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NATURAL ENVIRONMENT RESEARCH COUNCIL

National Oceanography Centre

Cruise Report No. 33

RRS *Discovery* Cruise DY008

18 MAR – 13 APR 2014
Southampton to Southampton, UK

Shelf sea biogeochemistry

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2015

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ABSTRACT

We addressed four interdisciplinary themes to provide a holistic view of the biogeochemistry of benthic shelf ecosystems, including the nepheloid layer. The relative size of the carbon (C) and nitrogen (N) pools, microbial transformation rates and fluxes between pools were quantified in shelf sediments on this, the first of several integrated cruises (Winter, post-bloom Spring, late Summer) scheduled to coincide with contrasting biogeochemical conditions. During each cruise, observations and experiments are to be made across a gradient of soft cohesive mud to coarse advective gravel. The effort has four modules: Module 1: Biogeochemical cycling of nitrogen, phosphorus, silicon and carbon within sediment; Module 2: Role of sediments in carbon storage; Module 3: Role of macrofauna and the impacts of natural and anthropogenic disturbance on sediment biogeochemical processes; Module 4: Role of sediment resuspension and near-bed current flow: Impacts on carbon and nutrient sediment-water exchange in diffusive and pumped sediments. Four primary sites were selected based on representation of the dominant habitat types (% area covered/ biogeochemically activity) within the Celtic Sea. This approach is to ensure that all data generated are applicable to the largest area of shelf sediments and thus suitable for scaling-up activities. Sites were chosen from a limited depth and temperature range to ensure high comparability between sites. Notably this was the first scientific research cruise of the 4th RRS *Discovery.* The vessel demonstrated its grand potential. It is the most advanced vessel like it and thus naturally has some teething to do, but any scientist who gets the opportunity use such a comprehensive platform is privileged.

KEYWORDS

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2. Cruise Narrative

18-20 March: The core objective of the cruise was to collect samples and data to understand how the chemistry and biology of the Celtic Sea link together to drive healthy and productive conditions, as well as how those conditions might change with climate change. It is one of a series of cruises in the Shelf Sea Biogeochemistry Programme.

The cruise programme has been modified from initial plans to take into account several factors including: The previously planned efforts to deploy SSB mooring infrastructure was not possible due to multiple weather delays; The winches had not passed trial inspections and additional speed trials were necessary. Thus, several days of mooring work was then added to the DY008 programme and additional days allocated. The first 3 days of the cruise were dedicated to trials to ensure that SSB had its key capability. These additional trials required the presence of eight engineers and NMF staff and necessitated that eight members of the science party join by boat transfer in Falmouth after the trial period.

Winch trials revealed several new issues that were corrected by Rolls Royce and the crew. The resulting status of the winch capability at the end of this period was that we were able to use the clean CTD winch for both Ti and standard CTDs with minimal swap over time. We were also able to use the steel CTD winch wire for coring to 200 m depth, including the USNEL/SMBA box corer. Restrictions were applied to winch speeds, which were not an issue for this depth. If we CTD to depths below 200 m, then 4 additional deployments with chain to the desired depth (potentially 2000 m). However, because there is added risk that deeper trials could result in the winch being decommissioned, it was expected that any deeper CTD work will occur at the end of the cruise. Other troubleshooting that arose during this period included issues with plumbing (scuppers leaking water from drains), and the temperature controlled lab and store spaces warming due to a recurrent trip in the chilling system. A separate report was made by NMF regarding the trials.

A boat transfer occurred at about 17:30 on the 20th and that brought the full scientific complement onboard. Given the weather forecast, we then headed to East of Celtic Deep for deployment of a guard buoy and Cefas mini-lander.

21 March: We arrived on station at East of Celtic Deep around 8 am and began preparations to deploy the guard buoy and mini lander. These were deployed by mid afternoon in a building sea state. There was a change made to the deployment procedure for the mini lander where the sideward laying cable was spooled off a winch drum rather than fed by hand. The deployment site was also moved to be 1 nm from a seafloor cable. We then proceeded to conduct trial deployment of the Ti-CTD system and

rinse all the bottles before first use. A full Ti-CTD was then done with a full set of samples taken. We explored the use of the SPI system, however, it was noted that the current deck arrangement was not ideal given the sea state and lack of experience with the procedure to be used. So we instead moved to collect a series of grabs to ground truth potential process study sites. This work continued overnight and found that Benthic A was indeed suitable for a cohesive site, as expected.

22 March: We moved to Nymph Bank and held station and ultimately deployed a guard buoy and mini lander. We then conducted a Ti-CTD cast before moving to East of Haig Fras for a repeat of the morning's activities. The next guard buoy was deployed in late afternoon and the mini lander by early evening. The guard buoy and mini lander were deployed about 3 km north than their original position. The related Ti-CTD was then taken. Grab sampling then proceeded overnight at Benthic D and then 4 stations at Benthic C. Benthic D proved to be a good site and C is likely to be scraped.

23 March: We moved from Benthic C to Celtic Deep Smart Buoy in the morning. Once on station we began prepping the deck for recovery and conducted a Ti-CTD with one sample at 5 m depth to relate to the buoy.

We then moved to the Benthic A site for the core sampling and process station for the cohesive end member. We first recovered bottom water using the Ti-CTD. Then we prepared the megacore for 2 drops. However, when the winch control system was started, several alarms rendered the winch inoperable. We then moved to conduct SPI deployments at Benthic B and then moved to a nearby site then named Benthic F. Both B and F were eventually found to be unsuitable for our four tier sampling design.

The pCO_2 system eventually had to be shut off because the drain system was not able to handle the minimal flow. The scupper in the met lab, were the system sits, had to be blocked because it was releasing grey water during rolling of the ship. The system could still be used to take 'instantaneous' measurements, but will need work to the sink, at least, to get it fully operational. The scuppers in the galley were also releasing grey water onto the galley floor before that scupper was also blocked.

24 March: The SPI activity finished at Benthic F in the early morning. We then proceed to Benthic C. The engineers had received feedback from the winch manufacturer and troubleshooting began in the morning. As we moved to Benthic C the weather was building and we eventually hove to for several hours to let the worst weather pass. We then refined our plan to go from Benthic E to C via ~1000 m intervals using SPI (E and C were also eventually found to be unsuitable or repeating criteria found already). By early evening there was no forward progress on the winch control system although several potential issues were discounted. It was thought that a parts fitting during the Falmouth port

call was likely. The temperature controlled cooling unit tripped again and both the chilled store and lab warmed to room temperature for a second time.

25 March: We stood ready for SPI imaging, however, the swells from the recently passed storm were still coming through into daylight. By 8 am we were able to do a Ti-CTD at Benthic D process station and then moved to Benthic A for another Ti-CTD. We then proceeded to conduct a SPI deployment at the Benthic G site. After the first deployment, however, the port crane went into an alarm state. The resulting limited system functionality gave the SPI camera a poorly controlled landing on deck. After about an hour the crane issues were investigated and another SPI imaging round was started. The sink in the met lab has been looked at and the pCO_2 system was now running full time again.

