CTD at depth. Wire out 4395m
26/09/2014 11:41	NAU_JR303_001	47.18637	-8.8176	Nauplii net at the surface
26/09/2014 11:45	NAU_JR303_001	47.18637	-8.8176	Nauplii net 001 fully recovered
26/09/2014 12:01	OPT_JR303_004	47.18636	-8.8176	Optic Rig 004 deployed to 250m
26/09/2014 12:15	OPT_JR303_004	47.18638	-8.8176	Optic Rig 004 at the surface
26/09/2014 12:17	OPT_JR303_005	47.18637	-8.8176	Optic Rig 005 deployed
26/09/2014 12:31	OPT_JR303_005	47.18639	-8.8176	Optic Rig 005 at the surface
26/09/2014 12:34	OPT_JR303_005	47.18638	-8.8176	Optic Rig 005 fully recovered

26/09/2014 13:11	CTD_JR303_S003	47.18635	-8.8176	CTD at the surface
26/09/2014 13:14	CTD_JR303_S003	47.18635	-8.8176	CTD 003 on deck
26/09/2014 13:40	Station 3	47.18637	-8.8176	V/l off DP
27/09/2014 10:52	Station 4	47.56718	-8.5048	V/l on DP (Station 4) in full auto pos.
27/09/2014 12:03	OPT_JR303_006	47.56722	-8.5049	Optic Rig off deck
27/09/2014 12:04	OPT_JR303_006	47.56722	-8.5049	Optic Rig 006 deployed
27/09/2014 12:04	CTD_JR303_S004	47.56722	-8.5049	CTD off the deck
27/09/2014 12:04	GAR_JR303_004	47.56722	-8.5049	Commence Garrett Screen 004 sampling
27/09/2014 12:06	CTD_JR303_S004	47.56723	-8.5049	CTD 004 deployed
27/09/2014 12:11	NAU_JR303_002	47.56721	-8.5049	Nauplii net off the deck
27/09/2014 12:12	NAU_JR303_002	47.5672	-8.5049	Nauplii net 002 deployed
27/09/2014 12:19	CTD_JR303_S004	47.56719	-8.5049	CTD at depth. Wire out 500m
27/09/2014 12:21	GAR_JR303_004	47.56721	-8.5049	Completed Garrett screen 004 sampling
27/09/2014 12:26	OPT_JR303_006	47.56721	-8.5049	Optic Rig 006 at the surface
27/09/2014 12:27	OPT_JR303_007	47.56721	-8.5049	Optic Rig 007 deployed
27/09/2014 12:34	NAU_JR303_002	47.56721	-8.5049	Nauplii net at the surface
27/09/2014 12:37	NAU_JR303_002	47.56721	-8.5049	Nauplii net 002 fully recovered
27/09/2014 12:44	OPT_JR303_007	47.56722	-8.5049	Optic Rig 007 at the surface
27/09/2014 12:46	OPT_JR303_007	47.56721	-8.5049	Optic Rig 007 fully recovered
27/09/2014 12:46	CTD_JR303_S004	47.56721	-8.5049	CTD 004 at the surface
27/09/2014 12:48	CTD_JR303_S004	47.56722	-8.5049	CTD 004 fully recovered
27/09/2014 12:57	MPV_JR303_001	47.56721	-8.5048	Microplankton nets 001 deployed
27/09/2014 13:16	MPV_JR303_001	47.56719	-8.5049	Microplankton nets 001 recovered
27/09/2014 13:45	Station 4	47.56524	-8.5095	V/l off DP
27/09/2014 16:38	SWATH Trials	47.56814	-8.8378	Completed SWATH trials. Increasing to passage speed.

27/09/2014 16:43	SWATH Trials	47.56767	-8.8516	Vessel at passage speed
28/09/2014 02:47	Station 5	46.38322	-10.951	V/l reducing speed for Station 5
28/09/2014 02:54	Station 5	46.37756	-10.961	V/l on DP (Station 5)
28/09/2014 02:57	ZPT_JR303_001	46.3773	-10.962	Zooplankton nets off the deck
28/09/2014 03:01	ZPT_JR303_001	46.37786	-10.963	Zooplankton net tow 001 deployed
28/09/2014 03:57	ZPT_JR303_001	46.38721	-10.982	Zooplankton net at the surface
28/09/2014 04:00	ZPT_JR303_001	46.38752	-10.983	Zooplankton net 001 recovered
28/09/2014 04:20	OPT_JR303_008	46.38758	-10.983	Optic Rig 008 off the deck
28/09/2014 04:22	OPT_JR303_008	46.38758	-10.983	Optic Rig 008 deployed (Effer Crane starboard quarter)
28/09/2014 04:25	CTD_JR303_S005	46.38758	-10.983	CTD 005 off the deck
28/09/2014 04:27	CTD_JR303_S005	46.38758	-10.983	CTD 005 deployed
28/09/2014 04:29	GAR_JR303_005	46.38758	-10.983	Commenced Garrett Screen 005 sampling
28/09/2014 04:33	ZPV_JR303_001	46.38757	-10.983	Bongo Net 001 off the deck
28/09/2014 04:34	ZPV_JR303_001	46.38757	-10.983	Bongo Net 001 deployed (Science Crane starboard bow)
28/09/2014 04:44	OPT_JR303_008	46.38758	-10.983	Optic Rig 008 at the surface
28/09/2014 04:46	OPT_JR303_009	46.38758	-10.983	Optic Rig 009 deployed (Effer Crane starboard quarter)
28/09/2014 04:56	GAR_JR303_005	46.38755	-10.983	Completed Garrett screen 005 sampling
28/09/2014 05:00	ZPV_JR303_001	46.38758	-10.983	Bongo Nets 001 at the surface
28/09/2014 05:01	ZPV_JR303_001	46.38759	-10.983	Bongo Nets 001 on deck
28/09/2014 05:08	CTD_JR303_S005	46.38758	-10.983	CTD 005 at the surface
28/09/2014 05:08	OPT_JR303_009	46.38758	-10.983	Optic Rig 009 at the surface
28/09/2014 05:09	OPT_JR303_009	46.38758	-10.983	Optic Rig 009 on deck
28/09/2014 05:11	CTD_JR303_S005	46.38759	-10.983	CTD 005 on deck
28/09/2014 05:18	Station 5	46.38758	-10.983	Decks
28/09/2014 05:26	Station 5	46.38667	-10.996	Vessel at passage speed

28/09/2014 12:52	Station 6	45.50414	-12.48	Reducing speed for Station 6
28/09/2014 12:56	Station 6	45.50212	-12.488	V/l on DP (Station 6)
28/09/2014 13:01	OPT_JR303_010	45.50205	-12.49	Optic Rig off deck
28/09/2014 13:02	OPT_JR303_010	45.50204	-12.49	Optic Rig 010 deployed
28/09/2014 13:02	CTD_JR303_S006	45.50204	-12.49	CTD 006 deployed
28/09/2014 13:09	GAR_JR303_006	45.50204	-12.49	Commenced Garrett Screen 006 sampling
28/09/2014 13:11	GOF_JR303_001	45.50204	-12.49	Go-Flo 001 deployed
28/09/2014 13:14	GOF_JR303_001	45.50205	-12.49	Go-Flo bottle fired
28/09/2014 13:16	GOF_JR303_001	45.50205	-12.49	Go-Flo 001 recovered
28/09/2014 13:20	CTD_JR303_S006	45.50205	-12.49	CTD at depth. Wire out 500m
28/09/2014 13:24	OPT_JR303_010	45.50208	-12.49	Optic Rig 010 at the surface
28/09/2014 13:26	NAU_JR303_003	45.50207	-12.49	Nauplii net off the deck
28/09/2014 13:26	OPT_JR303_011	45.50207	-12.49	Optic Rig 011 deployed
28/09/2014 13:27	NAU_JR303_003	45.50207	-12.49	Nauplii net 003 deployed
28/09/2014 13:27	GAR_JR303_006	45.50207	-12.49	Completed Garrett screen 006 sampling
28/09/2014 13:42	GAR_JR303_006	45.50206	-12.49	Garret screen re-deployed for further sampling
28/09/2014 13:46	GAR_JR303_006	45.50206	-12.49	Completed Garrett screen 006 sampling
28/09/2014 13:49	CTD_JR303_S006	45.50204	-12.49	CTD 006 at the surface
28/09/2014 13:51	OPT_JR303_011	45.50203	-12.49	Optic Rig 011 recovered
28/09/2014 13:51	CTD_JR303_S006	45.50203	-12.49	CTD 006 on deck
28/09/2014 13:52	NAU_JR303_003	45.50203	-12.49	Nauplii net at the surface
28/09/2014 13:54	NAU_JR303_003	45.50203	-12.49	Nauplii net 003 fully recovered
28/09/2014 14:06	MPV_JR303_002	45.50205	-12.49	Microplankton nets 002 deployed
28/09/2014 14:32	MPV_JR303_002	45.50205	-12.49	Microplankton nets 002 recovered
28/09/2014 14:43	Station 6	45.41985	-12.635	V/l off DP

28/09/2014 14:49	Station 6	45.50259	-12.494	V/l at passage speed
29/09/2014 02:47	Station 7	44.09504	-14.88	Reducing speed for Station 7
29/09/2014 02:53	Station 7	44.08679	-14.894	V/l on DP (Station 7)
29/09/2014 03:00	ZPT_JR303_002	44.08668	-14.897	Zooplankton net tow off the deck
29/09/2014 03:02	ZPT_JR303_002	44.08687	-14.898	Zooplankton net tow 002 deployed
29/09/2014 03:56	ZPT_JR303_002	44.09312	-14.92	Zooplankton net at the surface
29/09/2014 03:58	ZPT_JR303_002	44.09332	-14.92	Zooplankton net 002 recovered
29/09/2014 04:07	OPT_JR303_012	44.09347	-14.921	Optic Rig 12 off the deck
29/09/2014 04:09	OPT_JR303_012	44.09347	-14.921	Optic Rig deployed (Effer Crane starboard quarter)
29/09/2014 04:09	CTD_JR303_S007	44.09347	-14.921	CTD 007 off the deck
29/09/2014 04:11	CTD_JR303_S007	44.09348	-14.921	CTD 007 deployed
29/09/2014 04:13	GAR_JR303_007	44.09348	-14.921	Commenced Garrett Screen 007 sampling
29/09/2014 04:15	ZPV_JR303_002	44.09349	-14.921	Bongo Net 002 off the deck
29/09/2014 04:16	ZPV_JR303_002	44.09348	-14.921	Bongo Nets 002 deployed (Science Crane starboard bow)
29/09/2014 04:22	CTD_JR303_S007	44.09347	-14.921	CTD 007 at depth. Wire out 500m. Commenced recovery
29/09/2014 04:31	OPT_JR303_012	44.09349	-14.921	Optic Rig 012 at the surface
29/09/2014 04:33	OPT_JR303_013	44.09349	-14.921	Optic Rig 013 deployed (Effer Crane starboard quarter)
29/09/2014 04:40	GAR_JR303_007	44.09344	-14.921	Completed Garrett Screen 007 sampling
29/09/2014 04:42	ZPV_JR303_002	44.09346	-14.921	Bongo Nets 002 at the surface
29/09/2014 04:44	ZPV_JR303_002	44.09346	-14.921	Bongo Nets 002 on deck
29/09/2014 04:51	CTD_JR303_S007	44.09344	-14.921	CTD 007 at the surface
29/09/2014 04:52	CTD_JR303_S007	44.09343	-14.921	CTD 007 on deck
29/09/2014 04:55	OPT_JR303_013	44.09346	-14.921	Optic Rig 013 at the surface
29/09/2014 04:56	OPT_JR303_013	44.09347	-14.921	Optic Rig 013 on deck
29/09/2014 05:02	Station 7	44.09347	-14.921	Decks

29/09/2014 05:09	Station 7	44.0935	-14.929	Vessel at passage speed
29/09/2014 12:50	Station 8	43.18116	-16.407	Reducing speed for Station 8
29/09/2014 12:56	Station 8	43.17085	-16.423	V/l on DP (Station 8)
29/09/2014 13:00	OPT_JR303_014	43.17025	-16.427	Optic Rig 14 off the deck
29/09/2014 13:01	OPT_JR303_014	43.17023	-16.427	Optic Rig 014 deployed
29/09/2014 13:04	CTD_JR303_S008	43.17022	-16.427	CTD 008 off the deck
29/09/2014 13:05	GOF_JR303_002	43.17025	-16.427	Go-Flo 002 deployed
29/09/2014 13:05	CTD_JR303_S008	43.17025	-16.427	CTD 008 deployed
29/09/2014 13:07	GAR_JR303_008	43.17025	-16.427	Commenced Garrett Screen 008 sampling
29/09/2014 13:08	GOF_JR303_002	43.17026	-16.427	Go-Flo 002 recovered
29/09/2014 13:16	NAU_JR303_004	43.1703	-16.427	Nauplii net off the deck
29/09/2014 13:17	NAU_JR303_004	43.1703	-16.427	Nauplii net 004 deployed
29/09/2014 13:22	CTD_JR303_S008	43.17028	-16.427	CTD at depth. Wire out 500m
29/09/2014 13:24	OPT_JR303_014	43.17026	-16.427	Optic Rig 014 recovered
29/09/2014 13:25	OPT_JR303_015	43.17026	-16.427	Optic Rig 015 deployed
29/09/2014 13:34	GAR_JR303_008	43.17029	-16.427	Completed Garrett screen 008 sampling
29/09/2014 13:43	NAU_JR303_004	43.17027	-16.427	Nauplii net at the surface
29/09/2014 13:45	NAU_JR303_004	43.17027	-16.427	Nauplii net 004 recovered
29/09/2014 13:49	OPT_JR303_015	43.17026	-16.427	Optic rig 15 at the surface
29/09/2014 13:50	CTD_JR303_S008	43.17027	-16.427	CTD 008 at the surface
29/09/2014 13:51	OPT_JR303_015	43.17028	-16.427	Optic Rig 015 recovered
29/09/2014 13:52	CTD_JR303_S008	43.17028	-16.427	CTD 008 fully recovered
29/09/2014 13:58	MPV_JR303_003	43.17025	-16.427	Microplankton nets 003 deployed
29/09/2014 14:26	MPV_JR303_003	43.17027	-16.427	Microplankton nets 003 recovered
29/09/2014 14:36	Station 8	43.17026	-16.427	V/l off DP

29/09/2014 14:42	Station 8	43.1703	-16.434	V/l at passage speed
30/09/2014 02:46	Station 9	41.77549	-18.717	Reducing speed for Station 9
30/09/2014 02:52	Station 9	41.76824	-18.731	V/l on DP (Station 9)
30/09/2014 02:56	ZPT_JR303_003	41.76837	-18.734	Zooplankton net tow off the deck
30/09/2014 02:58	ZPT_JR303_003	41.76839	-18.734	Zooplankton net tow 003 deployed
30/09/2014 03:47	ZPT_JR303_003	41.77133	-18.756	Zooplankton net at the surface
30/09/2014 03:49	ZPT_JR303_003	41.77144	-18.757	Zooplankton net 003 recovered. V/l stopped
30/09/2014 04:00	CTD_JR303_S009	41.77153	-18.757	CTD 009 off the deck
30/09/2014 04:01	CTD_JR303_S009	41.77154	-18.757	CTD 009 deployed
30/09/2014 04:01	OPT_JR303_016	41.77154	-18.757	Optic Rig 016 off the deck
30/09/2014 04:03	OPT_JR303_016	41.77153	-18.757	Optic Rig 016 deployed (EFFER Crane starboard quarter)
30/09/2014 04:05	GAR_JR303_009	41.77155	-18.757	Commenced Garrett Screen 009 sampling
30/09/2014 04:06	ZPV_JR303_003	41.77155	-18.757	Bongo Nets 003 off the deck
30/09/2014 04:07	ZPV_JR303_003	41.77154	-18.757	Bongo Nets 003 deployed (Science Crane starboard bow)
30/09/2014 04:13	CTD_JR303_S009	41.77153	-18.757	CTD 009 at depth. Wire out 500m. Commenced recovery
30/09/2014 04:26	OPT_JR303_016	41.77152	-18.757	Optic Rig 016 at the surface
30/09/2014 04:27	OPT_JR303_017	41.77152	-18.757	Optic Rig 017 deployed (EFFER Crane starboard quarter)
30/09/2014 04:30	GAR_JR303_009	41.7715	-18.757	Completed Garrett Screen 009 sampling
30/09/2014 04:31	ZPV_JR303_003	41.7715	-18.757	Bongo Nets 003 at the surface
30/09/2014 04:33	ZPV_JR303_003	41.7715	-18.757	Bongo Nets 003 on deck
30/09/2014 04:44	CTD_JR303_S009	41.77149	-18.757	CTD 009 at the surface
30/09/2014 04:45	CTD_JR303_S009	41.77151	-18.757	CTD 009 on deck
30/09/2014 04:52	OPT_JR303_017	41.77151	-18.757	Optic Rig 017 at the surface
30/09/2014 04:53	OPT_JR303_017	41.7715	-18.757	Optic Rig 017 on deck
30/09/2014 04:57	Station 9	41.77151	-18.757	Decks

30/09/2014 05:05	Station 9	41.77037	-18.766	Vessel at passage speed
30/09/2014 12:50	Station 10	40.84911	-20.208	Reducing speed for Station 10
30/09/2014 12:54	Station 10	40.84422	-20.216	V/l on DP (Station 10)
30/09/2014 12:58	OPT_JR303_018	40.84222	-20.215	Optic Rig off deck
30/09/2014 13:01	OPT_JR303_018	40.84221	-20.215	Optic Rig 018 deployed
30/09/2014 13:02	CTD_JR303_S010	40.84221	-20.215	CTD 010 deployed
30/09/2014 13:05	GOF_JR303_003	40.8422	-20.215	Go-Flo 003 deployed
30/09/2014 13:06	GAR_JR303_010	40.84221	-20.215	Commenced Garrett Screen 010 sampling
30/09/2014 13:08	GOF_JR303_003	40.84222	-20.215	Go-Flo 003 recovered
30/09/2014 13:18	NAU_JR303_005	40.84222	-20.215	Nauplii net 005 deployed
30/09/2014 13:20	CTD_JR303_S010	40.84222	-20.215	CTD at depth. Wire out 500m
30/09/2014 13:23	OPT_JR303_018	40.84223	-20.215	Optic Rig 018 recovered
30/09/2014 13:23	OPT_JR303_019	40.84223	-20.215	Optic Rig 019 deployed
30/09/2014 13:38	NAU_JR303_005	40.84221	-20.215	Nauplii net at the surface
30/09/2014 13:40	NAU_JR303_005	40.84221	-20.215	Nauplii net 005 fully recovered
30/09/2014 13:46	CTD_JR303_S010	40.84221	-20.215	CTD 010 at the surface
30/09/2014 13:49	CTD_JR303_S010	40.8422	-20.215	CTD 010 fully recovered
30/09/2014 13:49	OPT_JR303_019	40.8422	-20.215	Optic Rig 019 at the surface
30/09/2014 13:50	OPT_JR303_019	40.84219	-20.215	Optic Rig 019 fully recovered
30/09/2014 13:51	MPV_JR303_004	40.84219	-20.215	Microplankton nets 004 deployed
30/09/2014 14:00	GAR_JR303_010	40.84218	-20.215	Completed Garrett screen 010 sampling
30/09/2014 14:14	MPV_JR303_004	40.8422	-20.215	Microplankton nets 004 recovered
30/09/2014 14:28	Station 10	40.84221	-20.215	V/l off DP
30/09/2014 14:35	Station 10	40.83624	-20.214	V/l at passage speed
01/10/2014 02:46	Station 11	39.42063	-22.467	Reducing speed for Station 11