26 March: We arrived at the Candyfloss site and then first deployed the guard buoy. During deployment the light was damaged. Given that there was no spare, it was deployed as is. The thermistor chain deployment was interrupted by the failure of the double barrel winch, but a switch to the 5t deck winch was made in addition to reversing the order from bottom first to top first. The NOC,L bedframe went in as expected and we then moved to do 4 SPI deployments around the Candyfloss area, as well as 1 grab before morning.

27 March: The ADCP mooring was first to go in of the remaining Candyfloss elements, followed by the ODAS buoy and then the Smart Buoy. The port side stern crane was having repeated alarms and it was decided to instead use the main crane for lifting the ODAS buoy. We then proceeded to do a full Ti-CTD cast. By late evening we were on our way to the Shelf Break.

28 March: We began glider deployments at first light and the first glider, a Slocum, went in well. The second deployment, using the port aft crane, was hampered by the crane having alarm issues. This left the glider hanging from the crane for 20 min while the issue was examined. We then moved the deployment position to the port gantry and then deployed the second Slocum.

The idea of putting a 400 m pennant wire on the Romica deck which was raised and that it could serve as a backup means of coring, although there is a ¼ day time delay for any swap over between the conducting wire and the other pennant. It is expected however, that we can run all three activities via the pennant if needed.

The iRobot glider deployments were hampered by Iridium connections, where the needed initiation files were not getting to NOC, taking hours to get good links through in moderate sea conditions. The issue was eventually identified that the key file for staring contact with shore was growing with time and making satellite communications issues progressively worse. Once this file was reset to its correct size, the communications went through and the last glider was in the water shortly before the cut off time to go to Falmouth. Procedures for launching which don't require a potentially long wait for Iridium connections should be considered further.

All long term gliders, landers and moorings were now in the water. NMF crew and shipboard tech support (led by Dan Comben) are mainly to thank for their efforts over the past days, as well as Chris Balfour (NOC), David White (MARS), David Sivyer (Cefas). CTDs at Candyfloss and Shelf Break were also done as well as for some benthic sites. Limited ground truthing of benthic sites was also done with 3 of our 4 site locations confirmed.

29 March: We arrived in Falmouth as expected and began to take on MARS equipment. By day's end, all MARS gear was onboard with the gantry in place. A Rolls Royce engineer also joined the ship for winch related work.

30 March: The Autosub6000 was then prepped throughout the day for attachment to the gantry and eventual repositioning of the shop van to its final position forward of the gantry. We departed at 16:00 GMT and then stopped for winch trials about an hour out of Falmouth. First trials revealed the there was limited control from most positions. We then departed for Benthic G to arrive in early morning. It was noted that the ships time on the various lab displays for winch, surf met etc. was showing BST, probably via an auto update. This was later rectified and screens were shown the correct time by the next day.

31 March: The winch related troubleshooting continued in the morning in collaboration with shore-based contractor staff. The Mini-STABEL lander was prepped for deployment throughout the morning and the deployment went well, although the lander should eventually be modified to have handling line loops at a higher point on the lander.

The winch troubleshooting eventually lead to the system being ready for trials. We then stood off the lander by about 1 km and ran the winches with a clump of chain, not landing on the seabed. After some testing we then moved to Benthic A to start a round of experimental core sampling, first doing a CTD dip to collect incubation water. The hanger gantry crane got stuck in the extend position for some time, but was eventually retracted.

We began coring at Benthic A in the evening and first did 2 megacore deployments, 1 with 12 regular tubes and then 1 with 4 WP3 tubes and 4 regular. Both were nearly all successful. NIOZ coring began next and a target of 3 per hour was set.

1 April: Coring continued overnight with some 18 deployments of the NIOZ corer being done by 4 am, almost all of which were suitable for use. The wire came off the sheave at ~111 m depth, very close to or at the bottom. The wire was eventually set back in and the corer recovered. The wire was damaged with several strands broken. Once it was wound off, it was then cut (at about 140 m) and then re-terminated.
While we had planned an Autosub6000 test mission, the vehicle set up period revealed too many issues for this to occur on this day. The most serious of these related to the navigation system not working properly. Thus, as simple 'dip' test was done where the vehicle was streamed aft, but left tethered to the ship.

With the wire issues and the Autsub6000 testing changing our plans, we did some targeted multibeam data collection along a ~5 x 1 km box centred over Benthic A.

We then moved to recover the Mini-STABLE lander. After many unsuccessful attempts to recall the system at Benthic G, we moved back to Benthic A for coring accepting that the timed release should work for noon on the 2nd. It's likely that the small acoustic system for the spooler line could not work in the moderate sea state next to the ship. While one confirmed link was made it was not clear that the release mechanism was activated. We then resumed NIOZ coring at about 20:00 hrs.

2 April: The NIOZ coring continued overnight with everyone getting what they needed for Benthic A by about breakfast time. We then planned to conduct a flume run, but the logging system failed to initialize thus preventing deployment. The flume team was soon working to find a fix working with NMF and the manufacturer to troubleshoot. Instead we conducted 3 SPI deployments at Benthic A.

We then moved to the lander deployment position at Benthic G and looked for the floating reel. It was expected that it should have triggered is release by timed mechanism. However the reel was not seen after extensive checking in good conditions. We then got communications going with the lander confirming that that its release jaw opened. This release command was repeated several times with confirmation, but the reel still did not appear after waiting over 1 hr and viewing in good conditions (excepting a brief period of fog). Notice was soon given to shore-based Mini-STABLE stakeholders.

Coring resumed, this time at Benthic G. First we attempted two box cores with the first drop bending the box due to a large rock. The second was also not working well and it was decided to go for NIOZ coring only at the site.

3 April: NIOZ coring continued overnight and about ½ of the coring Benthic G was achieved, considering that the site was too sandy for other types of coring. It was also clear that Benthic G

would be suitable as an advective end member despite the grab revealing muddier samples. After this particular set of cores was aboard, we went for another look for the lander buoy to see if it had been freed up overnight. It was not seen and conditions were good. We came as close as 50 m to the lander position. We then set out for the next Falmouth boat transfer, which was to drop off a winch engineer. After the boat transfer we did a second test dip for the Autosub6000, which suggested it was ready for deployment.

4 April: We reached the next coring station at about 5:00 and continued coring until about 8:00. We then prepared Autosub6000 for launch and it was deployed by about 9:30. Shortly after deploying the sub, a fault was found in the mission script such that only the bathymetry would be completed as planned. Because we were working in such shallow water the sub was not having sufficient communications to alter the mission script. We therefore had to wait until the mission finished and the vehicle surfaced to know its precise location.

While the sub was in the water we conducted the first flume deployment which went until about 17:35. Upon recover it was discovered that the kill switch was damaged and caused the system to stop mid deployment. After it was on deck it was examined and readied for another deployment at that site. The sub surfaced before 20:00 and was recovered shortly after. Then the last of the NIOZ and USNEL/SMBA cores were collected for that site.

5 April:

In the early morning we moved to conduct ship based multibeam mapping in the Benthic G area. The CT lab and cold store warmed again overnight, this time to 17C. This was corrected at about 04:00. The system was noted as being in need of comprehensive examination and alarm indicators for temperature anomalies.

The morning Autosub6000 dive was eventually cancelled due to the downward looking flash not working. It was soon repaired and ready for 7 April deployment.

The flume was repaired overnight and was deployed at about 01:00 and recovered 3 hrs later with a successful deployment. We then went and had another look for the Mini-STABLE lander, this time during a slack tide. It was not seen.

A completion of SPI sites was then done for Benthic A, followed by SAPS and then Flume Benthic A.

6 April: Overnight an issue with the Ti-CTD winch control system was discovered with a symptom of showing erroneous overheating alarms when the system was known to be well within normal temperature. This system was then taken out of service for the remainder of the cruise.

We started moving south to Benthic D in anticipation of building weather. Upon arriving we moved the station 1 nm to the northeast and used a new title of Benthic H for this location. We then did a grab to check sediment quality and found it to be muddy sand. We then conducted a megacore and got enough tubes to satisfy all megacore tube needs for the site. The NIOZ corer was then set up and deployed. The winch power control unit failed when the system was near the seabed and the corer was eventually recovered under controls from the winch room. After some investigation it was thought that this failure was similar in cause to those two times previously with the winch control computer board.

We then moved back to Benthic A for deployment of Autosub6000 for a bathymetric, photographic and sidescan mission.

7 April: We recovered the sub in the early morning and found that only the bathymetric survey was successful. A series of troubleshooting activates was initiated that focused on the logger and its disk. In the mean time a set of detailed SPI observations was made for Benthic G. We eventually finished this around 20:00 and then conducted multibeam lines between A and G.
During the day the winch control system was brought back online and a set of power trials and observations were done.

8 April: The sub was launched around 06:00 and set off on a photo only mission. It was at the surface just after 11:00. Once recovered, we found that the seafloor was obscured my turbid water. This was not a great surprise considering the images from spy and the fact that there were a dozen or so fishing vessels in the greater area around Benthic A. Next surveyed was a photographic mission for Benthic G, which has less inherent turbidity due to its sandy sediment.

During the Autsub6000 deployment at Benthic A, the CTD-coring winch was trailed using chain and it was expected that this will be available for use on the 9th when we arrived back at Benthic H. The Autosub6000 deployment seemed to go as planned, excepting that the water clarity was not good enough to see the seafloor in much of the photography. The vehicle had to be within 2 m to get seafloor visibility, too low for normal navigation.

The deployment of the sub at Benthic G, however, did get usable seafloor images from the vertical camera. Results from these two dives corroborated CTD cast and other evidence that the resuspension at A was substantially higher at G with it having negligible differences between any benthic boundary layer and midwater turbidity.

During the Benthic A sub dive, the ‘CTD coring’ winch systems were trialled with a chain lump and eventually put back into service. The fault found earlier in the week, while initially thought to be the same as previous faults, was found to be a new issue related to wiring.

9 April: The ship moved back to Benthic H overnight and coring began around 03:00 with the NIOZ corer. About half of the requisite cores were collected by breakfast. The remaining NIOZ cores for Benthic H were collected by about 14:00 and we then set to finish H coring with the USNEL/SMBA Boxcorer. Then we conducted a SAPS deployment followed by the Flume system and then a series of 5 SPI deployments.
In preparation for the next sub dive, we examined the CTD transmissometer data and found that H could be comparable to A in terms of water clarity. We then set to toe in the flash and run a test mission for flying the sub at 2.2 m, which may generate more useful photographs, but with little or no overlap.

10 April: The SPI imaging continued overnight and was followed by ground truthing to confirm the location of Benthic I. The ground truthing found one potential area, but it was not large and we will look at alternatives during the Autosub6000 mission. In the morning, when the SPI images from the night before were reviewed, it was found that the images were too dark and the flash for the system needed to be examined and/or we should switch to the alternate system for any further SPI imaging. The sub was in the water just after 06:00, but without the forward camera. The sub set out on a test mission to first check the capability for lower altitude photography. After a review of data and images we sent the sub to fly at 2.2 m altitude.

The surveying for Benthic I continued with most grabs getting sediment that was rather similar to Benthic H. We picked up the sub from Benthic H to find it had collected a good set of images and acoustic data showing the trawl scars and other features well.

On the fourth area search for I, we found sandy mud in an area northwest of Benthic H. We then proceeded to conduct a limited core sampling given the time allowed for experiments and incubations.

11 April: Coring continued overnight until about 06:00 and the sub was then ready to deploy. We then repositioned the ship to the deployment waypoint. The sub went in and we then proceeded to conduct SPI operations at Benthic H (repeat as the flash was not working well during last run) and I. The last of the NIOZ coring went smoothing with coring finished about 16:00. We then moved to the sub

recovery position in the late afternoon and the sub was recovered just before dinner. The photographs from the mission were of a similar good quality to those from Benthic H.

We then moved to just west of the Benthic I site centre position and conducted a SAPS deployment followed by the flume. We then moved off towards Southampton with the towfish for taking iron samples en route via west of the Isles of Scilly.