01/10/2014 02:53	Station 11	39.41164	-22.479	V/l on DP (Station 11)
01/10/2014 02:55	ZPT_JR303_004	39.41146	-22.479	Zooplankton nets off the deck
01/10/2014 02:57	ZPT_JR303_004	39.41129	-22.479	Zooplankton net tow 004 deployed
01/10/2014 03:14	ZPT_JR303_004	39.40699	-22.471	Nets out to 550m
01/10/2014 03:46	ZPT_JR303_004	39.39924	-22.457	Zooplankton net at the surface
01/10/2014 03:48	ZPT_JR303_004	39.39873	-22.456	Zooplankton net 004 recovered. V/l stopped
01/10/2014 03:59	OPT_JR303_020	39.3985	-22.455	Optic Rig 020 off the deck
01/10/2014 04:01	CTD_JR303_S011	39.3985	-22.455	CTD 011 off the deck
01/10/2014 04:01	OPT_JR303_020	39.3985	-22.455	Optic Rig 020 deployed (EFFER Crane starboard quarter)
01/10/2014 04:02	CTD_JR303_S011	39.39849	-22.455	CTD 011 deployed
01/10/2014 04:03	GAR_JR303_011	39.39849	-22.455	Commenced Garrett Screen 011 sampling
01/10/2014 04:06	ZPV_JR303_004	39.39849	-22.455	Bongo Net 004 off the deck
01/10/2014 04:07	ZPV_JR303_004	39.39849	-22.455	Bongo Net 004 deployed (Science Crane starboard bow)
01/10/2014 04:15	CTD_JR303_S011	39.39847	-22.455	CTD 011 at depth. Wire out 500m. Commenced recovery
01/10/2014 04:23	OPT_JR303_020	39.39846	-22.455	Optic Rig 020 at the surface
01/10/2014 04:24	GAR_JR303_011	39.39847	-22.455	Completed Garrett screen 011 sampling
01/10/2014 04:25	OPT_JR303_021	39.39847	-22.455	Optic Rig 021 deployed (EFFER CRane starboard quarter)
01/10/2014 04:31	ZPV_JR303_004	39.39848	-22.455	Bongo Net 004 at the surface
01/10/2014 04:33	ZPV_JR303_004	39.39848	-22.455	Bongo Net 004 on deck
01/10/2014 04:42	CTD_JR303_S011	39.39848	-22.455	CTD 011 at the surface
01/10/2014 04:43	CTD_JR303_S011	39.39847	-22.455	CTD 011 on deck
01/10/2014 04:50	OPT_JR303_021	39.39844	-22.455	Optic Rig 021 at the surface
01/10/2014 04:51	OPT_JR303_021	39.39844	-22.455	Optic Rig 021 on deck
01/10/2014 04:55	Station 11	39.39847	-22.455	Decks
01/10/2014 05:03	Station 11	39.39338	-22.453	Vessel at passage speed

01/10/2014 12:47	Station 12	38.50716	-23.879	Reducing speed for Station 12
01/10/2014 12:53	Station 12	38.4973	-23.892	V/l on DP (Station 12)
01/10/2014 12:57	OPT_JR303_022	38.49598	-23.892	Optic Rig 022 deployed
01/10/2014 12:59	GAR_JR303_012	38.49595	-23.892	Commenced Garrett Screen 012 sampling
01/10/2014 13:02	CTD_JR303_S012	38.49597	-23.892	CTD 012 deployed
01/10/2014 13:05	GOF_JR303_004	38.49597	-23.892	Go-Flo 004 deployed
01/10/2014 13:09	GOF_JR303_004	38.49597	-23.892	Go-Flo 004 recovered
01/10/2014 13:15	NAU_JR303_006	38.49598	-23.892	Nauplii net 006 deployed
01/10/2014 13:17	CTD_JR303_S012	38.49598	-23.892	CTD at depth. Wire out 500m
01/10/2014 13:20	OPT_JR303_022	38.49596	-23.892	Optic rig 022 recovered
01/10/2014 13:21	OPT_JR303_023	38.49596	-23.892	Optic Rig 023 deployed
01/10/2014 13:28	GAR_JR303_012	38.49597	-23.892	Completed Garrett screen 012 sampling
01/10/2014 13:38	NAU_JR303_006	38.49594	-23.892	Nauplii net 006 fully recovered
01/10/2014 13:45	OPT_JR303_023	38.49592	-23.892	Optic rig 023 recovered
01/10/2014 13:45	CTD_JR303_S012	38.49592	-23.892	CTD 012 at the surface
01/10/2014 13:47	CTD_JR303_S012	38.49593	-23.892	CTD 012 fully recovered
01/10/2014 13:48	MPV_JR303_005	38.49593	-23.892	Microplankton nets 005 deployed
01/10/2014 14:11	MPV_JR303_005	38.49592	-23.892	Microplankton nets 005 recovered
01/10/2014 14:21	Station 12	38.49594	-23.892	V/l off DP
01/10/2014 14:29	Station 12	38.49195	-23.888	V/l at passage speed
02/10/2014 12:47	Station 13	36.96838	-25.907	Reducing speed for Station 13
02/10/2014 12:57	Station 13	36.95084	-25.911	V/l on DP (Station 13)
02/10/2014 12:59	OPT_JR303_024	36.95052	-25.911	Optic Rig 024 deployed
02/10/2014 13:02	CTD_JR303_S013	36.95047	-25.911	CTD 013 deployed
02/10/2014 13:02	GOF_JR303_005	36.95047	-25.911	Go-Flo 005 deployed

02/10/2014 13:04	GAR_JR303_013	36.95047	-25.911	Commenced Garrett Screen 013 sampling
02/10/2014 13:06	GOF_JR303_005	36.95046	-25.911	Go-Flo 005 recovered
02/10/2014 13:11	NAU_JR303_007	36.95048	-25.911	Nauplii net 007 deployed
02/10/2014 13:17	CTD_JR303_S013	36.95047	-25.911	CTD at depth. Wire out 500m
02/10/2014 13:21	OPT_JR303_024	36.95044	-25.911	Optic rig 024 recovered
02/10/2014 13:22	OPT_JR303_025	36.95045	-25.911	Optic Rig 025 deployed
02/10/2014 13:34	GAR_JR303_013	36.95046	-25.911	Completed Garrett screen 013 sampling
02/10/2014 13:35	NAU_JR303_007	36.95046	-25.911	Nauplii net 007 fully recovered
02/10/2014 13:42	CTD_JR303_S013	36.95044	-25.911	CTD 013 at the surface
02/10/2014 13:45	CTD_JR303_S013	36.95044	-25.911	CTD 013 fully recovered
02/10/2014 13:47	MPV_JR303_006	36.95044	-25.911	Microplankton nets 006 deployed
02/10/2014 13:48	OPT_JR303_025	36.95044	-25.911	Optic rig 025 recovered
02/10/2014 14:07	MPV_JR303_006	36.95045	-25.911	Microplankton nets 006 recovered
02/10/2014 14:20	Station 13	36.95047	-25.911	V/l off DP
02/10/2014 14:29	Station 13	36.9446	-25.905	V/l at passage speed
03/10/2014 02:46	Station 14	34.76251	-26.632	Reducing speed for Station 14
03/10/2014 02:53	Station 14	34.74973	-26.634	V/l on DP (Station 14)
03/10/2014 02:55	ZPT_JR303_005	34.74961	-26.633	Zooplankton nets off the deck
03/10/2014 02:57	ZPT_JR303_005	34.74954	-26.633	Zooplankton net tow 005 deployed
03/10/2014 03:16	ZPT_JR303_005	34.74522	-26.624	Zooplankton net at depth
03/10/2014 03:46	ZPT_JR303_005	34.73967	-26.611	Zooplankton net at the surface
03/10/2014 03:48	ZPT_JR303_005	34.73932	-26.61	Zooplankton net 005 recovered. V/l stopped
03/10/2014 04:00	OPT_JR303_026	34.73898	-26.609	Optic Rig 026 off the deck
03/10/2014 04:01	OPT_JR303_026	34.73898	-26.609	Optic Rig 026 deployed (EFFER Crane Starboard Quarter)
03/10/2014 04:01	CTD_JR303_S014	34.73898	-26.609	CTD 014 off the deck

03/10/2014 04:02	CTD_JR303_S014	34.73897	-26.609	CTD 014 deployed
03/10/2014 04:05	GAR_JR303_014	34.73897	-26.609	Commenced Garrett Screen 014 sampling
03/10/2014 04:06	ZPV_JR303_005	34.73897	-26.609	Bongo Net 005 off the deck
03/10/2014 04:07	ZPV_JR303_005	34.73898	-26.609	Bongo Net 005 deployed (Science Crane Starboard Bow)
03/10/2014 04:16	CTD_JR303_S014	34.73898	-26.609	CTD 014 at depth. Wire out 500m. Commenced recovery
03/10/2014 04:25	OPT_JR303_026	34.73897	-26.609	Optic Rig 026 at the surface
03/10/2014 04:26	OPT_JR303_027	34.73894	-26.609	Optic Rig 027 deployed (EFFER Crane Starboard Quarter)
03/10/2014 04:28	GAR_JR303_014	34.73895	-26.609	Completed Garrett Screen 014 sampling
03/10/2014 04:33	ZPV_JR303_005	34.73896	-26.609	Bongo Net 005 at the surface
03/10/2014 04:36	ZPV_JR303_005	34.73894	-26.609	Bongo Net 005 on deck
03/10/2014 04:42	CTD_JR303_S014	34.73896	-26.609	CTD 014 at the surface
03/10/2014 04:44	CTD_JR303_S014	34.73895	-26.609	CTD 014 on deck
03/10/2014 04:50	OPT_JR303_027	34.73895	-26.609	Optic Rig 027 at the surface
03/10/2014 04:51	OPT_JR303_027	34.73895	-26.609	Optic Rig 027 on deck
03/10/2014 04:55	Station 14	34.73893	-26.609	Decks
03/10/2014 05:04	Station 14	34.73261	-26.604	Vessel at passage speed
03/10/2014 12:49	Station 15	33.36588	-27.082	Reducing speed for Station 15
03/10/2014 12:54	Station 15	33.35476	-27.085	V/l on DP (Station 15)
03/10/2014 12:58	OPT_JR303_028	33.35386	-27.085	Optic Rig 028 deployed
03/10/2014 13:01	GAR_JR303_015	33.35388	-27.085	Commenced Garrett Screen 015 sampling
03/10/2014 13:01	CTD_JR303_S015	33.35388	-27.085	CTD 015 off the deck
03/10/2014 13:02	CTD_JR303_S015	33.35389	-27.085	CTD 015 deployed
03/10/2014 13:03	GOF_JR303_006	33.35389	-27.085	Go-Flo 006 deployed
03/10/2014 13:08	GOF_JR303_006	33.35388	-27.085	Go-Flo 006 recovered
03/10/2014 13:15	NAU_JR303_008	33.35386	-27.085	Nauplii net 008 deployed

03/10/2014 13:18	CTD_JR303_S015	33.35385	-27.085	CTD at depth. Wire out 500m
03/10/2014 13:22	OPT_JR303_028	33.35385	-27.085	Optic Rig 028 recovered
03/10/2014 13:23	OPT_JR303_029	33.35385	-27.085	Optic Rig 029 deployed
03/10/2014 13:37	NAU_JR303_008	33.35385	-27.085	Nauplii net at the surface
03/10/2014 13:38	NAU_JR303_008	33.35384	-27.085	Nauplii net 008 fully recovered
03/10/2014 13:46	CTD_JR303_S015	33.35386	-27.085	CTD 015 at the surface
03/10/2014 13:47	OPT_JR303_029	33.35386	-27.085	Optic Rig 029 at the surface
03/10/2014 13:49	GAR_JR303_015	33.35385	-27.085	Completed Garrett Screen 015 sampling
03/10/2014 13:49	OPT_JR303_029	33.35385	-27.085	Optic Rig 029 fully recovered
03/10/2014 13:50	CTD_JR303_S015	33.35386	-27.085	CTD 015 recovered
03/10/2014 13:50	MPV_JR303_007	33.35386	-27.085	Microplankton nets 007 deployed
03/10/2014 14:12	MPV_JR303_007	33.35383	-27.085	Microplankton nets 007 recovered
03/10/2014 14:24	Station 15	33.35381	-27.085	V/l off DP
03/10/2014 14:29	Station 15	33.35336	-27.082	V/l at passage speed
03/10/2014 22:50	Station 16	31.88182	-27.551	V/L man. onto DP station
03/10/2014 22:58	Station 16	31.87149	-27.553	V/L on DP hd 131 at 0.5kts
03/10/2014 23:00	ZPS_JR303_001	31.87149	-27.553	ZPS_JR303_001 deployed and increase to 0.75kts
03/10/2014 23:24	ZPS_JR303_001	31.86955	-27.55	ZPS_JR303_001 at the surface
03/10/2014 23:26	ZPS_JR303_001	31.86938	-27.55	ZPS_JR303_001 on deck
03/10/2014 23:35	Station 16	31.86861	-27.549	V/L off DP man. on passage
04/10/2014 02:50	Station 17	31.30584	-27.729	Reducing speed for Station 17
04/10/2014 02:55	Station 17	31.30062	-27.73	V/l on DP (Station 17)
04/10/2014 02:57	ZPT_JR303_006	31.30048	-27.73	Zooplankton net tow 006 deployed
04/10/2014 03:46	ZPT_JR303_006	31.29554	-27.706	Zooplankton net at the surface
04/10/2014 03:48	ZPT_JR303_006	31.29539	-27.705	Zooplankton net 006 recovered. V/l stopped

04/10/2014 03:59	OPT_JR303_030	31.2952	-27.704	Optic Rig 030 off the deck
04/10/2014 04:00	OPT_JR303_030	31.29521	-27.704	Optic Rig 030 deployed (EFFER Crane Starboard Quarter)
04/10/2014 04:01	CTD_JR303_S016	31.2952	-27.704	CTD 16 off the deck
04/10/2014 04:02	CTD_JR303_S016	31.29522	-27.704	CTD 016 deployed
04/10/2014 04:04	GAR_JR303_016	31.2952	-27.704	Commenced Garrett Screen 016 sampling
04/10/2014 04:05	ZPV_JR303_006	31.29518	-27.704	Bongo Net 006 off deck
04/10/2014 04:07	ZPV_JR303_006	31.2952	-27.704	Bongo Net 006 deployed (Science Crane Starboard Bow)
04/10/2014 04:15	CTD_JR303_S016	31.2952	-27.704	CTD 016 at depth. Wire out 500m. Commenced recovery
04/10/2014 04:22	OPT_JR303_030	31.2952	-27.704	Optic Rig 030 at the surface
04/10/2014 04:25	OPT_JR303_031	31.29521	-27.704	Optic Rig 031 deployed (EFFER Crane Starboard Quarter
04/10/2014 04:31	GAR_JR303_016	31.2952	-27.704	Completed Garrett Screen 016 sampling
04/10/2014 04:31	ZPV_JR303_006	31.2952	-27.704	Bongo Net 006 at the surface
04/10/2014 04:34	ZPV_JR303_006	31.29522	-27.704	Bongo Net 006 on deck
04/10/2014 04:46	CTD_JR303_S016	31.29519	-27.704	CTD 016 at the surface
04/10/2014 04:47	CTD_JR303_S016	31.2952	-27.704	CTD 016 on deck
04/10/2014 04:48	OPT_JR303_031	31.2952	-27.704	Optic Rig 031 at the surface
04/10/2014 04:49	OPT_JR303_031	31.2952	-27.704	Optic Rig 031 on deck
04/10/2014 04:55	Station 17	31.29521	-27.704	Decks
04/10/2014 05:01	Station 17	31.29364	-27.7	Vessel at passage speed
04/10/2014 12:52	Station 18	29.90865	-28.164	V/l reducing speed for Station 18
04/10/2014 12:56	Station 18	29.89995	-28.166	V/l on DP (Station 18)
04/10/2014 12:57	OPT_JR303_032	29.89922	-28.166	Optic Rig 032 off the deck
04/10/2014 12:58	OPT_JR303_032	29.89888	-28.165	Optic Rig 032 deployed
04/10/2014 13:02	CTD_JR303_S017	29.89864	-28.165	CTD 017 off the deck
04/10/2014 13:03	CTD_JR303_S017	29.89863	-28.165	CTD 017 deployed

04/10/2014 13:05	GOF_JR303_007	29.89866	-28.165	Go-Flo 007 deployed
04/10/2014 13:07	GAR_JR303_017	29.89866	-28.165	Commenced Garrett Screen 017 sampling
04/10/2014 13:10	GOF_JR303_007	29.89866	-28.165	Go-Flo 007 recovered
04/10/2014 13:19	NAU_JR303_009	29.89866	-28.165	Nauplii net 009 deployed
04/10/2014 13:22	OPT_JR303_032	29.89865	-28.165	Optic Rig 032 recovered
04/10/2014 13:23	OPT_JR303_033	29.89866	-28.165	Optic Rig 033 deployed
04/10/2014 13:30	GAR_JR303_017	29.89864	-28.165	Completed Garrett screen 017 sampling
04/10/2014 13:37	NAU_JR303_009	29.89865	-28.165	Nauplii net 009 fully recovered
04/10/2014 13:47	MPV_JR303_008	29.89865	-28.165	Microplankton nets 010 deployed
04/10/2014 13:49	OPT_JR303_033	29.89865	-28.165	Optic Rig 033 fully recovered
04/10/2014 13:52	CTD_JR303_S017	29.89864	-28.165	CTD 017 recovered
04/10/2014 14:07	MPV_JR303_008	29.89864	-28.165	Microplankton nets 010 recovered
04/10/2014 14:17	Station 18	29.89861	-28.165	V/l off DP
04/10/2014 14:25	Station 18	29.89599	-28.159	V/l at passage speed
05/10/2014 03:49	Station 19	27.50987	-28.889	Reducing speed for Station 19
05/10/2014 03:53	Station 19	27.50049	-28.892	V/l on DP (Station 19)
05/10/2014 03:55	ZPT_JR303_007	27.49936	-28.891	Zooplankton nets off the deck
05/10/2014 03:57	ZPT_JR303_007	27.49916	-28.891	Zooplankton net tow 007 deployed
05/10/2014 04:48	ZPT_JR303_007	27.50003	-28.865	Zooplankton net at the surface
05/10/2014 04:49	ZPT_JR303_007	27.50006	-28.865	Zooplankton net 007 recovered. V/l stopped
05/10/2014 05:03	OPT_JR303_034	27.50009	-28.864	Optic Rig 034 off the deck
05/10/2014 05:04	OPT_JR303_034	27.50011	-28.864	Optic Rig 034 deployed
05/10/2014 05:04	CTD_JR303_S018	27.50011	-28.864	CTD 018 off the deck
05/10/2014 05:05	GAR_JR303_018	27.50011	-28.864	Commenced Garrett Screen 018 sampling
05/10/2014 05:05	CTD_JR303_S018	27.50011	-28.864	CTD 018 deployed

05/10/2014 05:11	ZPV_JR303_007	27.50013	-28.864	Bongo Net 007 off deck
05/10/2014 05:12	ZPV_JR303_007	27.50013	-28.864	Bongo Net 007 deployed
05/10/2014 05:17	CTD_JR303_S018	27.50013	-28.864	CTD 018 at depth. Wire out 500m. Commenced recovery
05/10/2014 05:26	OPT_JR303_034	27.50013	-28.864	Optic Rig 034 at the surface
05/10/2014 05:28	OPT_JR303_035	27.50012	-28.864	Optic Rig 035 deployed
05/10/2014 05:30	GAR_JR303_018	27.50011	-28.864	Completed Garrett screen 018 sampling
05/10/2014 05:36	ZPV_JR303_007	27.50011	-28.864	Bongo Net 007 at the surface
05/10/2014 05:39	ZPV_JR303_007	27.5001	-28.864	Bongo Net 007 on deck
05/10/2014 05:45	CTD_JR303_S018	27.50008	-28.864	CTD 018 at the surface
05/10/2014 05:46	CTD_JR303_S018	27.50008	-28.864	CTD 018 on deck
05/10/2014 05:52	OPT_JR303_035	27.50011	-28.864	Optic Rig 035 at the surface
05/10/2014 05:53	OPT_JR303_035	27.5001	-28.864	Optic Rig 035 on deck
05/10/2014 05:56	Station 19	27.5001	-28.864	Decks
05/10/2014 06:04	Station 19	27.49562	-28.862	Vessel at passage speed
05/10/2014 13:51	Station 20	26.11758	-29.303	Reducing speed for Station 20
05/10/2014 13:55	Station 20	26.10777	-29.306	V/l on DP (Station 20)
05/10/2014 13:59	OPT_JR303_036	26.10587	-29.305	Optic Rig 036 deployed
05/10/2014 14:03	CTD_JR303_S019	26.10583	-29.305	CTD 019 deployed
05/10/2014 14:07	GOF_JR303_008	26.10582	-29.305	Go-Flo 008 deployed
05/10/2014 14:08	GAR_JR303_019	26.10582	-29.305	Commenced Garrett Screen 019 sampling
05/10/2014 14:11	GOF_JR303_008	26.10584	-29.305	Go-Flo 008 recovered
05/10/2014 14:18	CTD_JR303_S019	26.10586	-29.305	CTD 019 at depth 500m
05/10/2014 14:18	NAU_JR303_010	26.10586	-29.305	Nauplii net 010 deployed
05/10/2014 14:22	OPT_JR303_036	26.10585	-29.305	Optic Rig 036 recovered
05/10/2014 14:23	OPT_JR303_037	26.10584	-29.305	Optic Rig 037 deployed