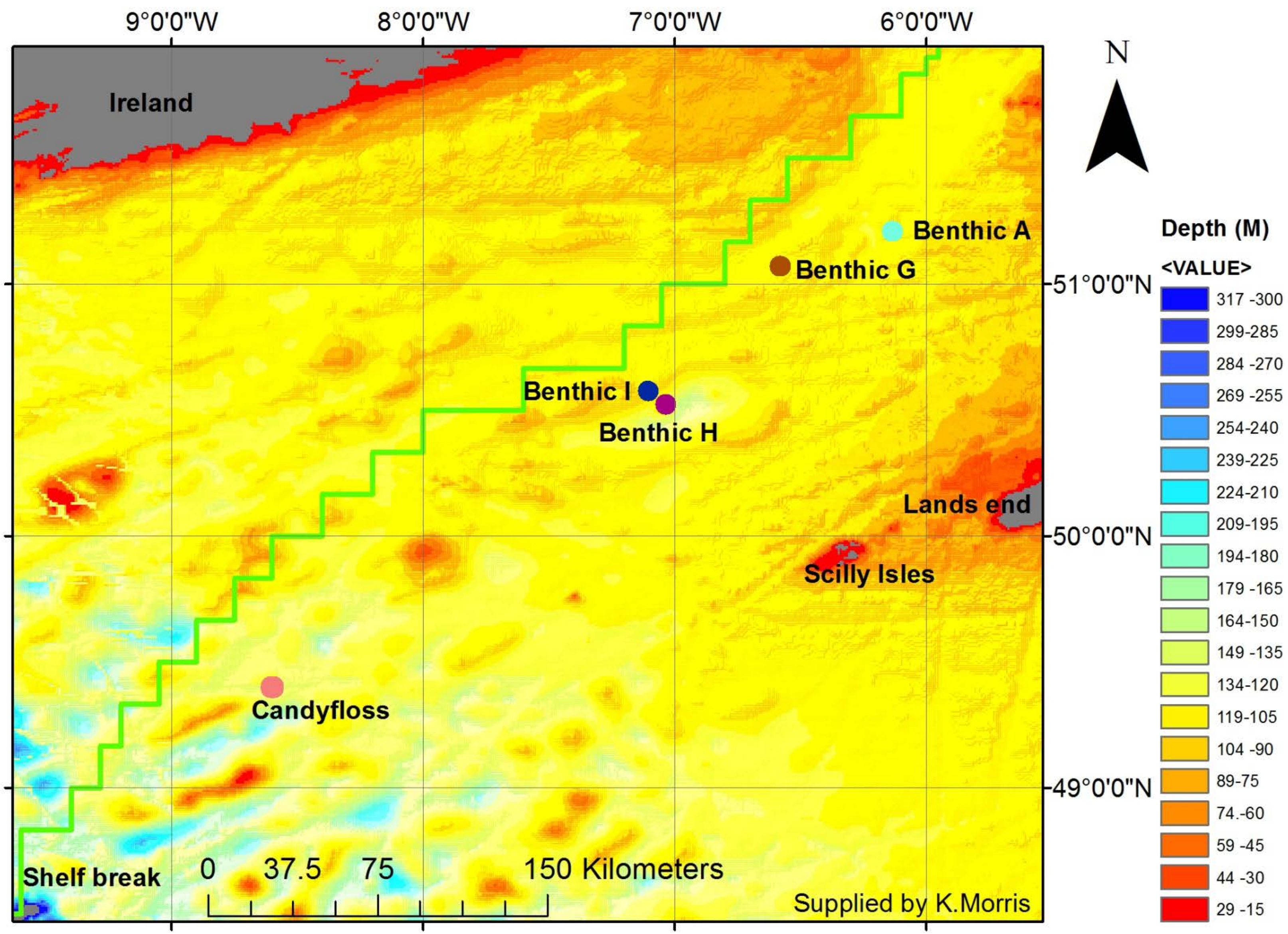


Figure 1.1. Chart illustrating various sampling areas and gear types at the largest scales.

12 & 13 April: The last full day of the cruise was spent organising metadata and going over various tasks to improve both efforts for the Shelf Sea Biogeochemistry Programme as well as use of RRS *Discovery* generally. The towfish was recovered in late afternoon on the 12th.

While the cruise has had more challenges than some, the focus of the various teams helped get us a long way towards completing the cruise objectives. The vessel demonstrated its grand potential. It's the most advanced like it and thus naturally has some teething to do, but any scientist who gets the opportunity use such a comprehensive platform is privileged. The ship has now done its first tour de force with tones of seafloor material brought on the ship giving it 'scientific charm'. Likewise, the scientists and crew will no doubt take a bit of sparkle with them from this special cruise.

3. Sea surface hydrography and meteorology (Surfmet)

Louise Darroch[1], Joanne Hopkins[2]
[1]Author, [2]Dataset PI

Background and objectives

The status of the sea surface and meteorology (surfmet) system was investigated and monitored by Louise Darroch (cruise participant) on behalf of Jo Hopkins at the National Oceanography Centre, Liverpool (NOC). The surfmet data will contribute to WP1 and will be processed by the British Oceanographic Data Centre (BODC). The information about the system will be used by NMF-SS ship-fitted systems and BODC for future cruises.

Instrument description

The sea surface hydrography suite of sensors were plumbed, in-line, to the clean seawater pumped supply line. The Sea-Bird SBE 38 was located close to the seawater intake towards the hull of the ship where it was less likely to suffer from any interior heating effects. The remaining sensors were located in the clean seawater laboratory on the main deck, directly above the intake pipe (estimated to be ~5 m). The depth of the seawater intake was estimated to be approximately 6 m (determined from the ship's plan). In the clean laboratory, the flow of seawater through the system was initially down-regulated and de-bubbled using an Instrument Laboratory, Vortex VDB-1H de-bubbler (s/n 13052403) before the flow was regulated to approximately 1500 ml/min using a floating ball flow meter prior to the first sensor, the fluorometer. This was followed in-line by the transmissometer and finally the thermosalinograph (TSG) before the water was wasted to the drain. The meteorology platform was located on the ship's foremast at the bow of the ship. According to the ship's plans, the foremast was approximately 17.6 m above typical sea level (16.2 m above the maximum loading mark, the 7 m draft mark). The foremast was located approximately 38 m in front of the nearest ship superstructure. Table 3.1 describes the current suite of surfmet sensors. Figure 3.1 shows the current orientation of the met platform. The met platform had two sonic anemometers. The starboard-side was used for science while the port-side anemometer was used by the bridge MET Office's AMOS system (AMOUK45).

Data processing

Output from the surfmet sensors were initially logged by a designated PC before being registered by the TECHSAS logging system and broadcast to NetCDF and UKORS format (the later being in raw_data area of the level-C logging system). Some of the sensor's firmware, connection modules and PC software manipulated the output prior to this (Figure 2.1). The setup was the same as that used on the RRS James Cook. Once in the Level-C logging system, the data was further manipulated by the in-house NMF processes, pro_wind and stored in the pro_data area of the files system.

Table 3.1. Surfmet sensors fitted on DY008.

Manufacturer	Model	Sensor	Serial number	Location (e.g Port)	Height above sea level (m)	Last calibration date	Comments (e.g accuracy)
WETLabs	WETStar		WS3S-247			12/06/2013	
WETLabs	CSTAR		CST-1131PR			02/07/2013	25 cm pathlength, 660 nm
Sea-Bird	SBE45		4548881-0232			18/10/2013	Unused since purchase. Installed on DY003. Original calibration (02/07/2009) applies
Sea-Bird	SBE38		3854115-0487			13/06/2013	Water not flowing over sensor until 23/03/2014 ~18.00
Skye	SKE 510		28556	Starboard	18.9	04/07/2013	
Skye	SKE 510		28559	Port	18.9	04/07/2013	
Kipp & Zonen	CM 6B		047463	Port	18.9	29/05/2013	
Kipp & Zonen	CM 6B		047462	Starboard	18.9	29/05/2013	
Gill	Windsonic	Option 3	250004845	Port	19.9	No calibration required	Sensor does not drift and therefore does not need calibration. Sensor noisy 24/03/2014. Fixed 27/03/2014 (not accessible due to bad weather).
Vaisala	PTB110		G0820001		18.1	04/06/2013	Sensor was adjusted at calibration laboratory to be correct. Therefore no calibration is required.
Vaisala	HMP45AL		E1055002		19.3	21/10/2011	New temperature and humidity probe. This probe has not been adjusted at the calibration laboratory for a long time. Humidity observed suspect 27/06/2014

General observations

The system flow changed with the pitch of the ship. Data appeared more noisy underway. Data were more stable when on station. The SBE 45 (in the clean seawater laboratory) was estimated to be positioned around 5 m in-line from the remote temperature probe (SST). Therefore, the difference in temperature appeared to be small between the remote and housing temperature sensors.

The temperature and humidity probe fitted to the met platform (Vaisala HMP45AL) was not the usual model used on the NMF-SS ships (which is a HMP45A). This was because all usual models had been sent for calibration. It is now known that Vaisala have ceased production of the usual temperature and humidity probe HMP45A, therefore ship-fitted systems will be looking to replace the HMP45As with a different, newer model in the near future.

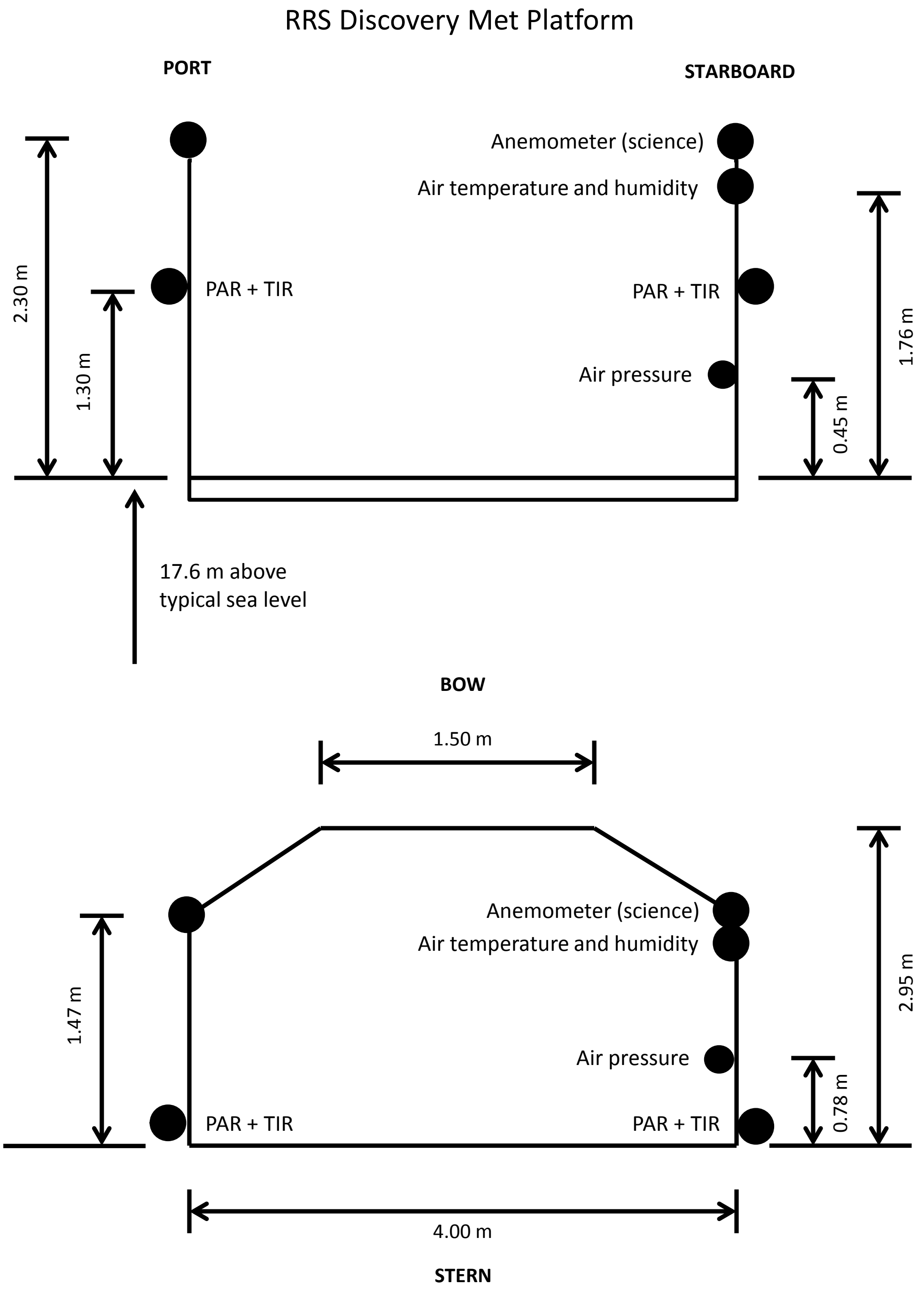


Figure 3.1. Schematic of met platform layout.

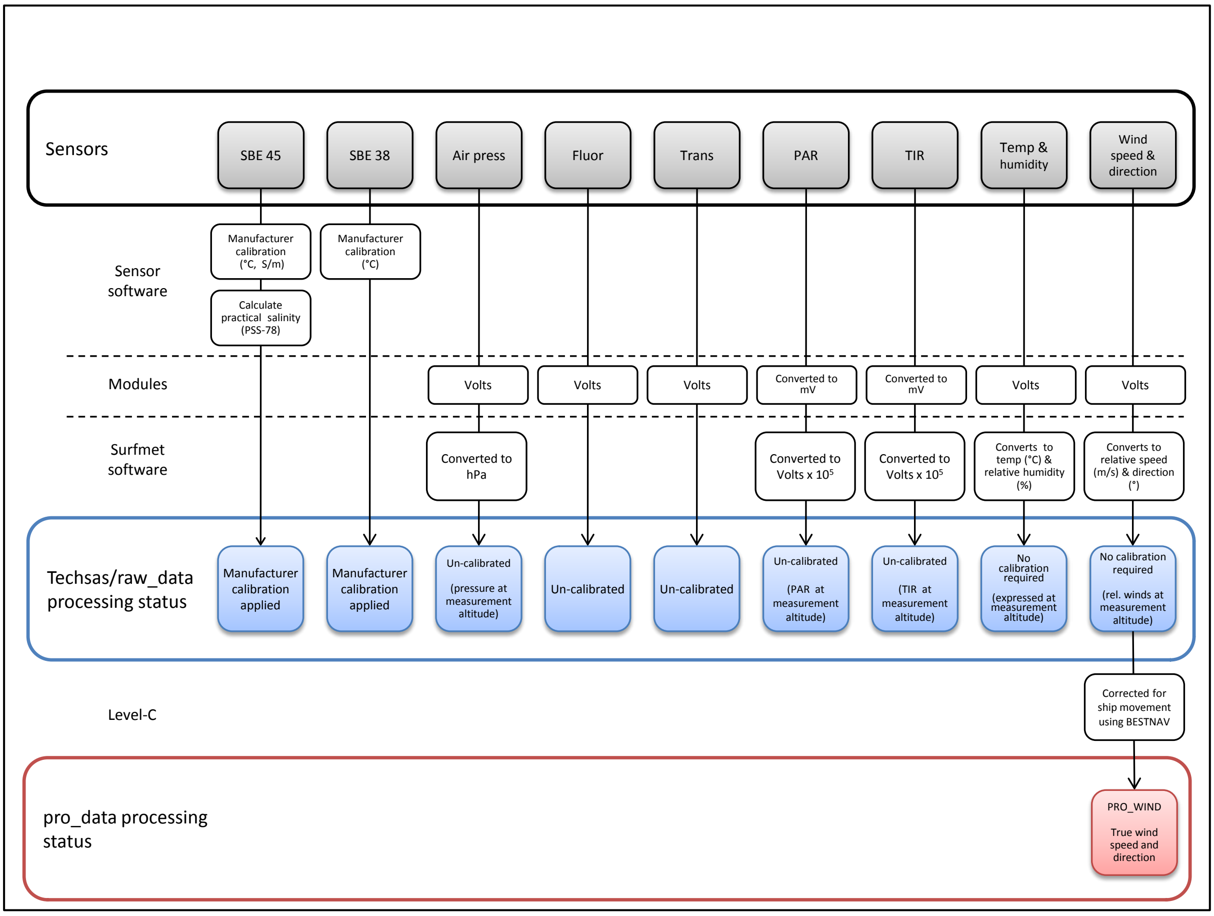


Figure 3.2. Surfmet data processing. Diagrams shows the processing route from sensor to *pro_data* in the level-C logging system.