05/10/2014 14:34	GAR_JR303_019	26.10585	-29.305	Completed Garrett screen 019 sampling
05/10/2014 14:41	NAU_JR303_010	26.10584	-29.305	Nauplii net 010 fully recovered
05/10/2014 14:48	OPT_JR303_037	26.10585	-29.305	Optic Rig 037 fully recovered
05/10/2014 14:49	CTD_JR303_S019	26.10585	-29.305	CTD 019 at the surface
05/10/2014 14:50	CTD_JR303_S019	26.10584	-29.305	CTD 019 recovered
05/10/2014 14:53	MPV_JR303_009	26.10585	-29.305	Microplankton nets 011 deployed
05/10/2014 15:16	MPV_JR303_009	26.10584	-29.305	Microplankton nets 011 recovered
05/10/2014 15:26	Station 20			V/l off DP
05/10/2014 15:32	Station 20			V/l at passage speed
05/10/2014 23:50	Station 21	24.62934	-29.746	V/l reducing speed for Station 21
05/10/2014 23:54	Station 21	24.62183	-29.747	V/L on DP hd 080 x 0.5kts
05/10/2014 23:55	ZPS_JR303_002	24.62174	-29.747	Zooplankton net slow tow 002 off the deck
05/10/2014 23:58	ZPS_JR303_002	24.62174	-29.747	Zooplankton net deployed
06/10/2014 00:25	ZPS_JR303_002	24.62223	-29.743	Zooplankton nets 002 on deck
06/10/2014 00:35	Station 21	24.62242	-29.742	V/L off DP man. on passage
06/10/2014 03:49	Station 22	24.06524	-29.91	Reducing speed for Station 22
06/10/2014 03:54	Station 22	24.05647	-29.911	V/l on DP (Station 22)
06/10/2014 04:00	ZPT_JR303_008	24.05615	-29.91	Zooplankton net tow 008 deployed
06/10/2014 04:52	ZPT_JR303_008	24.06025	-29.884	Zooplankton net 008 recovered. V/l stopped
06/10/2014 05:03	OPT_JR303_038	24.06046	-29.883	Optic Rig 038 off deck
06/10/2014 05:04	OPT_JR303_038	24.06048	-29.883	Optic Rig 038 deployed
06/10/2014 05:05	CTD_JR303_S020	24.06047	-29.883	CTD 020 off the deck
06/10/2014 05:06	CTD_JR303_S020	24.06045	-29.883	CTD 020 deployed
06/10/2014 05:08	GAR_JR303_020	24.06046	-29.883	Commenced Garrett Screen 020 sampling
06/10/2014 05:09	ZPV_JR303_008	24.06046	-29.883	Bongo Nets 008 off the deck

06/10/2014 05:10	ZPV_JR303_008	24.06045	-29.883	Bongo Nets 008 deployed
06/10/2014 05:18	CTD_JR303_S020	24.06048	-29.883	CTD 020 at depth. Wire out 500m. Commenced recovery
06/10/2014 05:26	OPT_JR303_038	24.06048	-29.883	Optic Rig 038 at the surface
06/10/2014 05:27	GAR_JR303_020	24.06048	-29.883	Completed Garrett Screen 020 sampling
06/10/2014 05:28	OPT_JR303_039	24.06048	-29.883	Optic Rig 039 deployed
06/10/2014 05:30	ZPV_JR303_008	24.06047	-29.883	Bongo Net 008 at the surface
06/10/2014 05:33	ZPV_JR303_008	24.06046	-29.883	Bongo Net 008 on deck
06/10/2014 05:51	CTD_JR303_S020	24.06048	-29.883	CTD 020 at the surface
06/10/2014 05:52	OPT_JR303_039	24.06046	-29.883	Optic Rig 039 at the surface
06/10/2014 05:53	CTD_JR303_S020	24.06047	-29.883	CTD 020 on deck
06/10/2014 05:53	OPT_JR303_039	24.06047	-29.883	Optic Rig 039 on deck
06/10/2014 05:59	Station 22	24.06047	-29.883	Decks
06/10/2014 06:08	Station 22	24.05697	-29.879	Vessel at passage speed
06/10/2014 13:50	Station 23	22.66612	-29.869	Reducing speed for Station 23
06/10/2014 13:53	Station 23	22.65954	-29.868	V/l on DP (Station 23)
06/10/2014 13:58	OPT_JR303_040	22.65876	-29.866	Optic Rig 040 deployed
06/10/2014 14:00	GAR_JR303_021	22.65876	-29.866	Commenced Garret Screen 021 sampling
06/10/2014 14:01	CTD_JR303_S021	22.65876	-29.866	CTD 021 deployed
06/10/2014 14:06	GOF_JR303_009	22.65877	-29.866	Go Flo 009 deployed
06/10/2014 14:10	GOF_JR303_009	22.65877	-29.866	Go Flo 009 recovered
06/10/2014 14:16	NAU_JR303_011	22.65875	-29.866	Nauplii nets 011 deployed
06/10/2014 14:16	CTD_JR303_S021	22.65875	-29.866	CTD at depth 500m
06/10/2014 14:22	OPT_JR303_040	22.65877	-29.866	Optic Rig 040 recovered
06/10/2014 14:25	OPT_JR303_041	22.65876	-29.866	Optic Rig 041 deployed
06/10/2014 14:38	NAU_JR303_011	22.65875	-29.866	Nauplii nets 011 recovered

06/10/2014 14:47	CTD_JR303_S021	22.65874	-29.866	CTD at the surface
06/10/2014 14:49	MPV_JR303_010	22.65875	-29.866	Microplankton nets 012 deployed
06/10/2014 14:50	CTD_JR303_S021	22.65876	-29.866	CTD 021 recovered
06/10/2014 14:50	OPT_JR303_041	22.65876	-29.866	Optic Rig 041 fully recovered
06/10/2014 15:10	MPV_JR303_010	22.65876	-29.866	Microplankton nets 012 recovered
06/10/2014 15:20	Station 23	22.65876	-29.866	V/l off DP
06/10/2014 15:28	Station 23	22.65726	-29.861	V/l at passage speed
07/10/2014 03:48	Station 24	20.45046	-29.276	Reducing speed for Station 24
07/10/2014 03:52	Station 24	20.44468	-29.274	V/l on DP (Station 24)
07/10/2014 03:55	ZPT_JR303_009	20.44464	-29.273	Zooplankton net tow off the deck
07/10/2014 03:57	ZPT_JR303_009	20.44478	-29.273	Zooplankton net tow 009 deployed
07/10/2014 04:13	ZPT_JR303_009	20.44771	-29.265	Zooplankton net at depth 550m
07/10/2014 04:47	ZPT_JR303_009	20.45263	-29.25	Zooplankton net at the surface
07/10/2014 04:50	ZPT_JR303_009	20.45308	-29.248	Zooplankton net 009 recovered. V/l stopped
07/10/2014 05:02	OPT_JR303_042	20.45327	-29.248	Optic Rig 042 off the deck
07/10/2014 05:03	OPT_JR303_042	20.45328	-29.248	Optic Rig 042 deployed
07/10/2014 05:04	CTD_JR303_S022	20.45329	-29.248	CTD 022 off the deck
07/10/2014 05:06	CTD_JR303_S022	20.45328	-29.248	CTD 022 deployed
07/10/2014 05:06	GAR_JR303_022	20.45328	-29.248	Commenced Garrett Screen 022 sampling
07/10/2014 05:09	ZPV_JR303_009	20.45326	-29.248	Bongo Net 009 off the deck
07/10/2014 05:10	ZPV_JR303_009	20.45327	-29.248	Bongo Net 009 deployed
07/10/2014 05:18	CTD_JR303_S022	20.45327	-29.248	CTD 022 at depth. Wire out 500m. Commenced recovery.
07/10/2014 05:25	OPT_JR303_042	20.45327	-29.248	Optic Rig 042 at the surface
07/10/2014 05:27	OPT_JR303_043	20.45328	-29.248	Optic Rig 043 deployed
07/10/2014 05:30	GAR_JR303_022	20.4533	-29.248	Completed Garrett Screen 022 sampling

07/10/2014 05:31	ZPV_JR303_009	20.4533	-29.248	Bongo Net at the surface
07/10/2014 05:34	ZPV_JR303_009	20.45329	-29.248	Bongo Nets on deck
07/10/2014 05:50	CTD_JR303_S022	20.4533	-29.248	CTD 022 at the surface
07/10/2014 05:52	CTD_JR303_S022	20.45329	-29.248	CTD 022 on deck
07/10/2014 05:53	OPT_JR303_043	20.45329	-29.248	Optic Rig 043 at the surface
07/10/2014 05:54	OPT_JR303_043	20.45328	-29.248	Optic Rig 043 on deck
07/10/2014 06:00	Station 24	20.45324	-29.248	Decks
07/10/2014 06:08	Station 24	20.45294	-29.243	Vessel at passage speed
07/10/2014 09:24	Station 25	19.8625	-29.142	V/L man. onto DP Station 25
07/10/2014 09:28	Station 25	19.85601	-29.14	V/l on DP in full pos hd 060
07/10/2014 09:35	CTD_JR303_T023	19.85531	-29.141	CTD_JR303_T023 off deck
07/10/2014 09:38	CTD_JR303_T023	19.85532	-29.141	CTD_JR303_T023 deployed
07/10/2014 11:00	CTD_JR303_T023	19.85545	-29.141	CTD_JR303_T023 at depth 4649m (EA600 4703m)
07/10/2014 13:07	CTD_JR303_T023	19.8554	-29.141	CTD T023 on deck
07/10/2014 13:58	OPT_JR303_044	19.8554	-29.141	Optic Rig 044 deployed
07/10/2014 14:04	CTD_JR303_S024	19.8554	-29.141	CTD 024 off the deck
07/10/2014 14:06	CTD_JR303_S024	19.85539	-29.141	CTD 024 deployed
07/10/2014 14:08	GOF_JR303_010	19.8554	-29.141	Go-Flo 010 deployed
07/10/2014 14:11	GOF_JR303_010	19.8554	-29.141	Go-Flo 010 recovered
07/10/2014 14:18	NAU_JR303_012	19.85538	-29.141	Nauplii net 012 deployed
07/10/2014 14:19	GAR_JR303_023	19.85538	-29.141	Commenced Garrett Screen 023 sampling
07/10/2014 14:20	CTD_JR303_S024	19.85539	-29.141	CTD at depth. Wire out 500m
07/10/2014 14:23	OPT_JR303_044	19.8554	-29.141	Optic Rig 044 recovered
07/10/2014 14:24	OPT_JR303_045	19.8554	-29.141	Optic Rig 045 deployed
07/10/2014 14:40	NAU_JR303_012	19.85538	-29.141	Nauplii net 012 fully recovered

07/10/2014 14:45	GAR_JR303_023	19.85537	-29.141	Completed Garrett Screen 023 sampling
07/10/2014 14:49	OPT_JR303_045	19.85539	-29.141	Optic Rig 045 fully recovered
07/10/2014 14:51	MPV_JR303_011	19.85538	-29.141	Microplankton nets 013 deployed
07/10/2014 14:53	CTD_JR303_S024	19.85537	-29.141	CTD 024 fully recovered
07/10/2014 15:11	MPV_JR303_011	19.85537	-29.141	Microplankton nets 013 recovered
07/10/2014 15:21	Station 25			V/l off DP
07/10/2014 15:28	Station 25			V/l at passage speed
07/10/2014 23:50	Station 26	18.34576	-28.815	V/L reducing speed for station 26
07/10/2014 23:57	Station 26	18.33133	-28.81	Stern thurster not responding on DP
08/10/2014 00:10	ZPS_JR303_003	18.33108	-28.809	Zooplankton slow tow net 003 deployed v/l speed between 1.0 and 1.5kts
08/10/2014 00:39	ZPS_JR303_003	18.33569	-28.8	Zooplankton slow tow 003 net recovered
08/10/2014 00:50	Station 26	18.34025	-28.794	V/L on passage speed
08/10/2014 03:49	Station 27	17.82942	-28.704	Reducing speed for Station 27
08/10/2014 03:54	Station 27	17.82146	-28.702	V/l on DP (Station 27)
08/10/2014 04:00	ZPT_JR303_010	17.82145	-28.702	Zooplankton net tow 010 deployed at 1.6kts
08/10/2014 04:51	ZPT_JR303_010	17.831	-28.683	Zooplankton net 010 recovered. V/l stopped
08/10/2014 05:04	OPT_JR303_046	17.83166	-28.681	Optic Rig 046 off the deck
08/10/2014 05:07	OPT_JR303_046	17.83165	-28.681	Optic Rig 046 deployed
08/10/2014 05:09	CTD_JR303_S025	17.83164	-28.681	CTD 025 off the deck
08/10/2014 05:10	CTD_JR303_S025	17.83165	-28.681	CTD 025 deployed
08/10/2014 05:10	GAR_JR303_024	17.83165	-28.681	Commenced Garrett Screen 024 sampling
08/10/2014 05:12	ZPV_JR303_010	17.83165	-28.681	Bongo Net 010 off the deck
08/10/2014 05:13	ZPV_JR303_010	17.83166	-28.681	Bongo Net 010 deployed
08/10/2014 05:23	CTD_JR303_S025	17.83166	-28.681	CTD 025 at depth. Wire out 500m. Commenced recovery
08/10/2014	GAR_JR303_024	17.83166	-	Completed Garrett Screen 024

05:30			28.681	sampling
08/10/2014 05:31	OPT_JR303_046	17.83166	-28.681	Optic Rig 046 at the surface
08/10/2014 05:33	OPT_JR303_047	17.83165	-28.681	Optic Rig 047 deployed
08/10/2014 05:35	ZPV_JR303_010	17.83165	-28.681	Bongo Net 010 at the surface
08/10/2014 05:38	ZPV_JR303_010	17.83165	-28.681	Bongo Net 010 on deck
08/10/2014 05:53	CTD_JR303_S025	17.83165	-28.681	CTD 025 at the surface
08/10/2014 05:55	CTD_JR303_S025	17.83165	-28.681	CTD 025 on deck
08/10/2014 05:57	OPT_JR303_047	17.83167	-28.681	Optic Rig 047 at the surface
08/10/2014 05:58	OPT_JR303_047	17.83166	-28.681	Optic Rig 047 on deck
08/10/2014 06:02	Station 27	17.83164	-28.681	Decks
08/10/2014 06:10	Station 27	17.82889	-28.678	Vessel at passage speed
08/10/2014 13:50	Station 28	16.44425	-28.409	Reducing speed for Station 28
08/10/2014 13:54	Station 28	16.43611	-28.406	V/l on DP (Station 28)
08/10/2014 13:57	OPT_JR303_048	16.43608	-28.405	Optic Rig 048 deployed
08/10/2014 14:00	CTD_JR303_S026	16.43608	-28.405	CTD 026 deployed
08/10/2014 14:02	GAR_JR303_025	16.43608	-28.405	Commenced Garrett Screen 025 sampling
08/10/2014 14:03	GOF_JR303_011	16.43608	-28.405	Go-Flo 011 deployed
08/10/2014 14:09	GOF_JR303_011	16.43606	-28.405	Go-Flo 011 recovered
08/10/2014 14:14	NAU_JR303_013	16.43608	-28.405	Nauplii net 013 deployed
08/10/2014 14:16	CTD_JR303_S026	16.43607	-28.405	CTD at depth 500m
08/10/2014 14:22	OPT_JR303_048	16.43608	-28.405	Optic Rig 048 recovered
08/10/2014 14:23	OPT_JR303_049	16.43608	-28.405	Optic Rig 049 deployed
08/10/2014 14:25	GAR_JR303_025	16.43609	-28.405	Completed Garrett Screen 025 sampling
08/10/2014 14:36	NAU_JR303_013	16.43609	-28.405	Nauplii net 013 fully recovered
08/10/2014 14:46	CTD_JR303_S026	16.43612	-28.405	CTD 026 at the surface
08/10/2014	OPT_JR303_049	16.43612	-	Optic Rig 049 fully recovered

14:48			28.405	
08/10/2014 14:49	CTD_JR303_S026	16.4361	-28.405	CTD 026 recovered
08/10/2014 14:49	MPV_JR303_012	16.4361	-28.405	Microplankton nets 014 deployed
08/10/2014 15:11	MPV_JR303_012	16.43609	-28.405	Microplankton nets 014 recovered
08/10/2014 15:26	Station 28	16.43606	-28.405	V/l off DP
08/10/2014 15:32	Station 28	16.43352	-28.399	V/l at passage speed
09/10/2014 03:49	Station 29	14.21441	-27.934	Reducing speed for Station 29
09/10/2014 03:54	Station 29	14.20497	-27.931	V/l on DP (Station 29)
09/10/2014 03:58	ZPT_JR303_011	14.20495	-27.931	Zooplankton net tow off the deck
09/10/2014 04:01	ZPT_JR303_011	14.20553	-27.93	Zooplankton net tow 011 deployed
09/10/2014 04:50	ZPT_JR303_011	14.21929	-27.909	Zooplankton net at the surface
09/10/2014 04:52	ZPT_JR303_011	14.21986	-27.908	Zooplankton net 011 recovered. V/l stopped
09/10/2014 05:06	OPT_JR303_050	14.22035	-27.908	Optic Rig 050 off the deck
09/10/2014 05:07	OPT_JR303_050	14.22037	-27.908	Optic Rig 050 deployed
09/10/2014 05:08	CTD_JR303_S027	14.22037	-27.908	CTD 027 off the deck
09/10/2014 05:10	CTD_JR303_S027	14.22038	-27.908	CTD 027 deployed
09/10/2014 05:10	GAR_JR303_026	14.22038	-27.908	Commenced Garrett Screen 026 sampling
09/10/2014 05:13	ZPV_JR303_011	14.22038	-27.908	Bongo Net 011 off the deck
09/10/2014 05:14	ZPV_JR303_011	14.22037	-27.908	Bongo Net 011 deployed
09/10/2014 05:22	CTD_JR303_S027	14.22036	-27.908	CTD 027 at depth. Wire out 500m. Commenced recovery
09/10/2014 05:30	GAR_JR303_026	14.2204	-27.908	Completed Garrett Screen 026 sampling
09/10/2014 05:31	OPT_JR303_050	14.2204	-27.908	Optic Rig 050 at the surface
09/10/2014 05:32	OPT_JR303_051	14.22039	-27.908	Optic Rig 051 deployed
09/10/2014 05:37	ZPV_JR303_011	14.22036	-27.908	Bongo Net 011 at the surface
09/10/2014 05:40	ZPV_JR303_011	14.22037	-27.908	Bongo Net 011 on deck
09/10/2014	CTD_JR303_S027	14.22035	-	CTD 027 at the surface

05:54			27.908	
09/10/2014 05:55	CTD_JR303_S027	14.22034	-27.908	CTD 027 on deck
09/10/2014 05:58	OPT_JR303_051	14.22036	-27.908	Optic Rig 051 at the surface
09/10/2014 05:59	OPT_JR303_051	14.22037	-27.908	Optic Rig 051 on deck
09/10/2014 06:05	BAF_JR303_001	14.22036	-27.908	METBIO Buoy 001 off the deck. Vessel moving ahead at 1 knot for deployment.
09/10/2014 06:06	Station 29	14.22035	-27.908	Decks
09/10/2014 06:06	BAF_JR303_001	14.22035	-27.908	METBIO Buoy 001 (serial No. METBIO 004) deployed.
09/10/2014 06:17	Station 29	14.21827	-27.901	Vessel at passage speed
09/10/2014 13:50	Station 30	12.85036	-27.65	Reducing speed for Station 30
09/10/2014 13:54	Station 30	12.844	-27.647	V/l on DP (Station 30)
09/10/2014 13:58	OPT_JR303_052	12.84403	-27.647	Optic Rig 052 deployed
09/10/2014 14:03	CTD_JR303_S028	12.84397	-27.647	CTD 028 deployed
09/10/2014 14:06	GOF_JR303_012	12.84398	-27.647	Go-Flo 012 deployed
09/10/2014 14:09	GAR_JR303_027	12.84398	-27.647	Commenced Garrett Screen 027 sampling
09/10/2014 14:10	GOF_JR303_012	12.84399	-27.647	Go-Flo 012 recovered
09/10/2014 14:17	NAU_JR303_014	12.84397	-27.647	Nauplii net 014 deployed
09/10/2014 14:19	CTD_JR303_S028	12.84394	-27.647	CTD at depth 500m
09/10/2014 14:23	GAR_JR303_027	12.84395	-27.647	Completed Garrett Screen 027 sampling
09/10/2014 14:24	OPT_JR303_053	12.84396	-27.647	Optic Rig 053 deployed
09/10/2014 14:24	OPT_JR303_052	12.84396	-27.647	Optic Rig 052 recovered
09/10/2014 14:40	NAU_JR303_014	12.84395	-27.647	Nauplii net 014 fully recovered
09/10/2014 14:49	MPV_JR303_013	12.84396	-27.647	Microplankton nets 015 deployed
09/10/2014 14:50	OPT_JR303_053	12.84398	-27.647	Optic Rig 053 recovered
09/10/2014 14:50	CTD_JR303_S028	12.84398	-27.647	CTD 028 recovered
09/10/2014 15:12	MPV_JR303_013	12.84395	-27.647	Microplankton nets 015 recovered