4. Underway pCO_2 analyser

Vas Kitidis

A Plymouth Marine Laboratory (PML)-Dartcom Live pCO_2 instrument was set up in the meteorological laboratory on the boat deck (hereafter met-lab). Gas standards (BOC Ltd.; nominal mixing ratios 250, 380, 450 ppmv in synthetic air; calibrated against NOAA primaries) were located in the gas bottle rack in the forward moorings area on the boat deck (port-side) and an air sampling line was taken from the met-lab to the foremast. The system comprises a showerhead equilibrator vented through a second equilibrator, in-line oxygen optode and platinum resistance thermometer, nafion dryer, non-dispersive infrared detector (LiCOR, LI-840) and associated hardware and electronics. The system was linked to the ship's LAN with the help of Gareth Knight and transmitted data in near-real-time to a server at PML. Underway pCO was measured every 15 minutes, marine air every 45 minutes and standards every hour. A series of water leaks related to the ship's plumbing impeded continuous operation. Firstly, it was discovered that when the ship rolled to port, water from the sink, flowed out of the scupper in the met lab instead of draining away. The scupper was sealed off by the second engineer, but leaked and flooded the met lab, alleyway and one cabin. The scupper was re-sealed by the chief engineer and did not leak further. A final leak was associated with the pipe-work under the sink. This was a slow, but persistent drip which was sealed by the crew. These leaks, clean-up, repair and downtime while sealants were curing as well as the port-call in Falmouth resulted in total downtime of ca. 10 days.

5. Underway nitrate sampling using SUV-6

Adrian Martin and Kirsty Morris

The SUV-6 is an ultraviolet spectrophotometer designed to measure the concentration of nitrate in seawater. It was developed at the National Oceanography Centre, in association with Valeport Ltd. It has previously been used successfully to map nitrate fields using a towed SeaSoar device (Pidcock et al., 2010). As a proof-of-concept study, on DY008 it was configured to measure nitrate concentrations from the surface using the non-toxic supply on the ship. The sensor was placed in a specially designed housing to keep the sensor head in dark conditions whilst allowing water to be fed past the sensor head via standard hose connections either side of the housing. The sensor was connected to a standard PC laptop running a suite of software designed by Mark Hartman (NOC) allowing data to be logged continuously throughout the cruise. This software activated the sensor to take a reading averaged over 2mins every 10mins. Data were logged continuously from port of departure to port of disembarkation. Bottle samples were taken to Malcolm Woodward for later comparison.

Pidcock, R. et al. 2010: A Novel Integration of an Ultraviolet Nitrate Sensor On Board a Towed Vehicle for Mapping Open-Ocean Submesoscale Nitrate Variability. J. Atmos. Oceanic Technol., 27, 1410–1416. doi: http://dx.doi.org/10.1175/2010JTECHO780.1

6. Long-term buoys, moorings and landers

Daniel Comben, David Sivyer, Chris Balfour *et al.*

SSB Guard Buoy 1

Operations Summary

The first guard buoy was deployed in earnest on 21st March 2014 1012 hrs GMT at position Lat: 57 07.598 Long: -006 09.498. Half a NM was decided upon for the run in, although conservative, this was the very first mooring operation to be carried out on the *Discovery* so decided to err on the side of caution with a large run in to enable time for any unforeseen eventualities. Fortunately there were none.

The Buoy was deployed via a single point lift (3 ton safe working load (SWL) master link) using the port side crane and 7 ton SWL Seacatch on load release. The initial ship speed on deployment was 0.2 knots. The crane had the runner removed and the 5 ton SWL hard eye was used. Two stray lines were run from the aft end of the port and stab crane pedestals. Ship speed was raised to 0.5 knots once buoy and rope streaming commenced.

The 40 mm diameter Geosquare rope was run directly through the double barrel winch along the deck and over the stern. No block/ diverter sheave was used in the Celtic Explorer ODAS deployment method style. All rope was streamed with the buoy aft. A 95 m anchor Rove was coupled in and the Rove was then realised in 10 m sections with rope stoppers to control any runaway. The rope stoppers were cut in sequence until all chain was deployed then the 2.5 ton cast sinker weight was deployed via port side crane and Seacatch.

Instrumentation

Light pattern of 5 flashes in a 20 second interval was pre programmed and the Planet Ocean watch circle monitor were enabled prior to leaving NOC.

Observations, problems and recommendations

Conservative run-in to be reduced. Anchor release just on deployment spot, as lay back was assumed to be arbitrary at this water depth and rope length. No problems were encountered. Double rope stoppers and triple at the last section of chain were used and needed to arrest the chain rove on deployment.

SSB Guard Buoy 2

Operations Summary

The second guard buoy was deployed on 22nd March 2014 0814 hrs GMT at position Lat 51'02.64 Long -06'35.85. A 300 m run in was decided upon. The Buoy was again deployed via a single point lift (3 ton master link) using the port side crane and 3 ton Seacatch on load release. The initial ship speed was 0.2 knots. The crane had the runner removed and the 5 ton SWL hard eye was used. Two stray lines were run from the aft end of the port and stab crane pedestals. The 40 mm diameter Geosquare rope was run directly through the double barrel winch along the deck and over the stern. No block/ diverter sheave was used in the Celtic Explorer ODAS deployment method style. All rope was streamed with the buoy aft. A 95 m anchor Rove was coupled in and the Rove was then realised in 10m sections with rope stoppers to control any runaway.

Instrumentation

Light pattern of 5 flashes in a 20 second interval was pre-programmed and the Planet Ocean watch circle monitor were enabled prior to leaving NOC.

Observations, problems and recommendations

Anchor release just on deployment spot as lay back is assumed to be arbitrary at this water depth and rope length. No problems were encountered. Double rope stoppers and triple at the last section of chain were used and needed to arrest the chain rove on deployment.

SSB Guard Buoy 3

Operations Summary

The third guard buoy was deployed on 22nd March 2014 1721 hrs GMT at position Lat 50'35.7 Long -07'01.2. A 300 m run in was decided upon. The Buoy was again deployed via a single point lift (3 ton master link) using the port side crane and 3ton Seacatch on load release. The initial ship speed 0.2 knots. The crane had the runner removed and the 5 ton SWL hard eye was used. Two stray lines were run from the aft end of the port and stab crane pedestals. The 40 mm diameter Geosquare rope was run directly through the double barrel capstan winch along the deck and over the stern. No block/ diverter sheave was used in the Celtic Explorer ODAS deployment method style. All rope was streamed with the buoy aft. A 95 m anchor Rove was coupled in and the Rove was then realised in 10 m sections with rope stoppers to control any runaway. The rope stoppers were doubled and tripled at the last bites of chain to control runaway.

Instrumentation

Light pattern of 5 flashes in a 20 second interval was pre-programmed and the Planet Ocean watch circle monitor were enabled prior to leaving NOC.