09/10/2014 15:26	Station 30	12.84392	-27.647	V/l off DP
09/10/2014 15:33	Station 30	12.84546	-27.641	V/l at passage speed
09/10/2014 23:50	Station 31	11.38107	-27.337	Reducing speed for station 31
09/10/2014 23:57	Station 31	11.36997	-27.334	V/L on DP hd 100 x 0.6kts
10/10/2014 00:00	ZPS_JR303_004	11.36995	-27.334	ZPS_JR303_004 deployed ship course and speed 105 x 0.6kts
10/10/2014 00:20	ZPS_JR303_004	11.36941	-27.33	ZPS_JR303_004 re3covered on deck
10/10/2014 00:30	Station 31	11.36892	-27.328	Off DP V/L man. on passage
10/10/2014 03:50	Station 32	10.78607	-27.213	Reducing speed for station 32
10/10/2014 03:55	Station 32	10.78244	-27.21	V/l on DP (Station 32)
10/10/2014 04:03	ZPT_JR303_012	10.78219	-27.208	Zooplankton net tow 012 deployed
10/10/2014 04:57	ZPT_JR303_012	10.76119	-27.196	Zooplankton net 012 recovered. V/l stopped
10/10/2014 05:13	OPT_JR303_054	10.76043	-27.196	Optic Rig 054 off the deck
10/10/2014 05:14	OPT_JR303_054	10.76043	-27.196	Optic Rig 054 deployed
10/10/2014 05:15	CTD_JR303_S029	10.76046	-27.196	CTD 029 off the deck
10/10/2014 05:16	CTD_JR303_S029	10.76045	-27.196	CTD 029 deployed
10/10/2014 05:17	GAR_JR303_028	10.76044	-27.196	Commenced Garrett Screen 028 sampling
10/10/2014 05:20	ZPV_JR303_012	10.76045	-27.196	Bongo Net 012 off the deck
10/10/2014 05:21	ZPV_JR303_012	10.76044	-27.196	Bongo Net 012 deployed
10/10/2014 05:29	CTD_JR303_S029	10.76047	-27.196	CTD 029 at depth. Wire out 500m. Commenced recovery
10/10/2014 05:38	OPT_JR303_054	10.76044	-27.196	Optic Rig 054 at the surface
10/10/2014 05:39	OPT_JR303_055	10.76045	-27.196	Optic Rig 055 deployed
10/10/2014 05:39	GAR_JR303_028	10.76045	-27.196	Completed Garrett Screen 028 sampling
10/10/2014 05:43	ZPV_JR303_012	10.76043	-27.196	Bongo Net 012 at the surface
10/10/2014 05:46	ZPV_JR303_012	10.76043	-27.196	Bongo Net 012 on deck
10/10/2014 05:58	CTD_JR303_S029	10.76043	-27.196	CTD 029 at the surface

10/10/2014 06:00	CTD_JR303_S029	10.76045	-27.196	CTD 029 on deck
10/10/2014 06:04	OPT_JR303_055	10.76044	-27.196	Optic Rig 055 at the surface
10/10/2014 06:05	OPT_JR303_055	10.76044	-27.196	Optic Rig 055 on deck
10/10/2014 06:09	BAF_JR303_002	10.7604	-27.196	METBIO Buoy 002 off the deck. Vessel moving ahead at 1 knot for deployment.
10/10/2014 06:11	BAF_JR303_002	10.76039	-27.196	METBIO Buoy 002 (serial No. METBIO 005) deployed.
10/10/2014 06:12	Station 32	10.76015	-27.196	Decks
10/10/2014 06:18	Station 32	10.75196	-27.195	Vessel at passage speed
10/10/2014 13:51	Station 33	9.38193	-26.924	Reducing speed for station 33
10/10/2014 13:55	Station 33	9.37179	-26.922	V/l on DP (Station 33)
10/10/2014 14:01	OPT_JR303_056	9.36836	-26.921	Optic Rig 056 deployed
10/10/2014 14:03	CTD_JR303_S030	9.36835	-26.921	CTD 030 deployed
10/10/2014 14:06	GAR_JR303_029	9.36836	-26.921	Commenced Garrett Screen 029 sampling
10/10/2014 14:11	GOF_JR303_013	9.36836	-26.921	Go-Flo 013 deployed
10/10/2014 14:16	GOF_JR303_013	9.36836	-26.921	Go-Flo 013 recovered
10/10/2014 14:18	CTD_JR303_S030	9.36836	-26.921	CTD at depth
10/10/2014 14:21	NAU_JR303_015	9.36836	-26.921	Nauplii net 015 deployed
10/10/2014 14:24	OPT_JR303_056	9.36836	-26.921	Optic Rig 056 recovered
10/10/2014 14:25	OPT_JR303_057	9.36836	-26.921	Optic Rig 057 deployed
10/10/2014 14:31	GAR_JR303_029	9.36836	-26.921	Completed Garrett screen 029 sampling
10/10/2014 14:44	NAU_JR303_015	9.36835	-26.921	Nauplii net 015 recovered
10/10/2014 14:49	CTD_JR303_S030	9.36836	-26.921	CTD 030 recovered
10/10/2014 14:50	OPT_JR303_057	9.36836	-26.921	Optic Rig 057 fully recovered
10/10/2014 14:55	MPV_JR303_014	9.36837	-26.921	Microplankton nets 016 deployed
10/10/2014 15:17	MPV_JR303_014	9.36837	-26.921	Microplankton nets 016 recovered
10/10/2014	Station 33	9.36835	-	V/l off DP and proceeding to next

15:27			26.921	station
11/10/2014 03:48	Station 34	7.30064	-26.495	Reducing speed for station 34
11/10/2014 03:54	Station 34	7.2896	-26.492	V/l on DP (Station 34)
11/10/2014 04:00	ZPT_JR303_013	7.28779	-26.491	Zooplankton net tow 013 deployed
11/10/2014 04:54	ZPT_JR303_013	7.27906	-26.512	Zooplankton net 013 recovered. V/l stopped
11/10/2014 05:05	OPT_JR303_058	7.27915	-26.513	Optic Rig 058 off the deck
11/10/2014 05:06	OPT_JR303_058	7.27917	-26.513	Optic Rig 058 deployed
11/10/2014 05:06	CTD_JR303_S031	7.27917	-26.513	CTD 031 off the deck
11/10/2014 05:08	CTD_JR303_S031	7.27916	-26.513	CTD 031 deployed
11/10/2014 05:08	GAR_JR303_030	7.27916	-26.513	Commenced Garrett Screen 030 sampling
11/10/2014 05:11	ZPV_JR303_013	7.27914	-26.513	Bongo Net 013 off the deck
11/10/2014 05:12	ZPV_JR303_013	7.27915	-26.513	Bongo Net 013 deployed
11/10/2014 05:18	CTD_JR303_S031	7.27914	-26.513	CTD 031 at depth. Wire out 500m. Commenced recovery
11/10/2014 05:29	GAR_JR303_030	7.27917	-26.513	Completed Garrett screen 030 sampling
11/10/2014 05:30	OPT_JR303_058	7.27915	-26.513	Optic Rig 058 at the surface
11/10/2014 05:32	OPT_JR303_059	7.27915	-26.513	Optic Rig 059 deployed
11/10/2014 05:35	ZPV_JR303_013	7.27915	-26.513	Bongo Net 013 at the surface
11/10/2014 05:39	ZPV_JR303_013	7.27916	-26.513	Bongo Net 013 on deck
11/10/2014 05:51	CTD_JR303_S031	7.27916	-26.513	CTD 031 at the surface
11/10/2014 05:52	CTD_JR303_S031	7.27915	-26.513	CTD 031 on deck
11/10/2014 05:57	OPT_JR303_059	7.27915	-26.513	Optic Rig 059 at the surface
11/10/2014 05:58	OPT_JR303_059	7.27916	-26.513	Optic Rig 059 on deck
11/10/2014 06:02	Station 34	7.27915	-26.513	Decks
11/10/2014 06:11	Station 34	7.27859	-26.517	Vessel at passage speed
11/10/2014 13:50	Station 35	5.91139	-26.207	Reducing speed for station 35
11/10/2014	Station 35	5.90079	-	V/l on DP (Station 35)

13:55			26.205	
11/10/2014 13:58	OPT_JR303_060	5.89915	-26.205	Optic Rig 060 deployed
11/10/2014 14:03	CTD_JR303_S032	5.89914	-26.205	CTD 032 deployed
11/10/2014 14:04	GAR_JR303_031	5.89914	-26.205	Commenced Garrett Screen 031 sampling
11/10/2014 14:12	GOF_JR303_014	5.89912	-26.205	Go-Flo 014 deployed
11/10/2014 14:16	CTD_JR303_S032	5.89913	-26.205	CTD at depth
11/10/2014 14:16	GOF_JR303_014	5.89913	-26.205	Go-Flo 014 recovered
11/10/2014 14:22	OPT_JR303_060	5.89912	-26.205	Optic Rig 060 recovered
11/10/2014 14:23	OPT_JR303_061	5.89912	-26.205	Optic Rig 061 deployed
11/10/2014 14:24	GAR_JR303_031	5.89912	-26.205	Completed Garrett screen 031 sampling
11/10/2014 14:25	NAU_JR303_016	5.89912	-26.205	Nauplii net 016 deployed
11/10/2014 14:42	CTD_JR303_S032	5.89911	-26.205	CTD 032 recovered
11/10/2014 14:48	OPT_JR303_061	5.89912	-26.205	Optic Rig 061 fully recovered
11/10/2014 14:49	NAU_JR303_016	5.8991	-26.205	Nauplii net 016 recovered
11/10/2014 15:00	MPV_JR303_015	5.8988	-26.204	Microplankton nets 017 deployed
11/10/2014 15:22	MPV_JR303_015	5.89836	-26.204	Microplankton nets 017 recovered
11/10/2014 15:31	Station 35	5.89831	-26.204	V/l off DP
11/10/2014 15:39	Station 35	5.89242	-26.205	V/l at passage speed
11/10/2014 23:50	Station 36	4.42867	-25.907	V/L reducing speed for station 36
11/10/2014 23:57	Station 36	4.41267	-25.904	V/L on DP hd 177 x 0.6kts
12/10/2014 00:01	ZPS_JR303_005	4.4119	-25.904	Zooplankton slow tow net 005 deployed
12/10/2014 00:20	ZPS_JR303_005	4.40904	-25.903	Zooplankton slow tow 005 recovered
12/10/2014 00:29	Station 36	4.4075	-25.903	V/L off DP man. on passage
12/10/2014 03:49	Station 37	3.81574	-25.779	Reducing speed for station 37
12/10/2014 03:54	Station 37	3.80676	-25.777	V/l on DP (Station 37)
12/10/2014	ZPT_JR303_014	3.80516	-	Zooplankton net tow 014 deployed

04:00			25.777	
12/10/2014 04:18	ZPT_JR303_014	3.79658	-25.777	Zooplankton net at depth 550m
12/10/2014 04:52	ZPT_JR303_014	3.78153	-25.775	Zooplankton net 014 recovered. V/l stopped
12/10/2014 05:03	OPT_JR303_062	3.78112	-25.775	Optic Rig 062 off the deck
12/10/2014 05:05	OPT_JR303_062	3.78111	-25.775	Optic Rig 062 deployed
12/10/2014 05:05	CTD_JR303_S033	3.78111	-25.775	CTD 033 off the deck
12/10/2014 05:06	CTD_JR303_S033	3.78111	-25.775	CTD 033 dployed
12/10/2014 05:07	GAR_JR303_032	3.78111	-25.775	Commenced Garrett Screen 032 sampling
12/10/2014 05:09	ZPV_JR303_014	3.78111	-25.775	Bongo Net 014 off the deck
12/10/2014 05:10	ZPV_JR303_014	3.78111	-25.775	Bongo Net 014 deployed
12/10/2014 05:19	CTD_JR303_S033	3.78111	-25.775	CTD 033 at depth. Wire out 500m. Commenced recovery
12/10/2014 05:28	OPT_JR303_062	3.78112	-25.775	Optic Rig 062 at the surface
12/10/2014 05:29	GAR_JR303_032	3.78112	-25.775	Completed Garrett screen 032 sampling
12/10/2014 05:30	OPT_JR303_063	3.78111	-25.775	Optic Rig 063 deployed
12/10/2014 05:33	ZPV_JR303_014	3.78113	-25.775	Bongo Net 014 at the surface
12/10/2014 05:36	ZPV_JR303_014	3.78112	-25.775	Bongo Net 014 on deck
12/10/2014 05:51	CTD_JR303_S033	3.78113	-25.775	CTD 033 at the surface
12/10/2014 05:52	CTD_JR303_S033	3.78112	-25.775	CTD 033 on deck
12/10/2014 05:54	OPT_JR303_063	3.78112	-25.775	Optic Rig 063 at the surface
12/10/2014 05:55	OPT_JR303_063	3.78113	-25.775	Optic Rig 063 on deck
12/10/2014 05:56	Station 37	3.7811	-25.775	Decks
12/10/2014 06:07	Station 37	3.77173	-25.772	Vessel at passage speed
12/10/2014 13:51	Station 38	2.38665	-25.488	Reducing speed for station 38
12/10/2014 13:55	Station 38	2.37801	-25.487	V/l on DP (Station 38)
12/10/2014 14:00	OPT_JR303_064	2.37583	-25.486	Optic Rig 064 deployed
12/10/2014	GOF_JR303_015	2.37583	-	Go-Flo 015 deployed

14:00			25.486	
12/10/2014 14:03	CTD_JR303_S034	2.37583	-25.486	CTD 034 deployed
12/10/2014 14:04	GOF_JR303_015	2.37582	-25.486	Go-Flo 015 recovered
12/10/2014 14:05	GAR_JR303_033	2.37581	-25.486	Commenced Garrett Screen 033 sampling
12/10/2014 14:18	CTD_JR303_S034	2.37582	-25.486	CTD at depth
12/10/2014 14:24	OPT_JR303_064	2.37583	-25.486	Optic Rig 064 recovered
12/10/2014 14:25	OPT_JR303_065	2.37582	-25.486	Optic Rig 065 deployed
12/10/2014 14:25	GAR_JR303_033	2.37582	-25.486	Completed Garrett screen 033 sampling
12/10/2014 14:34	NAU_JR303_017	2.37582	-25.486	Nauplii net 017 deployed
12/10/2014 14:44	CTD_JR303_S034	2.37582	-25.486	CTD 034 recovered
12/10/2014 14:50	OPT_JR303_065	2.37583	-25.486	Optic Rig 065 fully recovered
12/10/2014 14:56	NAU_JR303_017	2.37582	-25.486	Nauplii net 017 recovered
12/10/2014 15:17	MPV_JR303_016	2.37583	-25.486	Microplankton nets 016 deployed
12/10/2014 15:39	MPV_JR303_016	2.37581	-25.486	Microplankton nets 016 recovered
12/10/2014 15:51	Station 38	2.37582	-25.486	V/l off DP
12/10/2014 15:58	Station 38	2.36509	-25.484	V/l at passage speed
13/10/2014 03:50	Station 39	0.09269	-25.018	Reducing speed for Station 39
13/10/2014 03:54	Station 39	0.08625	-25.017	V/l on DP (Station 39)
13/10/2014 03:59	ZPT_JR303_015	0.08432	-25.016	Zooplankton net tow 015 deployed
13/10/2014 04:17	ZPT_JR303_015	0.07602	-25.012	Zooplankton net at depth 550m
13/10/2014 04:52	ZPT_JR303_015	0.05987	-25.003	Zooplankton net 015 recovered
13/10/2014 04:54	Station 39	0.0589	-25.002	V/l off DP
13/10/2014 05:32	Station 40 (The Hot One)	0.00021	-25	Vessel set up on station in full auto pos DP
13/10/2014 05:32	CTD_JR303_S035	0.00021	-25	CTD 035 off the deck
13/10/2014 05:32	OPT_JR303_066	0.00021	-25	Optic Rig 066 off the deck
13/10/2014	CTD_JR303_S035	-0.00003	-25	CTD 035 deployed

05:33				
13/10/2014 05:34	OPT_JR303_066	-0.00003	-25	Optic Rig 066 deployed
13/10/2014 05:37	GAR_JR303_034	-0.00001	-25	Commenced Garrett Screen 034 sampling
13/10/2014 05:37	ZPV_JR303_015	-0.00001	-25	Bongo Net 015 off the deck
13/10/2014 05:38	ZPV_JR303_015	0.00002	-25	Bongo Net 015 deployed
13/10/2014 05:44	CTD_JR303_S035	0.00006	-25	CTD 035 at depth. Wire out 500m. Commenced recovery
13/10/2014 05:58	Station 040	0.00005	-25	Subsurface current dragging all instruments under the hull. Moving vessel bodily to port at 0.5kts to compensate. Ships Head 138
13/10/2014 06:00	GAR_JR303_034	0.00012	-25	Completed Garrett screen 034 sampling
13/10/2014 06:03	OPT_JR303_066	0.00042	-25	Optic Rig 066 at the surface
13/10/2014 06:04	OPT_JR303_067	0.00052	-24.999	Optic Rig 067 deployed
13/10/2014 06:05	ZPV_JR303_015	0.0006	-24.999	Bongo Net 015 at the surface
13/10/2014 06:08	ZPV_JR303_015	0.00083	-24.999	Bongo Net 015 on deck
13/10/2014 06:16	CTD_JR303_S035	0.00129	-24.999	CTD 035 at the surface
13/10/2014 06:18	CTD_JR303_S035	0.0014	-24.998	CTD 035 on deck
13/10/2014 06:27	OPT_JR303_067	0.00188	-24.998	Optic Rig 067 at the surface. Stopping the vessel
13/10/2014 06:28	OPT_JR303_067	0.00197	-24.998	Optic Rig 067 on deck
13/10/2014 06:33	Station 40	0.00211	-24.998	Decks
13/10/2014 06:41	Station 40	-0.00664	-24.997	Vessel at passage speed
14/10/2014 03:49	Station 41	-3.87925	-25.021	Reducing speed for station 41
14/10/2014 03:54	Station 41	-3.88473	-25.02	V/l on DP (Station 41)
14/10/2014 04:00	ZPT_JR303_016	-3.88525	-25.02	Zooplankton nets off the deck
14/10/2014 04:02	ZPT_JR303_016	-3.8858	-25.019	Zooplankton net tow 016 deployed
14/10/2014 04:20	ZPT_JR303_016	-3.89079	-25.011	Zooplankton net at depth 550m
14/10/2014 04:54	ZPT_JR303_016	-3.89993	-24.997	Zooplankton net 016 recovered
14/10/2014	OPT_JR303_068	-3.90024	-	Optic Rig 068 off the deck

05:03			24.996	
14/10/2014 05:04	OPT_JR303_068	-3.90023	-24.996	Optic Rig 068 deployed
14/10/2014 05:05	CTD_JR303_S036	-3.90023	-24.997	CTD 036 off the deck
14/10/2014 05:06	CTD_JR303_S036	-3.90025	-24.997	CTD 036 deployed
14/10/2014 05:06	GAR_JR303_035	-3.90025	-24.997	Commenced Garrett Screen 035 sampling
14/10/2014 05:09	ZPV_JR303_016	-3.90024	-24.996	Bongo Net 016 off the deck
14/10/2014 05:10	ZPV_JR303_016	-3.90024	-24.996	Bongo Net 016 deployed
14/10/2014 05:18	CTD_JR303_S036	-3.90023	-24.996	CTD 036 at depth. Wire out 500m. Commenced recovery
14/10/2014 05:26	GAR_JR303_035	-3.90025	-24.997	Completed Garrett screen 035 sampling
14/10/2014 05:28	OPT_JR303_068	-3.90025	-24.997	Optic Rig 068 at the surface
14/10/2014 05:29	OPT_JR303_069	-3.90024	-24.997	Optic Rig 069 deployed
14/10/2014 05:32	ZPV_JR303_016	-3.90023	-24.997	Bongo Net 016 at the surface
14/10/2014 05:35	ZPV_JR303_016	-3.90023	-24.996	Bongo Net 016 on deck
14/10/2014 05:44	CTD_JR303_S036	-3.90023	-24.996	CTD 036 at the surface
14/10/2014 05:46	CTD_JR303_S036	-3.90025	-24.996	CTD 036 on deck
14/10/2014 05:53	OPT_JR303_069	-3.90021	-24.996	Optic Rig 069 at the surface
14/10/2014 05:54	OPT_JR303_069	-3.90022	-24.997	Optic Rig 069 on deck
14/10/2014 05:59	Station 41	-3.90024	-24.996	Decks
14/10/2014 06:10	Station 41	-3.91215	-24.992	Vessel at passage speed
14/10/2014 13:50	Station 42	-5.31318	-25.027	Reducing speed for station 42
14/10/2014 13:54	Station 42	-5.32193	-25.026	V/l on DP (Station 42)
14/10/2014 14:01	OPT_JR303_070	-5.32235	-25.026	Optic Rig 070 deployed
14/10/2014 14:03	GOF_JR303_016	-5.32235	-25.026	Go-Flo 016 deployed
14/10/2014 14:04	CTD_JR303_S037	-5.32234	-25.026	CTD 037 deployed
14/10/2014 14:07	GOF_JR303_016	-5.32234	-25.026	Go-Flo 016 recovered
14/10/2014	GAR_JR303_036	-5.32234	-	Commenced Garrett Screen 036

14:07			25.026	sampling
14/10/2014 14:16	NAU_JR303_018	-5.32235	-25.026	Nauplii net 018 deployed
14/10/2014 14:20	CTD_JR303_S037	-5.32234	-25.026	CTD at depth
14/10/2014 14:25	OPT_JR303_070	-5.32235	-25.026	Optic Rig 070 recovered
14/10/2014 14:26	OPT_JR303_071	-5.32234	-25.026	Optic Rig 071 deployed
14/10/2014 14:35	GAR_JR303_036	-5.32236	-25.026	Completed Garrett screen 036 sampling
14/10/2014 14:40	NAU_JR303_018	-5.32235	-25.026	Nauplii net 018 recovered
14/10/2014 14:46	CTD_JR303_S037	-5.32236	-25.026	CTD 037 recovered
14/10/2014 14:50	MPV_JR303_017	-5.32235	-25.026	Microplankton nets 017 deployed
14/10/2014 14:51	OPT_JR303_071	-5.32235	-25.026	Optic Rig 071 fully recovered
14/10/2014 15:14	MPV_JR303_017	-5.32234	-25.026	Microplankton nets 017 recovered
14/10/2014 15:25	Station 42	-5.32233	-25.026	V/l off DP
14/10/2014 15:33	Station 42	-5.33027	-25.023	V/l at passage speed
14/10/2014 23:50	Station 43	-6.85162	-25.034	V/L reducing speed for DP
14/10/2014 23:55	Station 43	-6.85488	-25.029	V/L on DP hd 111 x 0.6 kts
14/10/2014 23:58	ZPS_JR303_006	-6.8552	-25.029	Zooplankton slow tow 6 deployed hd 111 x 0.6 kts
15/10/2014 00:17	ZPS_JR303_006	-6.85795	-25.024	Zooplankton slow tow 6 recovered on deck
15/10/2014 00:24	Station 43	-6.85891	-25.022	V/L off DP man. on passage
15/10/2014 03:48	Station 44	-7.46245	-25.039	Reducing speed for station 44
15/10/2014 03:53	Station 44	-7.47062	-25.039	V/l on DP (Station 44)
15/10/2014 03:56	ZPT_JR303_017	-7.47076	-25.039	Zooplankton net tow 017 deployed
15/10/2014 04:15	ZPT_JR303_017	-7.47249	-25.03	Zooplankton net at depth 550m
15/10/2014 04:49	ZPT_JR303_017	-7.47732	-25.014	Zooplankton net 017 recovered. V/l stopped
15/10/2014 04:59	OPT_JR303_072	-7.47753	-25.014	Optic Rig 072 off the deck
15/10/2014 05:01	OPT_JR303_072	-7.47753	-25.014	Optic Rig 072 deployed
15/10/2014	CTD_JR303_S038	-7.47752	-	CTD 038 off the deck

05:02			25.014	
15/10/2014 05:03	CTD_JR303_S038	-7.47752	-25.014	CTD 038 deployed
15/10/2014 05:04	GAR_JR303_037	-7.4775	-25.014	Commenced Garrett Screen 037 sampling
15/10/2014 05:06	ZPV_JR303_017	-7.47752	-25.014	Bongo Net 017 off the deck
15/10/2014 05:07	ZPV_JR303_017	-7.4775	-25.014	Bongo Net 017 deployed
15/10/2014 05:14	CTD_JR303_S038	-7.47751	-25.014	CTD 038 at depth. Wire out 500m. Commenced recovery
15/10/2014 05:24	OPT_JR303_072	-7.4775	-25.014	Optic Rig 072 at the surface
15/10/2014 05:26	OPT_JR303_073	-7.4775	-25.014	Optic Rig 073 deployed
15/10/2014 05:28	GAR_JR303_037	-7.4775	-25.014	Completed Garrett screen 037 sampling
15/10/2014 05:29	ZPV_JR303_017	-7.4775	-25.014	Bongo Net 017 at the surface
15/10/2014 05:32	ZPV_JR303_017	-7.47751	-25.014	Bongo Net 017 on deck
15/10/2014 05:44	CTD_JR303_S038	-7.47751	-25.014	CTD 038 at the surface
15/10/2014 05:46	CTD_JR303_S038	-7.47749	-25.014	CTD 038 on deck
15/10/2014 05:50	OPT_JR303_073	-7.4775	-25.014	Optic Rig 073 at the surface
15/10/2014 05:51	OPT_JR303_073	-7.47752	-25.014	Optic Rig 073 on deck
15/10/2014 05:54	Station 44	-7.47752	-25.014	Decks
15/10/2014 06:03	Station 44	-7.483	-25.012	Vessel at passage speed
15/10/2014 13:51	Station 45	-8.90341	-25.044	Reducing speed for station 45
15/10/2014 13:54	Station 45	-8.91055	-25.044	V/l on DP (Station 45)
15/10/2014 13:57	OPT_JR303_074	-8.91117	-25.043	Optic Rig 074 deployed
15/10/2014 14:00	GOF_JR303_017	-8.91119	-25.043	Go-Flo 017 deployed
15/10/2014 14:03	CTD_JR303_S039	-8.91122	-25.043	CTD 039 deployed
15/10/2014 14:08	GAR_JR303_038	-8.91121	-25.043	Commenced Garrett Screen 038 sampling
15/10/2014 14:13	GOF_JR303_017	-8.91122	-25.043	Go-Flo 017 recovered
15/10/2014 14:16	CTD_JR303_S039	-8.91122	-25.043	CTD at depth
15/10/2014	GAR_JR303_038	-8.91121	-	Garrett screen 038 recovered

14:18			25.043	
15/10/2014 14:22	GAR_JR303_038	-8.91121	-25.043	Re-commenced Garrett Screen 038 sampling
15/10/2014 14:23	NAU_JR303_019	-8.9112	-25.043	Nauplii net 019 deployed
15/10/2014 14:24	OPT_JR303_074	-8.91121	-25.043	Optic Rig 074 recovered
15/10/2014 14:25	OPT_JR303_075	-8.91121	-25.043	Optic Rig 075 deployed
15/10/2014 14:30	GAR_JR303_038	-8.91122	-25.043	Completed Garrett screen 038 sampling
15/10/2014 14:41	CTD_JR303_S039	-8.91122	-25.043	CTD 039 recovered
15/10/2014 14:46	NAU_JR303_019	-8.91122	-25.043	Nauplii net 019 recovered
15/10/2014 14:49	OPT_JR303_075	-8.91124	-25.043	Optic Rig 075 recovered
15/10/2014 14:56	MPV_JR303_017	-8.91121	-25.043	Microplankton nets 017 deployed
15/10/2014 15:22	MPV_JR303_018	-8.91121	-25.043	Microplankton nets 018 recovered
15/10/2014 15:30	Station 45	-8.91122	-25.043	V/l off DP
15/10/2014 15:39	Station 45	-8.92043	-25.04	V/l at passage speed
15/10/2014 23:50	Station 46	-10.429	-25.054	V/L reducing speed for station 46
15/10/2014 23:56	Station 46	-10.4319	-25.05	V/L on DP hd 110 x 1.6kts
16/10/2014 00:01	ZPS_JR303_007	-10.4326	-25.049	Zooplankton slow tow net 007 deployed
16/10/2014 00:26	ZPS_JR303_007	-10.4383	-25.038	Zooplankton slow tow 007 recovered on deck and v/l off DP
16/10/2014 00:36	Station 46	-10.441	-25.032	V/l at passage speed
16/10/2014 03:50	Station 47	-11.0346	-25.049	Reducing speed for station 47
16/10/2014 03:54	Station 47	-11.0377	-25.048	V/l on DP (Station 47)
16/10/2014 03:58	ZPT_JR303_018	-11.0378	-25.047	Zooplankton net tow 018 deployed at 1.7kts
16/10/2014 04:50	ZPT_JR303_018	-11.0474	-25.023	Zooplankton net 018 recovered. V/l stopped
16/10/2014 05:01	OPT_JR303_076	-11.0476	-25.022	Optic Rig 076 off the deck
16/10/2014 05:01	GAR_JR303_039	-11.0476	-25.022	Commenced Garrett Screen 039 sampling
16/10/2014 05:02	OPT_JR303_076	-11.0476	-25.022	Optic Rig 076 deployed
16/10/2014	CTD_JR303_S040	-11.0477	-	CTD 040 off the deck

05:04			25.022	
16/10/2014 05:05	CTD_JR303_S040	-11.0476	-25.022	CTD 040 deployed
16/10/2014 05:09	ZPV_JR303_018	-11.0477	-25.022	Bongo Net 018 off the deck
16/10/2014 05:10	ZPV_JR303_018	-11.0477	-25.022	Bongo Net 018 deployed
16/10/2014 05:17	CTD_JR303_S040	-11.0476	-25.022	CTD 040 at depth. Wire out 500m. Commenced recovery
16/10/2014 05:24	GAR_JR303_039	-11.0476	-25.022	Completed Garrett screen 039 sampling
16/10/2014 05:26	OPT_JR303_076	-11.0477	-25.022	Optic Rig 076 at the surface
16/10/2014 05:28	OPT_JR303_077	-11.0477	-25.022	Optic Rig 077 deployed
16/10/2014 05:32	ZPV_JR303_018	-11.0476	-25.022	Bongo Net 018 at the surface
16/10/2014 05:35	ZPV_JR303_018	-11.0477	-25.022	Bongo Net 018 on deck
16/10/2014 05:45	CTD_JR303_S040	-11.0477	-25.022	CTD 040 at the surface
16/10/2014 05:46	CTD_JR303_S040	-11.0477	-25.022	CTD 040 on deck
16/10/2014 05:51	OPT_JR303_077	-11.0477	-25.022	Optic Rig 077 at the surface
16/10/2014 05:52	OPT_JR303_077	-11.0477	-25.022	Optic Rig 077 on deck
16/10/2014 05:57	Station 47	-11.0477	-25.022	Decks
16/10/2014 06:05	Station 47	-11.0552	-25.019	Vessel at passage speed
16/10/2014 13:50	Station 48	-12.4808	-25.066	Reducing speed for station 48
16/10/2014 13:55	Station 48	-12.4934	-25.066	V/l on DP (Station 48)
16/10/2014 14:00	OPT_JR303_078	-12.4948	-25.065	Optic Rig 078 deployed
16/10/2014 14:01	CTD_JR303_S041	-12.4948	-25.065	CTD 041 deployed
16/10/2014 14:02	GAR_JR303_040	-12.4948	-25.065	Commenced Garrett Screen 040 sampling
16/10/2014 14:02	GOF_JR303_018	-12.4948	-25.065	Go-Flo 018 deployed
16/10/2014 14:08	GOF_JR303_018	-12.4948	-25.065	Go-Flo 018 recovered
16/10/2014 14:15	NAU_JR303_020	-12.4948	-25.065	Nauplii net 020 deployed
16/10/2014 14:16	CTD_JR303_S041	-12.4948	-25.065	CTD at depth
16/10/2014	GAR_JR303_040	-12.4948	-	Completed Garrett screen 040

14:20			25.065	sampling
16/10/2014 14:24	OPT_JR303_078	-12.4948	-25.065	Optic Rig 078 recovered
16/10/2014 14:25	OPT_JR303_079	-12.4948	-25.065	Optic Rig 079 deployed
16/10/2014 14:38	NAU_JR303_020	-12.4948	-25.065	Nauplii net 020 recovered
16/10/2014 14:47	CTD_JR303_S041	-12.4948	-25.065	CTD 041 recovered
16/10/2014 14:49	MPV_JR303_019	-12.4948	-25.065	Microplankton nets 019 deployed
16/10/2014 14:50	OPT_JR303_079	-12.4948	-25.065	Optic Rig 079 fully recovered
16/10/2014 15:12	MPV_JR303_019	-12.4948	-25.065	Microplankton nets 019 recovered
16/10/2014 15:25	Station 48	-12.4948	-25.065	V/l off DP
16/10/2014 15:33	Station 48	-12.5017	-25.061	V/l at passage speed
16/10/2014 23:50	Station 49	-14.0309	-25.071	V/L reducing speed for station 49
16/10/2014 23:55	Station 49	-14.0404	-25.07	V/L on DP hd 113 x 1.5kts
17/10/2014 00:00	ZPS_JR303_008	-14.0412	-25.07	Zooplankton slow tow net 008 deployed
17/10/2014 00:23	ZPS_JR303_008	-14.0466	-25.058	Zooplankton slow tow 008 recovered
17/10/2014 00:24	Station 49	-14.0469	-25.058	V/L off DP
17/10/2014 00:33	Station 49	-14.0502	-25.051	V/L on passage speed
17/10/2014 03:51	Station 50	-14.6526	-25.077	Reducing speed for station 50
17/10/2014 03:54	Station 50	-14.6576	-25.076	V/l on DP (Station 50)
17/10/2014 03:57	ZPT_JR303_019	-14.6581	-25.076	Zooplankton net tow 019 deployed
17/10/2014 04:50	ZPT_JR303_019	-14.6704	-25.052	Zooplankton net 019 recovered. V/l stopped
17/10/2014 04:59	OPT_JR303_080	-14.6706	-25.052	Optic Rig 080 off the deck
17/10/2014 04:59	GAR_JR303_041	-14.6706	-25.052	Commenced Garrett Screen 041 sampling
17/10/2014 05:00	OPT_JR303_080	-14.6706	-25.052	Optic Rig 080 deployed
17/10/2014 05:02	CTD_JR303_S042	-14.6706	-25.052	CTD 042 off the deck
17/10/2014 05:03	CTD_JR303_S042	-14.6706	-25.052	CTD 042 deplloyed
17/10/2014	ZPV_JR303_019	-14.6706	-	Bongo Net 019 off the deck

05:06			25.052	
17/10/2014 05:07	ZPV_JR303_019	-14.6706	-25.052	Bongo Net 019 deployed
17/10/2014 05:14	CTD_JR303_S042	-14.6706	-25.052	CTD 042 at depth. Wire out 500m. Commenced recovery
17/10/2014 05:23	OPT_JR303_080	-14.6706	-25.052	Optic Rig 080 at the surface
17/10/2014 05:25	OPT_JR303_081	-14.6706	-25.051	Optic Rig 081 deployed
17/10/2014 05:26	GAR_JR303_041	-14.6706	-25.051	Completed Garrett screen 041 sampling
17/10/2014 05:29	ZPV_JR303_019	-14.6706	-25.052	Bongo Net 019 at the surface
17/10/2014 05:32	ZPV_JR303_019	-14.6706	-25.052	Bongo Net 019 on deck
17/10/2014 05:47	CTD_JR303_S042	-14.6706	-25.051	CTD 042 at the surface
17/10/2014 05:48	CTD_JR303_S042	-14.6706	-25.051	CTD 042 on deck
17/10/2014 05:49	OPT_JR303_081	-14.6706	-25.052	Optic Rig 081 at the surface
17/10/2014 05:50	OPT_JR303_081	-14.6706	-25.051	Optic Rig 081 on deck
17/10/2014 05:54	Station 50	-14.6706	-25.051	Decks
17/10/2014 06:02	Station 50	-14.676	-25.048	Vessel at passage speed
17/10/2014 13:51	Station 51	-16.1218	-25.087	Reducing speed for station 51
17/10/2014 13:55	Station 51	-16.1308	-25.085	V/l on DP (Station 51)
17/10/2014 13:58	OPT_JR303_082	-16.1315	-25.085	Optic Rig 082 deployed
17/10/2014 14:01	GOF_JR303_019	-16.1316	-25.084	Go-Flo 019 deployed
17/10/2014 14:02	CTD_JR303_S043	-16.1315	-25.084	CTD 043 deployed
17/10/2014 14:05	GAR_JR303_042	-16.1315	-25.084	Commenced Garrett Screen 042 sampling
17/10/2014 14:07	GOF_JR303_019	-16.1315	-25.084	Go-Flo 019 recovered
17/10/2014 14:12	NAU_JR303_021	-16.1315	-25.084	Nauplii net 021 deployed
17/10/2014 14:16	CTD_JR303_S043	-16.1315	-25.084	CTD at depth
17/10/2014 14:22	OPT_JR303_082	-16.1315	-25.084	Optic Rig 082 recovered
17/10/2014 14:23	OPT_JR303_083	-16.1315	-25.084	Optic Rig 083 deployed
17/10/2014	NAU_JR303_021	-16.1315	-	Nauplii net 021 recovered

14:34			25.084	
17/10/2014 14:40	GAR_JR303_042	-16.1316	-25.084	Completed Garrett screen 042 sampling
17/10/2014 14:44	CTD_JR303_S043	-16.1315	-25.084	CTD 043 recovered
17/10/2014 14:45	MPV_JR303_020	-16.1316	-25.084	Microplankton nets 020 deployed
17/10/2014 14:48	OPT_JR303_083	-16.1316	-25.084	Optic Rig 083 fully recovered
17/10/2014 15:17	MAF_JR303_001	-16.1316	-25.084	ARGO float deployed (#6998) at 1kt
17/10/2014 15:19	Station 51	-16.1316	-25.083	V/l off DP
17/10/2014 15:25	Station 51	-16.1334	-25.076	V/l at passage speed
17/10/2014 23:50	Station 52	-17.6761	-25.095	V/L reducing speed for station 52
17/10/2014 23:55	Station 52	-17.6836	-25.093	V/L on Dp hd 100 x 1.5kts
17/10/2014 23:58	ZPS_JR303_009	-17.6838	-25.093	Zooplankton slow tow net 009 deployed
18/10/2014 00:22	ZPS_JR303_009	-17.686	-25.08	Zooplankton slow tow 009 recovered on deck
18/10/2014 00:26	Station 52	-17.6864	-25.078	V/L off DP
18/10/2014 00:31	Station 52	-17.689	-25.071	V/L on Passage speed
18/10/2014 03:50	Station 53	-18.3068	-25.096	Reducing speed for station 53
18/10/2014 03:54	Station 53	-18.3157	-25.096	V/l on DP (Station 53)
18/10/2014 04:03	ZPT_JR303_020	-18.3164	-25.093	Zooplankton net tow 020 deployed
18/10/2014 04:55	ZPT_JR303_020	-18.3165	-25.065	Zooplankton net 020 recovered. V/l stopped
18/10/2014 05:04	OPT_JR303_084	-18.3165	-25.065	Optic Rig 084 off the deck
18/10/2014 05:05	OPT_JR303_084	-18.3165	-25.065	Optic Rig 084 deployed
18/10/2014 05:05	CTD_JR303_S044	-18.3165	-25.065	CTD 044 off the deck
18/10/2014 05:05	GAR_JR303_043	-18.3165	-25.065	Commenced Garrett Screen 043 sampling
18/10/2014 05:06	CTD_JR303_S044	-18.3165	-25.065	CTD 044 deployed
18/10/2014 05:10	ZPV_JR303_020	-18.3165	-25.065	Bongo Net 020 off the deck
18/10/2014 05:11	ZPV_JR303_020	-18.3165	-25.065	Bongo Net 020 deployed