Observations, problems and recommendations

Anchor release just on deployment spot as lay back is assumed to be arbitrary at this depth and rope length. No problems were encountered. Double rope stoppers and triple at the last section of chain were used and needed to arrest the chain on deployment.

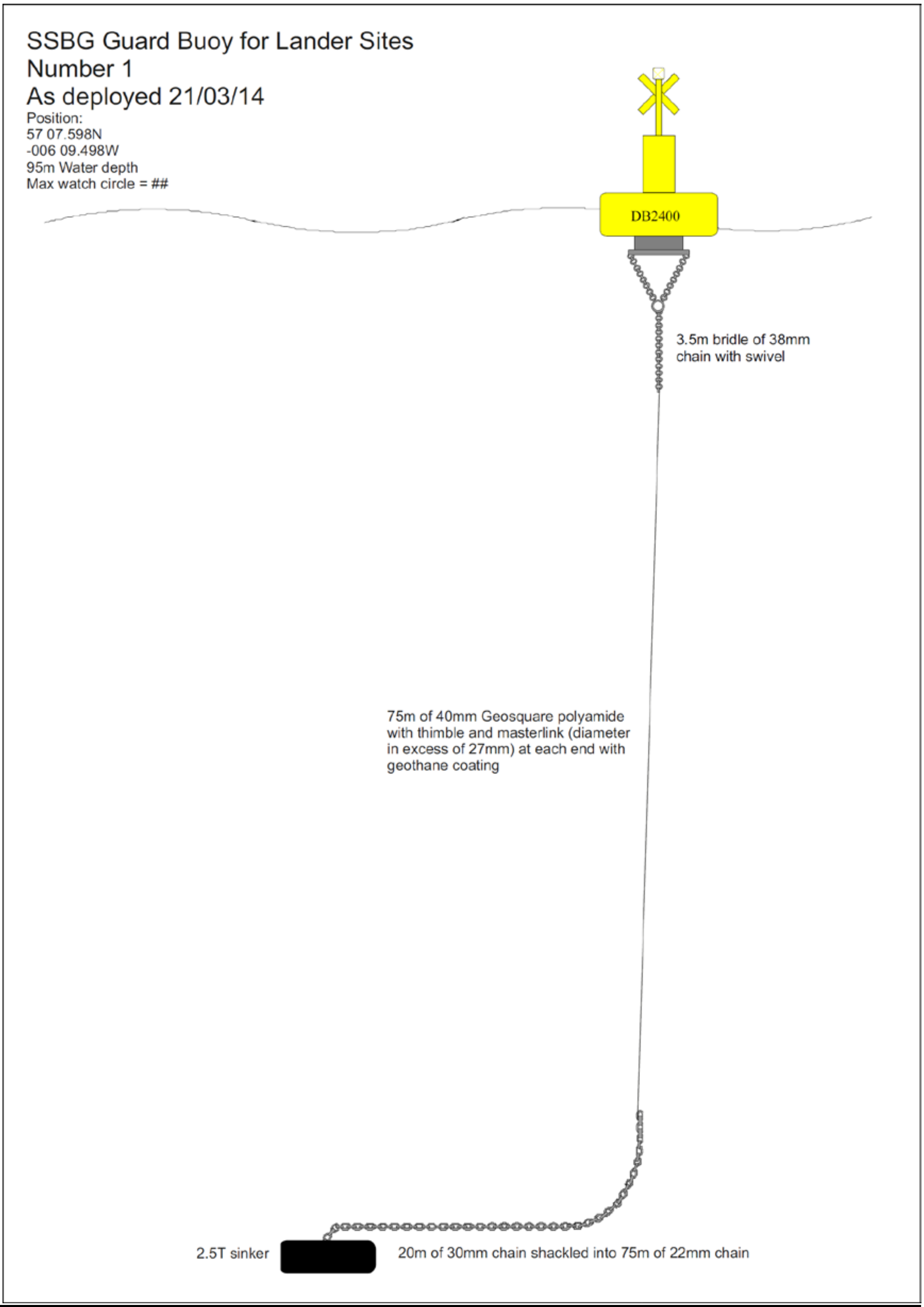


Figure 6.1. Guard bouy 1 for Cefas Minilander 1.

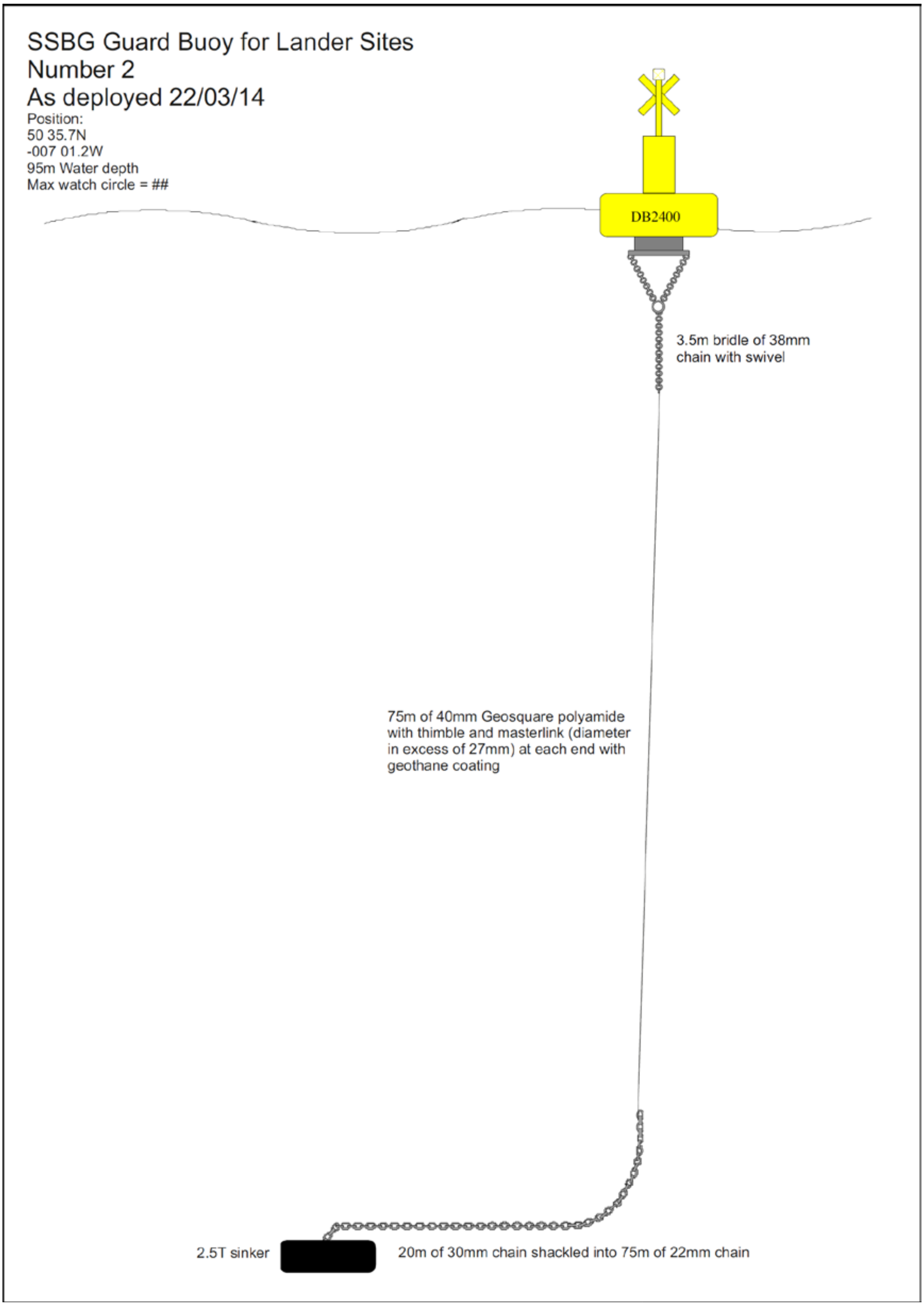


Figure 6.2. Guard bouy 2 for Cefas Minilander 2.