18/10/2014 05:18	CTD_JR303_S044	-18.3165	-25.065	CTD 044 at depth. Wire out 500m. Commenced recovery
18/10/2014 05:28	OPT_JR303_084	-18.3165	-25.065	Optic Rig 084 at the surface
18/10/2014 05:29	GAR_JR303_043	-18.3165	-25.065	Completed Garrett screen 043 sampling
18/10/2014 05:30	OPT_JR303_085	-18.3165	-25.065	Optic Rig 085 deployed
18/10/2014 05:32	ZPV_JR303_020	-18.3165	-25.065	Bongo Net 020 at the surface
18/10/2014 05:35	ZPV_JR303_020	-18.3165	-25.065	Bongo net 020 on deck
18/10/2014 05:48	CTD_JR303_S044	-18.3165	-25.065	CTD 044 at the surface
18/10/2014 05:50	CTD_JR303_S044	-18.3164	-25.065	CTD 044 on deck
18/10/2014 05:54	OPT_JR303_085	-18.3165	-25.065	Optic Rig 085 at the surface
18/10/2014 05:55	OPT_JR303_085	-18.3165	-25.065	Optic Rig 085 on deck
18/10/2014 05:59	Station 53	-18.3164	-25.065	Decks
18/10/2014 06:08	Station 53	-18.322	-25.059	Vessel at passage speed
18/10/2014 07:23	SOG 1 Recovery	-18.5478	-25.095	Commenced reducing speed
18/10/2014 07:28	SOG 1 Recovery	-18.5549	-25.094	Vessel set up on station in full auto Pos DP 0.5' down current of mooring
18/10/2014 07:57	SOG 1 Recovery	-18.5536	-25.094	Hydrophone deployed
18/10/2014 08:07	SOG 1 Recovery	-18.5534	-25.095	Release signal sent
18/10/2014 10:00	SOG 1 Recovery	-18.5506	-25.099	Billing float and recovery line at the surface
18/10/2014 10:37	SOG 1 Recovery	-18.5551	-25.09	Hooked on to recovery line
18/10/2014 10:55	SOG 1 Recovery	-18.5544	-25.088	1st Sediment Trap on board
18/10/2014 11:16	SOG 1 Recovery	-18.5529	-25.081	2nd Sediment Trap on board
18/10/2014 12:29	SOG 1 Recovery / Station 54	-18.5508	-25.072	SOG 1 mooring fully recovered
18/10/2014 14:04	CTD_JR303_S045	-18.5506	-25.071	CTD 045 deployed
18/10/2014 14:18	CTD_JR303_S045	-18.5506	-25.071	CTD at depth
18/10/2014 14:38	CTD_JR303_S045	-18.5506	-25.071	CTD 045 recovered
18/10/2014 15:39	CTD_JR303_S046	-18.5506	-25.071	CTD 046 deployed

18/10/2014 15:47	CTD_JR303_S046	-18.5506	-25.071	CTD at depth
18/10/2014 16:20	CTD_JR303_S046	-18.5506	-25.071	CTD 046 recovered
18/10/2014 16:21	Station 54	-18.5506	-25.071	Completed station
19/10/2014 07:24	SOG 1 Redeployment	-18.5453	-25.121	Vessel set up on DP 2.0' downstream of deployment position
19/10/2014 07:35	SOG 1 Redeployment	-18.5453	-25.121	Beacon tested (156.625MHz)
19/10/2014 07:41	SOG 1 Redeployment	-18.5453	-25.121	Ready on deck. Vessel moving off along 100Â° at 0.4kts
19/10/2014 07:42	SOG 1 Redeployment	-18.5453	-25.121	Commenced deployment
19/10/2014 07:43	SOG 1 Redeployment	-18.5453	-25.121	Billings Float in the water
19/10/2014 10:03	SOG 1 Redeployment	-18.5507	-25.092	SOG mooring fully deployed depth 5259m
19/10/2014 10:09	SOG 1 Redeployment	-18.5507	-25.092	Transducer in water to ping mooring
19/10/2014 10:27	SOG 1 Redeployment	-18.5507	-25.092	Transducer recovered on deck
19/10/2014 10:28	SOG 1 Redeployment	-18.5507	-25.092	V/L off DP to reposition for mooring recovery
19/10/2014 10:45	SOG 2 Recovery	-18.5301	-25.097	V/L on DP
19/10/2014 10:50	SOG 2 Recovery	-18.5305	-25.097	Transducer deployed in the water
19/10/2014 10:54	SOG 2 Recovery	-18.5304	-25.097	Release trigger sent
19/10/2014 11:39	SOG 2 Recovery	-18.5304	-25.097	mooring at the surface
19/10/2014 11:40	SOG 2 Recovery	-18.5304	-25.097	Transducer recovered on deck
19/10/2014 11:48	SOG 2 Recovery	-18.5304	-25.097	V/L off Dp man. for mooring recovery
19/10/2014 12:00	SOG 2 Recovery	-18.5279	-25.107	V/L on DP for recovering mooring
19/10/2014 12:07	SOG 2 Recovery	-18.5298	-25.109	Hooked on to recovery line commenced recovery
19/10/2014 14:15	SOG 2 Recovery	-18.5307	-25.097	SOG 2 mooring fully recovered
19/10/2014 14:18	SOG 2 Recovery	-18.5306	-25.096	V/l off DP
19/10/2014 14:23	SOG 1 Redeployment	-18.5317	-25.094	Ranging complete
20/10/2014 03:50	Station 55	-20.8461	-25.082	Reducing speed for station 55
20/10/2014	Station 55	-20.855	-25.08	V/l on DP (Station 55)

03:55				
20/10/2014 03:58	ZPT_JR303_021	-20.8552	-25.08	Zooplankton net tow 021 deployed at 1.8kts
20/10/2014 04:16	ZPT_JR303_021	-20.8555	-25.07	Zooplankton net at depth 550m
20/10/2014 04:51	ZPT_JR303_021	-20.856	-25.052	Zooplankton net 021 recovered. V/l stopped
20/10/2014 04:59	OPT_JR303_086	-20.856	-25.052	Optic Rig 086 off the deck
20/10/2014 05:00	OPT_JR303_086	-20.856	-25.052	Optic Rig 086 deployed
20/10/2014 05:00	GAR_JR303_044	-20.856	-25.052	Commenced Garrett Screen 044 sampling
20/10/2014 05:02	CTD_JR303_S047	-20.856	-25.052	CTD 047 off the deck
20/10/2014 05:04	CTD_JR303_S047	-20.856	-25.052	CTD 047 deployed
20/10/2014 05:07	ZPV_JR303_021	-20.8561	-25.052	Bongo Net 021 off the deck
20/10/2014 05:08	ZPV_JR303_021	-20.8561	-25.052	Bongo Net 021 deployed
20/10/2014 05:16	CTD_JR303_S047	-20.856	-25.052	CTD 047 at depth. Wire out 500m. Commenced recovery
20/10/2014 05:23	OPT_JR303_086	-20.856	-25.052	Optic Rig 086 at the surface
20/10/2014 05:25	OPT_JR303_087	-20.8561	-25.052	Optic Rig 087 deployed
20/10/2014 05:27	GAR_JR303_044	-20.856	-25.052	Completed Garrett screen 044 sampling
20/10/2014 05:30	ZPV_JR303_021	-20.856	-25.052	Bongo Net 021 at the surface
20/10/2014 05:33	ZPV_JR303_021	-20.856	-25.052	Bongo Net 021 on deck
20/10/2014 05:45	CTD_JR303_S047	-20.856	-25.052	CTD 047 at the surface
20/10/2014 05:46	CTD_JR303_S047	-20.856	-25.052	CTD 047 on deck
20/10/2014 05:49	OPT_JR303_087	-20.856	-25.052	Optic Rig 087 at the surface
20/10/2014 05:50	OPT_JR303_087	-20.856	-25.052	Optic Rig 087 on deck
20/10/2014 05:54	Station 55	-20.856	-25.052	Decks
20/10/2014 06:01	Station 55	-20.8612	-25.048	Vessel at passage speed
20/10/2014 13:51	Station 56	-22.3081	-25.062	Reducing speed for station 56
20/10/2014 13:55	Station 56	-22.3161	-25.061	V/l on DP (Station 56)
20/10/2014	OPT_JR303_088	-22.3164	-25.06	Optic Rig 088 deployed

14:00				
20/10/2014 14:01	GAR_JR303_045	-22.3164	-25.06	Commenced Garrett Screen 045 sampling
20/10/2014 14:02	GOF_JR303_020	-22.3164	-25.06	Go-Flo 020 deployed
20/10/2014 14:03	CTD_JR303_S048	-22.3164	-25.06	CTD 048 deployed
20/10/2014 14:08	GOF_JR303_020	-22.3164	-25.06	Go-Flo 020 recovered
20/10/2014 14:15	NAU_JR303_022	-22.3164	-25.06	Nauplii net 022 deployed
20/10/2014 14:18	CTD_JR303_S048	-22.3164	-25.06	CTD at depth
20/10/2014 14:25	GAR_JR303_045	-22.3164	-25.06	Completed Garrett screen 045 sampling
20/10/2014 14:26	OPT_JR303_088	-22.3164	-25.06	Optic Rig 088 recovered
20/10/2014 14:27	OPT_JR303_089	-22.3164	-25.06	Optic Rig 089 deployed
20/10/2014 14:38	NAU_JR303_022	-22.3164	-25.06	Nauplii net 022 recovered
20/10/2014 14:48	MPV_JR303_021	-22.3164	-25.06	Microplankton nets 021 deployed
20/10/2014 14:50	CTD_JR303_S048	-22.3164	-25.06	CTD 048 recovered
20/10/2014 14:51	OPT_JR303_089	-22.3164	-25.06	Optic Rig 089 fully recovered
20/10/2014 15:11	MPV_JR303_021	-22.3164	-25.06	Microplankton nets 021 recovered
20/10/2014 15:13	MAF_JR303_002	-22.3162	-25.06	ARGO float deployed (#6999) at 1kt
20/10/2014 15:18	BAF_JR303_003	-22.3155	-25.058	Bio-Argo float MET BIO 007 deployed at 1.4kts
20/10/2014 15:22	Station 56	-22.3149	-25.057	V/l off DP
20/10/2014 15:28	Station 56	-22.3149	-25.051	V/l at passage speed
20/10/2014 23:50	Station 57	-23.8562	-25.048	V/L reducing speed for station 57
20/10/2014 23:54	Station 57	-23.8587	-25.046	V/L on D.P hd 025 x 1.5kts
20/10/2014 23:58	ZPS_JR303_010	-23.8579	-25.045	Zooplankton slow tow net 010 deployed
21/10/2014 00:20	ZPS_JR303_010	-23.8484	-25.04	Zooplankton slow tow 010 recovered on deck
21/10/2014 00:23	Station 57	-23.8471	-25.04	Station 57 V/L off DP awaiting deck securing
21/10/2014 00:32	Station 57	-23.8467	-25.034	V/L on passage speed
21/10/2014	Station 58	-24.4526	-	Reducing speed for station 58

03:50			25.044	
21/10/2014 03:54	Station 58	-24.4598	-25.043	V/l on DP (Station 58)
21/10/2014 03:59	ZPT_JR303_022	-24.4594	-25.042	Zooplankton net tow 022 deployed
21/10/2014 04:19	ZPT_JR303_020	-24.4498	-25.04	Zooplankton net at depth 550m
21/10/2014 04:52	ZPT_JR303_022	-24.4335	-25.037	Zooplankton net 022 recovered. V/l stopped
21/10/2014 05:00	OPT_JR303_090	-24.4331	-25.037	Optic Rig 090 off the deck
21/10/2014 05:01	OPT_JR303_090	-24.4331	-25.037	Optic Rig 090 deployed
21/10/2014 05:02	CTD_JR303_S049	-24.4331	-25.037	CTD 049 off the deck
21/10/2014 05:02	GAR_JR303_046	-24.4331	-25.037	Commenced Garrett Screen 046 sampling
21/10/2014 05:03	CTD_JR303_S049	-24.4331	-25.037	CTD 049 deployed
21/10/2014 05:06	ZPV_JR303_022	-24.4331	-25.037	Bongo Net 022 off the deck
21/10/2014 05:07	ZPV_JR303_022	-24.4331	-25.037	Bongo Net 022 deployed
21/10/2014 05:15	CTD_JR303_S049	-24.4331	-25.037	CTD 049 at depth. Wire out 500m. Commenced recovery
21/10/2014 05:24	GAR_JR303_046	-24.4331	-25.037	Completed Garrett screen 046 sampling
21/10/2014 05:29	OPT_JR303_090	-24.4331	-25.037	Optic Rig 090 at the surface
21/10/2014 05:31	OPT_JR303_091	-24.4331	-25.037	Optic Rig 091 deployed
21/10/2014 05:31	ZPV_JR303_022	-24.4331	-25.037	Bongo Net 022 at the surface
21/10/2014 05:34	ZPV_JR303_022	-24.4331	-25.037	Bongo Net 022 on deck
21/10/2014 05:45	CTD_JR303_S049	-24.4331	-25.037	CTD 049 at the surface
21/10/2014 05:46	CTD_JR303_S049	-24.4331	-25.037	CTD 049 on deck
21/10/2014 05:54	OPT_JR303_091	-24.4331	-25.037	Optic Rig 091 at the surface
21/10/2014 05:55	OPT_JR303_091	-24.4331	-25.037	Optic Rig 091 on deck
21/10/2014 05:58	Station 58	-24.4331	-25.037	Decks
21/10/2014 06:07	Station 58	-24.4364	-25.032	Vessel at passage speed
21/10/2014 13:50	Station 59	-25.5851	-25.034	Reducing speed for station 59
21/10/2014	Station 59	-25.5952	-	V/l on DP (Station 59)

13:55			25.035	
21/10/2014 13:59	OPT_JR303_092	-25.5947	-25.036	Optic Rig 092 deployed
21/10/2014 14:01	CTD_JR303_S050	-25.5947	-25.036	CTD 050 deployed
21/10/2014 14:04	GAR_JR303_047	-25.5947	-25.036	Commenced Garrett Screen 047 sampling
21/10/2014 14:04	GOF_JR303_021	-25.5947	-25.036	Go-Flo 021 deployed
21/10/2014 14:08	GOF_JR303_021	-25.5947	-25.036	Go-Flo 021 recovered
21/10/2014 14:15	NAU_JR303_023	-25.5947	-25.036	Nauplii net 023 deployed
21/10/2014 14:15	CTD_JR303_S050	-25.5947	-25.036	CTD at depth
21/10/2014 14:23	OPT_JR303_092	-25.5947	-25.036	Optic Rig 092 recovered
21/10/2014 14:24	OPT_JR303_093	-25.5947	-25.036	Optic Rig 093 deployed
21/10/2014 14:28	GAR_JR303_047	-25.5947	-25.036	Completed Garrett screen 047 sampling
21/10/2014 14:36	NAU_JR303_023	-25.5947	-25.036	Nauplii net 023 recovered
21/10/2014 14:43	CTD_JR303_S050	-25.5947	-25.036	CTD 050 recovered
21/10/2014 14:48	MPV_JR303_022	-25.5947	-25.036	Microplankton nets 022 deployed
21/10/2014 15:11	MPV_JR303_022	-25.5947	-25.036	Microplankton nets 022 recovered
21/10/2014 15:13	MAF_JR303_003	-25.5945	-25.036	ARGO float deployed (#7000) at 1kt
21/10/2014 15:22	Station 59	-25.5909	-25.038	V/l off DP
21/10/2014 15:29	Station 59	-25.5901	-25.042	V/l at passage speed
21/10/2014 23:50	Station 60	-27.1197	-25.015	V/L reducing speed for station 60
21/10/2014 23:58	Station 60	-27.1301	-25.014	V/L on DP hd 180 x 1.5kts
22/10/2014 00:01	ZPS_JR303_011	-27.1307	-25.014	Zooplankton slow tow net 011 deployed
22/10/2014 00:25	ZPS_JR303_011	-27.143	-25.014	Zooplankton slow tow 011 recovered on deck
22/10/2014 00:27	Station 60	-27.1442	-25.014	V/L off DP awaiting deck securing
22/10/2014 00:34	Station 60	-27.1557	-25.015	V/L on passage speed
22/10/2014 03:50	Station 61	-27.756	-25.006	Reducing speed for station 61
22/10/2014	Station 61	-27.7637	-	V/l on DP (Station 61)

03:55			25.008	
22/10/2014 04:02	ZPT_JR303_023	-27.7622	-25.009	Zooplankton net tow 023 deployed
22/10/2014 04:21	ZPT_JR303_023	-27.7564	-25.018	Zooplankton net at depth 550m
22/10/2014 04:54	ZPT_JR303_023	-27.747	-25.03	Zooplankton net 023 recovered. V/l stopped
22/10/2014 05:02	OPT_JR303_094	-27.7469	-25.031	Optic Rig 094 off the deck
22/10/2014 05:04	OPT_JR303_094	-27.7469	-25.031	Optic Rig 094 deployed
22/10/2014 05:04	GAR_JR303_048	-27.7469	-25.031	Commenced Garrett Screen 048 sampling
22/10/2014 05:05	CTD_JR303_S051	-27.7469	-25.031	CTD 051 off the deck
22/10/2014 05:06	CTD_JR303_S051	-27.7468	-25.031	CTD 051 deployed
22/10/2014 05:09	ZPV_JR303_023	-27.7469	-25.031	Bongo Net 023 off the deck
22/10/2014 05:10	ZPV_JR303_023	-27.7469	-25.031	Bong Net 023 deployed
22/10/2014 05:20	CTD_JR303_S051	-27.7469	-25.031	CTD 051 at depth. Wire out 500m. Commenced recovery
22/10/2014 05:27	OPT_JR303_094	-27.7469	-25.031	Optic Rig 094 at the surface
22/10/2014 05:29	OPT_JR303_095	-27.7468	-25.031	Optic Rig 095 deployed
22/10/2014 05:30	GAR_JR303_048	-27.7469	-25.031	Completed Garrett screen 048 sampling
22/10/2014 05:34	ZPV_JR303_023	-27.7468	-25.031	Bongo net 023 at the surface
22/10/2014 05:37	ZPV_JR303_023	-27.7468	-25.031	Bongo Net 023 on deck
22/10/2014 05:47	CTD_JR303_S051	-27.7468	-25.031	CTD 051 at the surface
22/10/2014 05:49	CTD_JR303_S051	-27.7468	-25.031	CTD 051 on deck
22/10/2014 05:53	OPT_JR303_095	-27.7468	-25.031	Optic Rig 095 at the surface
22/10/2014 05:54	OPT_JR303_095	-27.7468	-25.031	Optic Rig 095 on deck
22/10/2014 05:57	Station 61	-27.7468	-25.031	Decks
22/10/2014 06:04	Station 61	-27.7539	-25.033	Vessel at passage speed
22/10/2014 13:51	Station 62	-29.1453	-25.272	Reducing speed for station 62
22/10/2014 13:56	Station 62	-29.1534	-25.275	V/l on DP (Station 62)
22/10/2014	OPT_JR303_096	-29.154	-	Optic Rig 096 deployed

14:00			25.276	
22/10/2014 14:01	GAR_JR303_049	-29.154	-25.276	Commenced Garrett Screen 049 sampling
22/10/2014 14:02	CTD_JR303_S052	-29.154	-25.276	CTD 052 deployed
22/10/2014 14:02	GOF_JR303_022	-29.154	-25.276	Go-Flo 022 deployed
22/10/2014 14:07	GOF_JR303_022	-29.154	-25.276	Go-Flo 022 recovered
22/10/2014 14:12	NAU_JR303_024	-29.154	-25.276	Nauplii net 024 deployed
22/10/2014 14:17	CTD_JR303_S052	-29.154	-25.276	CTD at depth
22/10/2014 14:26	OPT_JR303_096	-29.154	-25.276	Optic Rig 096 recovered
22/10/2014 14:26	GAR_JR303_049	-29.154	-25.276	Completed Garrett screen 049 sampling
22/10/2014 14:27	OPT_JR303_097	-29.154	-25.276	Optic Rig 097 deployed
22/10/2014 14:34	NAU_JR303_024	-29.1539	-25.276	Nauplii net 024 recovered
22/10/2014 14:47	MPV_JR303_023	-29.1539	-25.276	Microplankton nets 023 deployed
22/10/2014 14:49	CTD_JR303_S052	-29.1539	-25.276	CTD 052 recovered
22/10/2014 14:52	OPT_JR303_097	-29.1539	-25.276	Optic Rig 097 fully recovered
22/10/2014 15:12	MPV_JR303_023	-29.1539	-25.276	Microplankton nets 023 recovered
22/10/2014 15:27	Station 62	-29.154	-25.276	V/l off DP
22/10/2014 15:36	Station 62	-29.161	-25.276	V/l at passage speed
22/10/2014 23:50	Station 63	-30.5764	-25.808	V/L reducing speed for station 63
22/10/2014 23:55	Station 63	-30.5804	-25.807	V/L on DP hd 155 x 1.5kts
23/10/2014 00:02	ZPS_JR303_012	-30.5827	-25.806	Zooplankton slow tow net 012 deployed
23/10/2014 00:28	ZPS_JR303_012	-30.5943	-25.799	Zooplankton slow tow 012 recovered on deck
23/10/2014 00:30	Station 63	-30.5953	-25.798	V/L off DP awaiting deck securing
23/10/2014 00:38	Station 63	-30.6097	-25.799	V/L at passage speed
23/10/2014 04:51	Station 64	-31.3326	-26.099	Reducing speed for station 64
23/10/2014 04:55	Station 64	-31.3376	-26.101	V/l on DP (Station 64)
23/10/2014	ZPT_JR303_024	-31.3382	-	Zooplankton net tow 024 deployed

04:58			26.101	
23/10/2014 05:17	ZPT_JR303_024	-31.3477	-26.1	Zooplankton net at depth 550m
23/10/2014 05:52	ZPT_JR303_024	-31.3649	-26.096	Zooplankton net 024 recovered. V/l stopped
23/10/2014 06:01	OPT_JR303_098	-31.3649	-26.096	Optic Rig 098 off the deck
23/10/2014 06:01	GAR_JR303_050	-31.3649	-26.096	Commenced Garrett Screen 050 sampling
23/10/2014 06:02	OPT_JR303_098	-31.3649	-26.096	Optic Rig 098 deployed
23/10/2014 06:02	CTD_JR303_S053	-31.3649	-26.096	CTD 053 off the deck
23/10/2014 06:04	CTD_JR303_S053	-31.3649	-26.096	CTD 053 deployed
23/10/2014 06:08	ZPV_JR303_024	-31.3649	-26.096	Bongo Net 024 off the deck
23/10/2014 06:09	ZPV_JR303_024	-31.3649	-26.096	Bongo Net 024 deployed
23/10/2014 06:16	CTD_JR303_S053	-31.3649	-26.096	CTD 053 at depth. Wire out 500m. commenced recovery
23/10/2014 06:25	OPT_JR303_098	-31.3649	-26.096	Optic Rig 098 at the surface
23/10/2014 06:26	OPT_JR303_099	-31.3649	-26.096	Optic Rig 099 deployed
23/10/2014 06:27	GAR_JR303_050	-31.3649	-26.096	Completed Garrett screen 050 sampling
23/10/2014 06:32	ZPV_JR303_024	-31.3649	-26.096	Bongo Net 024 at the surface
23/10/2014 06:36	ZPV_JR303_024	-31.3649	-26.096	Bongo Net 024 on deck
23/10/2014 06:43	CTD_JR303_S053	-31.3649	-26.096	CTD 053 at the surface
23/10/2014 06:44	CTD_JR303_S053	-31.3649	-26.096	CTD 053 on deck
23/10/2014 06:49	OPT_JR303_099	-31.3649	-26.096	Optic Rig 099 at the surface
23/10/2014 06:50	OPT_JR303_099	-31.3649	-26.096	Optic Rig 099 on deck
23/10/2014 07:03	Station 64	-31.3649	-26.096	Decks
23/10/2014 07:09	Station 64	-31.3712	-26.099	Vessel at passage speed
23/10/2014 14:51	Station 65	-32.708	-26.627	Reducing speed for station 65
23/10/2014 14:55	Station 65	-32.7158	-26.631	V/l on DP (Station 65)
23/10/2014 15:00	OPT_JR303_100	-32.7165	-26.632	Optic Rig 100 deployed
23/10/2014	GAR_JR303_051	-32.7165	-	Commenced Garrett Screen 051

15:00			26.632	sampling
23/10/2014 15:00	CTD_JR303_S054	-32.7165	-26.632	CTD 054 deployed
23/10/2014 15:01	GOF_JR303_023	-32.7166	-26.632	Go-Flo 023 deployed
23/10/2014 15:05	GOF_JR303_023	-32.7166	-26.632	Go-Flo 023 recovered
23/10/2014 15:13	NAU_JR303_025	-32.7166	-26.632	Nauplii net 025 deployed
23/10/2014 15:15	CTD_JR303_S054	-32.7166	-26.632	CTD at depth
23/10/2014 15:24	OPT_JR303_100	-32.7166	-26.632	Optic Rig 100 recovered
23/10/2014 15:25	OPT_JR303_101	-32.7166	-26.632	Optic Rig 101 deployed
23/10/2014 15:26	GAR_JR303_051	-32.7166	-26.632	Completed Garrett screen 051 sampling
23/10/2014 15:36	NAU_JR303_025	-32.7166	-26.632	Nauplii net 025 recovered
23/10/2014 15:46	CTD_JR303_S054	-32.7166	-26.632	CTD 054 recovered
23/10/2014 15:46	MPV_JR303_024	-32.7166	-26.632	Microplankton nets 024 deployed
23/10/2014 15:49	OPT_JR303_101	-32.7166	-26.632	Optic Rig 101 fully recovered
23/10/2014 16:09	MPV_JR303_024	-32.7166	-26.632	Microplankton nets 024 recovered
23/10/2014 16:20	Station 65	-32.7166	-26.632	V/l off DP
23/10/2014 16:29	Station 65	-32.7276	-26.638	V/l at passage speed
24/10/2014 00:50	Station 66	-34.1814	-27.202	V/L reducing speed for Station 66
24/10/2014 00:55	Station 66	-34.1856	-27.204	V/L on DP hd 290 x 1.5kts
24/10/2014 01:00	ZPS_JR303_013	-34.1852	-27.206	Zooplankton slow tow net 013 deployed
24/10/2014 01:27	ZPS_JR303_013	-34.1797	-27.223	Zooplankton slow tow 013 recovered on deck
24/10/2014 01:30	Station 66	-35.0438	-27.58	V/L off dp
24/10/2014 01:39	Station 66	-35.0438	-27.58	V/L at passage speed
24/10/2014 04:49	Station 67	-35.0438	-27.58	Reducing speed for station 67
24/10/2014 04:53	Station 67	-35.0438	-27.58	V/l on DP (Station 67)
24/10/2014 04:58	ZPT_JR303_025	-35.0438	-27.58	Zooplankton net tow 025 deployed
24/10/2014	ZPT_JR303_025	-35.0438	-27.58	Zooplankton net at depth 400m

05:11				
24/10/2014 05:36	ZPT_JR303_025	-35.0438	-27.58	Zooplankton net 025 recovered. V/l stopped
24/10/2014 06:00	OPT_JR303_102	-35.0438	-27.58	Optic Rig 102 off the deck
24/10/2014 06:00	CTD_JR303_S055	-35.0438	-27.58	CTD 055 off the deck
24/10/2014 06:01	OPT_JR303_102	-35.0438	-27.58	Optic Rig 102 deployed
24/10/2014 06:02	CTD 055	-35.0438	-27.58	CTD 055 deployed
24/10/2014 06:04	GAR_JR303_052	-35.0438	-27.58	Commenced Garrett Screen 052 sampling
24/10/2014 06:13	CTD_JR303_S055	-35.0438	-27.58	CTD 055 at depth. Wire out 500m. Commenced recovery
24/10/2014 06:18	GAR_JR303_052	-35.0438	-27.58	Completed Garrett screen 052 sampling
24/10/2014 06:24	OPT_JR303_102	-35.0438	-27.58	Optic Rig 102 at the surface
24/10/2014 06:25	OPT_JR303_102	-35.0438	-27.58	Optic Rig 102 on deck
24/10/2014 06:42	CTD_JR303_S055	-35.0438	-27.58	CTD 055 at the surface
24/10/2014 06:44	CTD_JR303_S055	-35.0438	-27.58	CTD 055 on deck. Vessel remaining on station during sampling
24/10/2014 06:48	Station 67	-35.0438	-27.58	Cranes and gantries secured
24/10/2014 08:00	Station 67	-35.0438	-27.58	All persons clear of the Upper Deck. Vessel off DP and proceeding
24/10/2014 08:12	Station 67	-35.0438	-27.58	Vessel at passage speed
24/10/2014 10:05	Hove to	-35.0438	-27.58	V/L Hove to for science equipment adjusting on deck/forecastle
24/10/2014 10:31	Hove to	-35.0451	-27.591	Deck secure all persons inside
24/10/2014 10:38	Hove to	-35.0531	-27.6	V/L on passage speed
24/10/2014 13:22	Hove to for crane rigging	-35.5509	-27.776	V/L reducing speed and hove to for safety of persons
24/10/2014 13:37	Hove to for crane rigging	-35.5625	-27.794	Crane wire rigged for Science Nets - deck secure
24/10/2014 13:41	Hove to for crane rigging	-35.5686	-27.799	V/L on passage speed
24/10/2014 14:51	Station 68	-35.7918	-27.869	Reducing speed for station 68
24/10/2014 14:56	Station 68	-35.795	-27.875	V/l on DP (Station 68)
24/10/2014 14:58	OPT_JR303_103	-35.7952	-27.875	Optic Rig 103 deployed

24/10/2014 15:02	CTD_JR303_S056	-35.7952	-27.875	CTD 056 deployed
24/10/2014 15:03	GAR_JR303_053	-35.7951	-27.875	Commenced Garrett Screen 053 sampling
24/10/2014 15:04	GOF_JR303_024	-35.7952	-27.875	Go-Flo 024 deployed
24/10/2014 15:07	GOF_JR303_024	-35.7951	-27.875	Go-Flo 024 recovered
24/10/2014 15:14	NAU_JR303_026	-35.7951	-27.875	Nauplii net 026 deployed
24/10/2014 15:17	CTD_JR303_S056	-35.7952	-27.875	CTD at depth
24/10/2014 15:23	OPT_JR303_103	-35.7951	-27.875	Optic Rig 103 recovered
24/10/2014 15:24	OPT_JR303_104	-35.7952	-27.875	Optic Rig 104 deployed
24/10/2014 15:25	GAR_JR303_053	-35.7953	-27.875	Completed Garrett screen 053 sampling
24/10/2014 15:26	NAU_JR303_026	-35.7955	-27.875	Nauplii net 026 recovered
24/10/2014 15:49	OPT_JR303_104	-35.7969	-27.875	Optic Rig 104 fully recovered
24/10/2014 15:51	CTD_JR303_S056	-35.797	-27.875	CTD 056 recovered
24/10/2014 15:58	BAF_JR303_004	-35.797	-27.875	Bio-Argo float MET BIO 009 deployed at 1kt
24/10/2014 16:10	Station 68	-35.7971	-27.881	Decks
24/10/2014 16:19	Station 68	-35.7997	-27.896	V/l at passage speed
25/10/2014 00:48	Station 69	-37.3218	-28.468	V/L reducing speed for station 69
25/10/2014 00:56	Station 69	-37.3255	-28.478	V/L on DP hd 265 x 1.5 kts
25/10/2014 01:02	ZPS_JR303_014	-37.3255	-28.481	Zooplankton slow tow net 014 deployed
25/10/2014 01:30	ZPS_JR303_014	-37.326	-28.497	Zooplankton slow tow 014 recovered
25/10/2014 01:33	Station 69	-37.326	-28.5	V/L off DP awaiting deck secure
25/10/2014 01:41	Station 69	-37.3323	-28.51	V/L at passage speed
25/10/2014 04:49	Station 70	-37.8869	-28.726	V/l reducing speed for station 70
25/10/2014 04:53	Station 70	-37.8926	-28.73	V/l on DP (Station 70)
25/10/2014 05:07	ZPT_JR303_026	-37.8927	-28.735	Zooplankton net tow 026 deployed
25/10/2014 05:24	ZPT_JR303_026	-37.8928	-28.746	Zooplankton net at depth

25/10/2014 05:57	ZPT_JR303_026	-37.8931	-28.767	Zooplankton net 026 recovered. V/l stopped
25/10/2014 06:05	OPT_JR303_105	-37.8931	-28.768	Optic Rig 105 off the deck
25/10/2014 06:05	GAR_JR303_054	-37.8931	-28.768	Commenced Garrett Screen 054 sampling
25/10/2014 06:06	OPT_JR303_105	-37.8931	-28.768	Optic Rig 105 deployed
25/10/2014 06:06	CTD_JR303_S057	-37.8931	-28.768	CTD 057 off the deck
25/10/2014 06:08	CTD_JR303_S057	-37.8931	-28.768	CTD 057 deployed
25/10/2014 06:11	ZPV_JR303_025	-37.8931	-28.768	Bongo Net 025 off the deck
25/10/2014 06:12	ZPV_JR303_025	-37.8931	-28.768	Bongo Net 025 deployed
25/10/2014 06:18	GAR_JR303_054	-37.8931	-28.768	Completed Garrett screen 054 sampling
25/10/2014 06:19	CTD_JR303_S057	-37.8931	-28.768	CTD 057 at depth. Wire out 500m. Commenced recovery
25/10/2014 06:22	ZPV_JR303_025	-37.8931	-28.768	Bongo Net 025 at the surface
25/10/2014 06:25	ZPV_JR303_025	-37.8931	-28.768	Bongo net 025 off the deck
25/10/2014 06:29	OPT_JR303_105	-37.8931	-28.768	Optic Rig 105 at the surface
25/10/2014 06:30	OPT_JR303_106	-37.8931	-28.768	Optic Rig 106 deployed
25/10/2014 06:48	CTD_JR303_S057	-37.8931	-28.768	CTD 057 at the surface
25/10/2014 06:50	CTD_JR303_S057	-37.8931	-28.768	CTD 057 on deck
25/10/2014 06:54	OPT_JR303_106	-37.8931	-28.768	Optic Rig 106 at the surface
25/10/2014 06:55	OPT_JR303_106	-37.8931	-28.768	Optic Rig 106 on deck
25/10/2014 07:00	Station 70	-37.8931	-28.768	Cranes and gantries secured
25/10/2014 07:42	Station 70	-37.8931	-28.768	All persons clear of the Upper Deck. Vessel off DP and proceeding
25/10/2014 07:52	Station 70	-37.9024	-28.779	Vessel at passage speed
25/10/2014 11:56	CTD reshuffle	-38.6222	-29.021	V/L reducing speed for DP station
25/10/2014 12:02	CTD reshuffle	-38.6296	-29.026	V/L on DP full auto pos for CTD reshuffle
25/10/2014 12:45	CTD reshuffle	-38.6301	-29.032	CTD reshuffle complete
25/10/2014 12:52	CTD reshuffle	-38.6306	-29.041	V/L on passage speed

25/10/2014 14:50	Station 71	-38.9588	-29.16	Reducing speed for station 71
25/10/2014 14:56	Station 71	-38.9615	-29.167	V/l on DP (Station 71)
25/10/2014 14:59	OPT_JR303_107	-38.9612	-29.167	Optic Rig 107 deployed
25/10/2014 15:00	GAR_JR303_055	-38.9612	-29.167	Commenced Garrett Screen 055 sampling
25/10/2014 15:06	GOF_JR303_025	-38.9612	-29.167	Go-Flo 025 deployed
25/10/2014 15:07	CTD_JR303_S058	-38.9613	-29.167	CTD 058 deployed
25/10/2014 15:11	GOF_JR303_025	-38.9613	-29.167	Go-Flo 025 recovered
25/10/2014 15:20	GAR_JR303_055	-38.9613	-29.167	Completed Garrett screen 055 sampling
25/10/2014 15:21	CTD_JR303_S058	-38.9612	-29.167	CTD at depth
25/10/2014 15:24	OPT_JR303_107	-38.9613	-29.167	Optic Rig 107 recovered
25/10/2014 15:25	OPT_JR303_108	-38.9612	-29.167	Optic Rig 108 deployed
25/10/2014 15:51	OPT_JR303_108	-38.9613	-29.167	Optic Rig 108 fully recovered
25/10/2014 15:57	CTD_JR303_S058	-38.9613	-29.167	CTD 058 recovered
25/10/2014 16:04	BAF_JR303_005	-38.9613	-29.168	Bio-Argo float MET BIO 013 deployed at 1kt
25/10/2014 16:06	MAF_JR303_004	-38.9613	-29.169	ARGO float (#7031) deployed at 1kt
25/10/2014 16:07	Station 71	-38.9613	-29.169	V/L off DP awaiting deck securing
25/10/2014 16:24	Station 71	-38.9605	-29.177	Decks secure and all persons clear of the upper deck
25/10/2014 16:32	Station 71	-38.9662	-29.186	V/l at passage speed
26/10/2014 04:50	Station 72	-40.3707	-31.43	Reducing speed for station 72
26/10/2014 04:56	Station 72	-40.3707	-31.43	V/l on DP (Station 72)
26/10/2014 05:06	ZPT_JR303_027	-40.3707	-31.43	Zooplankton net tow 027 deployed
26/10/2014 05:22	ZPT_JR303_027	-40.3707	-31.43	Zooplankton net at depth 550m
26/10/2014 05:56	ZPT_JR303_027	-40.3707	-31.43	Zooplankton net 027 recovered. V/l stopped
26/10/2014 06:12	OPT_JR303_109	-40.3707	-31.43	Optic Rig 109 off the deck
26/10/2014 06:14	OPT_JR303_109	-40.3707	-31.43	Optic Rig 109 deployed

26/10/2014 06:14	GAR_JR303_056	-40.3707	-31.43	Commenced Garrett Screen 056 sampling
26/10/2014 06:16	CTD_JR303_S059	-40.3707	-31.43	CTD 059 off the deck
26/10/2014 06:18	CTD_JR303_S059	-40.3707	-31.43	CTD 059 deployed
26/10/2014 06:25	GAR_JR303_056	-40.3707	-31.43	Completed Garrett screen 056 sampling
26/10/2014 06:29	CTD_JR303_S059	-40.3707	-31.43	CTD 057 at depth. Wire out 500m. Commenced recovery
26/10/2014 06:37	OPT_JR303_109	-40.3707	-31.43	Optic Rig 109 at the surface
26/10/2014 06:39	OPT_JR303_110	-40.3707	-31.43	Optic Rig 110 deployed
26/10/2014 06:57	CTD_JR303_S059	-40.3707	-31.43	CTD 059 at the surface
26/10/2014 07:00	CTD_JR303_S059	-40.3707	-31.43	CTD 059 on deck
26/10/2014 07:02	OPT_JR303_110	-40.3707	-31.43	Optic Rig 110 at the surface
26/10/2014 07:03	OPT_JR303_110	-40.3707	-31.43	Optic Rig 110 on deck
26/10/2014 07:10	Station 72	-40.3707	-31.43	Cranes and gantries secured
26/10/2014 07:16	Station 72	-40.3707	-31.43	All persons clear of the Upper Deck. Vessel off DP and proceeding
26/10/2014 07:24	Station 72	-40.3707	-31.43	Vessel at passage speed
26/10/2014 08:01	Station 72	-40.3707	-31.43	Vessel hove to for work on incubator
26/10/2014 08:17	Station 72	-40.3707	-31.43	Vessel at passage speed
26/10/2014 13:00	Hove to	-40.5647	-31.841	V/L hove to to rig wire on crane for bongo nets and check science equipment on forecastle
26/10/2014 13:50	Hove to	-40.5837	-31.905	Deck secure and V/L on passage speed
26/10/2014 14:51	Station 73	-40.6799	-32.091	Reducing speed for station 73
26/10/2014 14:56	Station 73	-40.6845	-32.102	V/l on DP (Station 73)
26/10/2014 15:01	OPT_JR303_111	-40.6855	-32.103	Optic Rig 111 deployed
26/10/2014 15:05	GOF_JR303_026	-40.6855	-32.103	Go-Flo 026 deployed
26/10/2014 15:06	CTD_JR303_S060	-40.6854	-32.103	CTD 060 deployed
26/10/2014 15:07	GAR_JR303_057	-40.6855	-32.103	Commenced Garrett Screen 057 sampling
26/10/2014	GOF_JR303_026	-40.6854	-	Go-Flo 026 recovered

15:09			32.103	
26/10/2014 15:16	NAU_JR303_027	-40.6854	-32.103	Nauplii net 027 deployed
26/10/2014 15:21	CTD_JR303_S060	-40.6854	-32.103	CTD at depth
26/10/2014 15:22	GAR_JR303_057	-40.6854	-32.103	Completed Garrett screen 057 sampling
26/10/2014 15:25	OPT_JR303_111	-40.6854	-32.103	Optic Rig 111 recovered
26/10/2014 15:27	OPT_JR303_112	-40.6855	-32.103	Optic Rig 112 deployed
26/10/2014 15:38	NAU_JR303_027	-40.6855	-32.103	Nauplii net 027 recovered
26/10/2014 15:50	MPV_JR303_025	-40.6862	-32.103	Microplankton nets 025 deployed
26/10/2014 15:51	CTD_JR303_S060	-40.6863	-32.103	CTD 060 recovered
26/10/2014 15:52	OPT_JR303_112	-40.6864	-32.103	Optic Rig 112 fully recovered
26/10/2014 16:12	MPV_JR303_025	-40.688	-32.103	Microplankton nets 025 recovered
26/10/2014 16:26	Station 73	-40.6881	-32.103	V/l off DP
26/10/2014 16:34	Station 73	-40.6946	-32.114	V/l at passage speed
27/10/2014 00:50	Station 74	-41.4093	-33.627	V/L reducing speed for DP
27/10/2014 00:55	Station 74	-41.4098	-33.631	V/L on DP hd 270 x 1.7kts
27/10/2014 01:06	RMT_JR303_001	-41.4093	-33.637	RMT net 001 deployed
27/10/2014 01:42	RMT_JR303_001	-41.406	-33.663	RMT at depth
27/10/2014 02:13	RMT_JR303_001	-41.4047	-33.686	Reduced to 1kt and commenced hauling
27/10/2014 03:39	RMT_JR303_001	-41.3994	-33.718	RMT net at the surface
27/10/2014 03:42	RMT_JR303_001	-41.399	-33.719	RMT net 001 recovered
27/10/2014 04:02	Station 74	-41.399	-33.719	Decks secure
27/10/2014 04:10	Station 74	-41.4038	-33.73	V/l at passage speed
27/10/2014 04:52	Station 75	-41.4768	-33.849	Reducing speed for station 75
27/10/2014 04:56	Station 75	-41.4777	-33.854	V/l on DP (Station 75)
27/10/2014 05:01	ZPT_JR303_028	-41.4776	-33.856	Zooplankton net tow 028 deployed at 1.6kts
27/10/2014	ZPT_JR303_028	-41.4712	-	Zooplankton net 028 recovered

05:51			33.882	
27/10/2014 05:53	ZPT_JR303_028	-41.4712	-33.883	V/l stopped on station
27/10/2014 06:01	OPT_JR303_113	-41.4711	-33.883	Optic Rig 113 off the deck
27/10/2014 06:02	OPT_JR303_113	-41.4711	-33.883	Optic Rig 113 deployed
27/10/2014 06:03	GAR_JR303_058	-41.4712	-33.883	Commenced Garrett Screen 058 sampling
27/10/2014 06:03	CTD_JR303_S061	-41.4712	-33.883	CTD 061 off the deck
27/10/2014 06:05	CTD_JR303_S061	-41.4711	-33.883	CTD 061 deployed
27/10/2014 06:16	CTD_JR303_S061	-41.4705	-33.881	CTD 061 at depth. Wire out 500m. Commenced recovery
27/10/2014 06:18	GAR_JR303_058	-41.4704	-33.881	Completed Garrett screen 058 sampling
27/10/2014 06:26	OPT_JR303_113	-41.4699	-33.879	Optic Rig 113 at the surface
27/10/2014 06:27	OPT_JR303_114	-41.4698	-33.879	Optic Rig 114 deployed
27/10/2014 06:45	CTD_JR303_S061	-41.4687	-33.877	CTD 061 at the surface
27/10/2014 06:47	CTD_JR303_S061	-41.4686	-33.876	CTD 061 on deck
27/10/2014 06:51	OPT_JR303_114	-41.4686	-33.876	Optic Rig 114 at the surface
27/10/2014 06:52	OPT_JR303_114	-41.4686	-33.876	Optic Rig 114 on deck
27/10/2014 06:56	Station 75	-41.4686	-33.876	Decks
27/10/2014 07:10	Station 75	-41.4732	-33.895	Vessel at passage speed
27/10/2014 07:51	Station 75	-41.537	-34.005	Vessel hove to for work on incubator
27/10/2014 08:07	Station 75	-41.5345	-34.03	Vessel at passage speed
27/10/2014 08:42	Station 75	-41.5865	-34.121	Vessel hove to for work on incubator
27/10/2014 08:50	Station 75	-41.5846	-34.132	Vessel at passage speed
27/10/2014 14:50	Station 76	-42.0814	-35.091	Reducing speed for station 76
27/10/2014 14:57	Station 76	-42.0809	-35.101	V/l on DP (Station 76)
27/10/2014 15:24	CTD_JR303_S062	-42.0805	-35.102	CTD 062 off the deck
27/10/2014 15:30	CTD_JR303_S062	-42.0806	-35.102	CTD 062 deployed
27/10/2014	GAR_JR303_059	-42.0806	-	Commenced Garrett Screen 059

15:32			35.102	sampling
27/10/2014 15:44	CTD_JR303_S062	-42.0805	-35.102	CTD at depth
27/10/2014 15:45	GAR_JR303_059	-42.0805	-35.102	Completed Garrett screen 059 sampling
27/10/2014 16:12	CTD_JR303_S062	-42.0805	-35.102	CTD 062 at the surface
27/10/2014 16:16	CTD_JR303_S062	-42.0805	-35.102	CTD 062 recovered
27/10/2014 16:23	MAF_JR303_005	-42.0804	-35.103	ARGO float (#7032) deployed at 1kt
27/10/2014 16:26	Station 76	-42.0802	-35.104	V/l stopped in full auto pos DP (engineers working on refrigerated container fwd)
27/10/2014 17:16	Station 76	-42.0801	-35.104	V/l off DP
27/10/2014 17:25	Station 76	-42.0838	-35.115	V/l at passage speed
28/10/2014 04:51	Station 77	-43.0236	-37.126	Reducing speed for station 77
28/10/2014 04:56	Station 77	-43.0221	-37.133	V/l on DP (Station 77)
28/10/2014 05:02	ZPT_JR303_029	-43.0203	-37.136	Zooplankton net tow 029 deployed
28/10/2014 05:53	ZPT_JR303_029	-43.0027	-37.141	Zooplankton net 029 recovered. V/l stopped
28/10/2014 06:02	OPT_JR303_115	-43.0027	-37.141	Optic Rig 115 off the deck
28/10/2014 06:03	OPT_JR303_115	-43.0026	-37.141	Optic Rig 115 deployed
28/10/2014 06:06	GAR_JR303_060	-43.0027	-37.141	Commenced Garrett Screen 060 sampling
28/10/2014 06:24	CTD_JR303_S063	-43.0027	-37.141	CTD 063 off the deck
28/10/2014 06:26	CTD_JR303_S063	-43.0026	-37.141	CTD 063 deployed
28/10/2014 06:27	OPT_JR303_115	-43.0026	-37.141	Optic Rig 115 at the surface
28/10/2014 06:29	OPT_JR303_116	-43.0027	-37.141	Optic Rig 116 deployed
28/10/2014 06:33	GAR_JR303_060	-43.0029	-37.141	Completed Garrett screen 060 sampling
28/10/2014 06:37	CTD_JR303_S063	-43.0032	-37.14	CTD 063 at depth. Wire out 500m. Commenced recovery
28/10/2014 06:52	OPT_JR303_116	-43.0043	-37.139	Optic Rig 116 at the surface
28/10/2014 06:53	OPT_JR303_116	-43.0044	-37.139	Optic Rig 116 on deck
28/10/2014 07:00	CTD_JR303_S063	-43.005	-37.138	CTD 063 at the surface

28/10/2014 07:02	CTD_JR303_S063	-43.0051	-37.138	CTD 063 on deck
28/10/2014 07:11	Station 77	-43.0051	-37.138	Decks
28/10/2014 07:15	Station 77	-43.002	-37.137	Vessel at passage speed
28/10/2014 14:51	Station 78	-43.5905	-38.387	Reducing speed for station 78
28/10/2014 14:56	Station 78	-43.5872	-38.389	V/l on DP (Station 78)
28/10/2014 15:01	OPT_JR303_117	-43.5872	-38.389	Optic Rig 117 deployed
28/10/2014 15:02	GOF_JR303_027	-43.5872	-38.389	Go-Flo 027 deployed
28/10/2014 15:05	CTD_JR303_S064	-43.5872	-38.389	CTD 064 deployed
28/10/2014 15:05	GOF_JR303_027	-43.5872	-38.389	Go-Flo 027 recovered
28/10/2014 15:10	GAR_JR303_061	-43.5872	-38.389	Commenced Garrett Screen 061 sampling
28/10/2014 15:15	NAU_JR303_028	-43.5872	-38.389	Nauplii net 028 deployed
28/10/2014 15:18	CTD_JR303_S064	-43.5872	-38.389	CTD at depth
28/10/2014 15:22	GAR_JR303_061	-43.5872	-38.389	Completed Garrett screen 061 sampling
28/10/2014 15:25	OPT_JR303_117	-43.5872	-38.389	Optic Rig 117 recovered
28/10/2014 15:26	OPT_JR303_118	-43.5872	-38.389	Optic Rig 118 deployed
28/10/2014 15:34	NAU_JR303_028	-43.5872	-38.389	Nauplii net 028 recovered
28/10/2014 15:48	CTD_JR303_S064	-43.5872	-38.389	CTD 064 recovered
28/10/2014 15:51	OPT_JR303_118	-43.5872	-38.389	Optic Rig 118 fully recovered
28/10/2014 16:03	Station 78	-43.5872	-38.389	V/l off DP
28/10/2014 16:12	Station 78	-43.5837	-38.388	V/l at passage speed
29/10/2014 04:51	Station 79	-44.6204	-40.678	Reducing speed for station 79
29/10/2014 04:56	Station 79	-44.6234	-40.687	V/l on DP (Station 79)
29/10/2014 05:01	ZPT_JR303_030	-44.6238	-40.689	Zooplankton net tow 030 deployed
29/10/2014 05:52	ZPT_JR303_030	-44.6258	-40.725	Zooplankton net 030 recovered
29/10/2014 06:01	OPT_JR303_119	-44.6259	-40.726	Optic Rig 119 off the deck

29/10/2014 06:02	OPT_JR303_119	-44.6259	-40.726	Optic Rig 119 deployed
29/10/2014 06:03	CTD_JR303_S065	-44.6259	-40.726	CTD 065 off the deck
29/10/2014 06:05	CTD_JR303_S065	-44.6259	-40.726	CTD 065 deployed
29/10/2014 06:06	GAR_JR303_062	-44.6259	-40.726	Commenced Garrett Screen 062 sampling
29/10/2014 06:09	ZPV_JR303_026	-44.6259	-40.726	Bongo Net 026 off the deck
29/10/2014 06:10	ZPV_JR303_026	-44.6259	-40.726	Bongo Net 026 deployed
29/10/2014 06:16	CTD_JR303_S065	-44.6259	-40.726	CTD 065 at depth. Wire out 500m. Commenced recovery
29/10/2014 06:25	OPT_JR303_119	-44.6259	-40.726	Optic Rig 119 at the surface
29/10/2014 06:27	OPT_JR303_120	-44.6259	-40.726	Optic Rig 120 deployed
29/10/2014 06:28	GAR_JR303_062	-44.6259	-40.726	Completed Garrett screen 062 sampling
29/10/2014 06:34	ZPV_JR303_026	-44.6259	-40.726	Bongo Net 026 at the surface
29/10/2014 06:37	ZPV_JR303_026	-44.6259	-40.726	Bongo Net 026 on deck
29/10/2014 06:45	CTD_JR303_S065	-44.6259	-40.726	CTD 065 at the surface
29/10/2014 06:46	CTD_JR303_S065	-44.6259	-40.726	CTD 065 on deck
29/10/2014 06:50	OPT_JR303_120	-44.6259	-40.726	Optic Rig 120 at the surface
29/10/2014 06:51	OPT_JR303_120	-44.6259	-40.726	Optic Rig on deck
29/10/2014 06:56	Station 79	-44.6259	-40.726	Decks
29/10/2014 07:03	Station 79	-44.6292	-40.737	Vessel at passage speed
29/10/2014 14:52	Station 80	-45.2866	-42.192	Reducing speed for station 80
29/10/2014 14:56	Station 80	-45.2876	-42.198	V/l on DP (Station 80)
29/10/2014 15:02	OPT_JR303_121	-45.2875	-42.198	Optic Rig 121 deployed
29/10/2014 15:05	CTD_JR303_S066	-45.2875	-42.198	CTD 066 deployed
29/10/2014 15:10	NAU_JR303_029	-45.2875	-42.198	Nauplii net 029 deployed
29/10/2014 15:10	GAR_JR303_063	-45.2875	-42.198	Commenced Garrett Screen 063 sampling
29/10/2014 15:19	CTD_JR303_S066	-45.2875	-42.198	CTD at depth

29/10/2014 15:25	OPT_JR303_121	-45.2875	-42.198	Optic Rig 121 fully recovered
29/10/2014 15:26	GAR_JR303_063	-45.2875	-42.198	Completed Garrett screen 063 sampling
29/10/2014 15:36	NAU_JR303_029	-45.2875	-42.198	Nauplii net 029 recovered
29/10/2014 15:46	CTD_JR303_S066	-45.2875	-42.198	CTD 066 recovered
29/10/2014 15:48	MPV_JR303_026	-45.2875	-42.198	Microplankton nets 026 deployed
29/10/2014 16:09	MPV_JR303_026	-45.2875	-42.198	Microplankton nets 026 recovered
29/10/2014 16:12	MAF_JR303_006	-45.287	-42.199	ARGO float (#7017) deployed at 1kt
29/10/2014 16:26	Station 80	-45.2849	-42.202	V/l off DP
29/10/2014 16:32	Station 80	-45.2826	-42.209	V/l at passage speed
30/10/2014 00:50	station 81	-46.0923	-44.041	reducing speed for station 81
30/10/2014 00:56	station 81	-46.0933	-44.048	on dp hd 000 x 1.7kts stw
30/10/2014 01:03	RMT_JR303_002	-46.09	-44.048	RMT net 002 deployed
30/10/2014 01:51	RMT_JR303_002	-46.0647	-44.047	RMT at depth
30/10/2014 02:22	RMT_JR303_002	-46.0487	-44.051	Reduced to 1kt and commenced hauling
30/10/2014 03:52	RMT_JR303_002	-46.025	-44.067	RMT net 002 recovered
30/10/2014 04:07	Station 81	-46.0216	-44.07	V/l off DP
30/10/2014 04:18	Station 81	-46.0206	-44.083	V/l at passage speed
30/10/2014 04:50	Station 82	-46.0859	-44.186	Reducing speed for station 82
30/10/2014 04:54	Station 82	-46.0903	-44.194	V/l on DP (Station 82)
30/10/2014 04:59	ZPT_JR303_031	-46.0898	-44.195	Zooplankton net tow 031 deployed at 1.5kts
30/10/2014 05:50	ZPT_JR303_031	-46.0725	-44.209	Zooplankton net 031 recovered
30/10/2014 05:58	OPT_JR303_122	-46.0724	-44.21	Optic Rig 122 off the deck
30/10/2014 05:59	OPT_JR303_122	-46.0724	-44.209	Optic Rig 122 deployed
30/10/2014 06:00	GAR_JR303_064	-46.0724	-44.209	Commenced Garrett Screen 064 sampling
30/10/2014 06:00	CTD_JR303_S067	-46.0724	-44.209	CTD 067 off the deck

30/10/2014 06:02	CTD_JR303_S067	-46.0724	-44.209	CTD 067 deployed
30/10/2014 06:13	CTD_JR303_S067	-46.0724	-44.209	CTD at depth. Wire out 500m. Commenced recovery
30/10/2014 06:18	GAR_JR303_064	-46.0724	-44.209	Completed Garrett screen 064 sampling
30/10/2014 06:22	OPT_JR303_122	-46.0724	-44.209	Optic Rig 122 at the surface
30/10/2014 06:23	OPT_JR303_122	-46.0724	-44.209	Optic Rig 122 on deck
30/10/2014 06:40	CTD_JR303_S067	-46.0725	-44.209	CTD 067 at the surface
30/10/2014 06:42	CTD_JR303_S067	-46.0724	-44.209	CTD 067 on deck
30/10/2014 06:49	Station 82	-46.0724	-44.209	Decks
30/10/2014 07:00	Station 82	-46.0723	-44.226	Vessel at passage speed
30/10/2014 07:41	Station 82	-46.1637	-44.41	Vessel hove to for work on incubator
30/10/2014 08:00	Station 82	-46.154	-44.394	Vessel at passage speed
30/10/2014 08:24	Station 82	-46.1959	-44.465	Vessel hove to for work on incubator
30/10/2014 08:35	Station 82	-46.2012	-44.486	Vessel at passage speed
30/10/2014 20:23	Station 82	-47.0685	-46.833	Vessel hove to for work on incubator
30/10/2014 20:41	Station 82	-47.0624	-46.852	Vessel at passage speed
31/10/2014 07:24	Station 82	-47.7141	-48.86	Vessel hove to for work on incubator
31/10/2014 07:46	Station 82	-47.7146	-48.892	Vessel at passage speed
31/10/2014 14:52	Station 83	-48.2385	-50.336	Reducing speed for station 83
31/10/2014 14:59	Station 83	-48.2446	-50.341	V/l on DP (Station 83)
31/10/2014 15:15	CTD_JR303_S068	-48.2452	-50.341	CTD 068 deployed
31/10/2014 15:16	OPT_JR303_123	-48.2451	-50.341	Optic Rig 123 deployed
31/10/2014 15:28	CTD_JR303_S068	-48.2451	-50.341	CTD at depth
31/10/2014 15:38	OPT_JR303_123	-48.2453	-50.34	Optic Rig 123 fully recovered
31/10/2014 15:54	CTD_JR303_S068	-48.2453	-50.34	CTD 068 recovered
31/10/2014 16:03	MAF_JR303_007	-48.2465	-50.341	ARGO float (#7016) deployed at 1kt

31/10/2014 16:07	Station 83	-48.2477	-50.342	V/l off DP
31/10/2014 16:13	Station 83	-48.2504	-50.344	Decks secure and all persons clear of the upper deck
31/10/2014 16:21	Station 83	-48.2613	-50.362	V/l at passage speed
01/11/2014 06:06	Station 84	-49.5766	-53.064	Reducing speed for station 84
01/11/2014 06:11	Station 84	-49.5806	-53.072	V/l on DP (Station 84)
01/11/2014 07:03	ZPV_JR303_027	-49.5799	-53.071	Bongo Net 027 off the deck
01/11/2014 07:04	ZPV_JR303_027	-49.5799	-53.071	Bongo Net 027 deployed
01/11/2014 07:06	CTD_JR303_S069	-49.5799	-53.071	CTD 069 off the deck
01/11/2014 07:07	CTD_JR303_S069	-49.5799	-53.071	CTD 069 deployed
01/11/2014 07:19	CTD_JR303_S069	-49.5799	-53.071	CTD 069 at depth. Wire out 500m. Commenced recovery
01/11/2014 07:25	GAR_JR303_065	-49.5799	-53.071	Commenced Garrett Screen 065 sampling
01/11/2014 07:27	ZPV_JR303_027	-49.5799	-53.071	Bongo Net 027 at the surface
01/11/2014 07:30	ZPV_JR303_027	-49.5799	-53.071	Bongo Net 027 on deck
01/11/2014 07:31	GAR_JR303_065	-49.5799	-53.071	Completed Garrett screen 065 sampling
01/11/2014 07:48	CTD_JR303_S069	-49.5799	-53.071	CTD 069 at the surface
01/11/2014 07:49	CTD_JR303_S069	-49.5799	-53.071	CTD 069 on deck
01/11/2014 08:02	MAF_JR303_008	-49.5799	-53.071	Argo Float 008 (#7015) off the deck. Vessel moving ahead at 1 knot
01/11/2014 08:03	MAF_JR303_008	-49.5802	-53.071	Argo Float 008 (#7015) deployed
01/11/2014 08:03	Station 84	-49.5802	-53.071	Decks
01/11/2014 08:12	Station 84	-49.5893	-53.083	Vessel at passage speed
01/11/2014 15:51	Station 85	-50.2576	-54.521	Reducing speed for station 85
01/11/2014 15:57	Station 85	-50.2594	-54.529	V/l on DP (Station 85)
01/11/2014 16:04	CTD_JR303_S070	-50.2593	-54.529	CTD 070 deployed
01/11/2014 16:06	GAR_JR303_066	-50.2593	-54.529	Commenced Garrett Screen 066 sampling
01/11/2014 16:15	GAR_JR303_066	-50.2593	-54.529	Completed Garrett screen 066 sampling

01/11/2014 16:20	CTD_JR303_S070	-50.2593	-54.529	CTD at depth
01/11/2014 17:05	Station 85	-50.2593	-54.529	V/l off DP
01/11/2014 17:12	Station 85	-50.2617	-54.537	V/l at passage speed