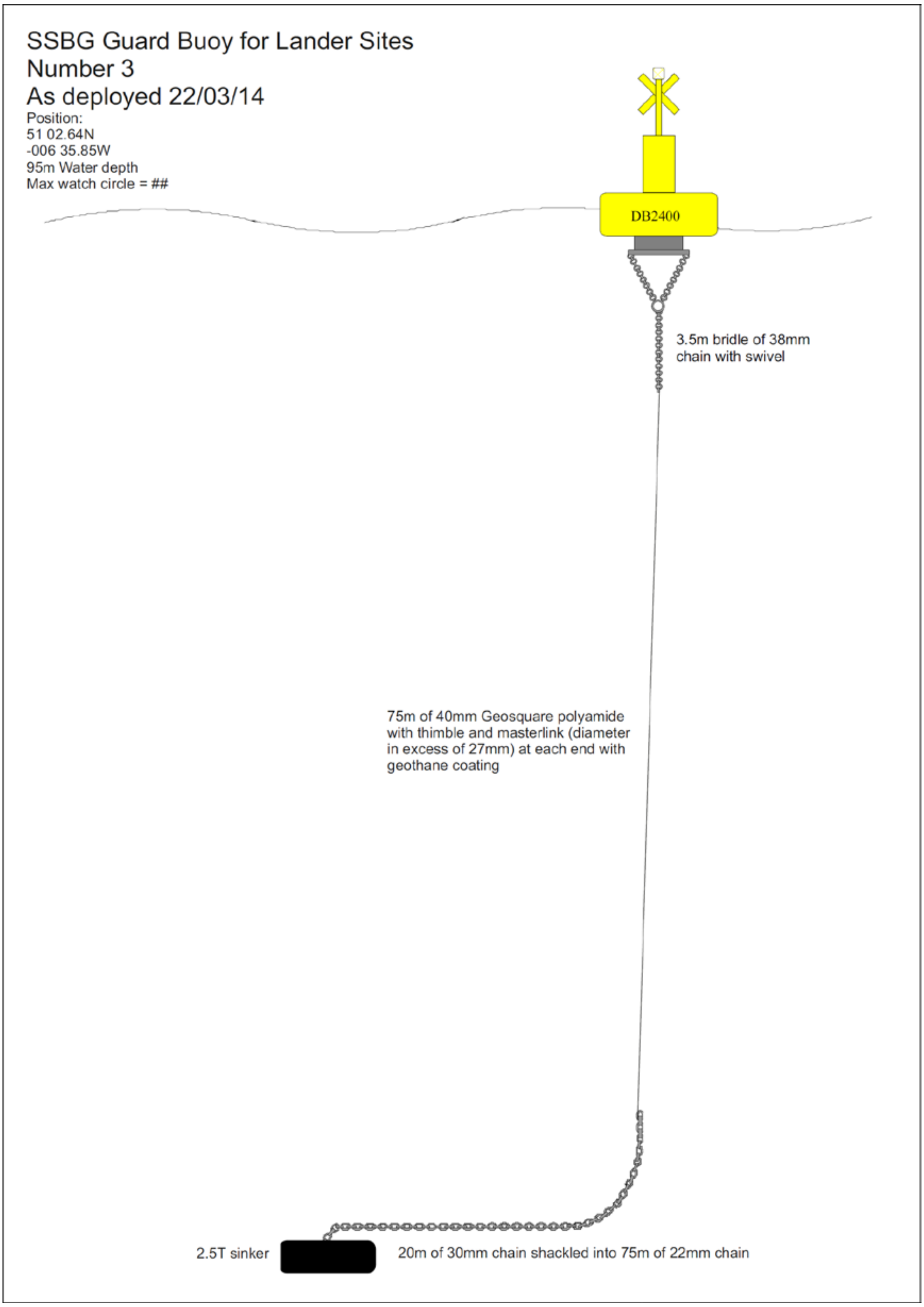


Figure 6.3. Guard bouy 3 for Cefas Minilander 3.

CEFAS Minilander 1

Operations Summary

The first Cefas mini Lander was deployed on 21st March 14:26 GMT at 51.12190, -6.16510. The water depth was 103 m. The Lander was lowered into position using a 220 m length of 20 mm polyprop line (its own recovery line) from the Double Barrel capstan winch. The ground cable was paid out simultaneously keeping minimal tension on it to stop the Lander from tipping. Once the Lander was on the sea bed it was released using acoustic release IXSEA861 S/N 1502. The 200 m ground cable was then paid out on the seabed using the Ex-Bas 10 ton deck winch and with the ship moving at 0.2 knots. Constant checking of the tension on the cable was required by hand to ensure that the Lander was not dragging behind the ship and that the cable was streamed effectively and not coiled on the seabed. The 200 kg clump weight was then hammer locked into the ground cable and the 220 m length of 20 mm polyprop. The 20 mm polyprop was then deployed forming a u shaped mooring with 3x buff floats yellow, yellow and red, red indicating the bitter end of the recovery line.

Instrumentation

A NOC L supplied and set up 600 kHz RDI ADCP, SN5803 was added to the existing Smart buoy instrumentation.

Site 5 – East of Celtic Deep (51.1258,-6.1770) - CEFAS Minilander (Deployed on 21/03/2014 at 14:26, 51.12190, -6.16510, Nominal depth 103m)	
NOCL component	**Details**
*600 kHz RDI ADCP, SN5803	One internal and two external batteries, all unused at deployment start. The top of the ADCP is 1m off the seabed and beam 1 points to the recovery spooler. Clock reset and logging set to start at 18:00 on 21/03/14, 2.5GB of memory installed.

* Script file/parameters available upon request

Observations, problems and recommendations.

The deployment method worked well.

CEFAS Minilander 2

Operations Summary

The second Cefas mini Lander was deployed on 22nd March 10:58 GMT at 51.12190, -6.16510. The water depth was 103 m. The Lander was lowered into position using a 220 m length of 20 mm polyprop line (its own recovery line) from the DB winch. The ground cable was paid out simultaneously keeping minimal tension on it to stop the Lander from tipping. Once on the sea bed it was released using acoustic release IXSEA861 S/N 1502 ARM 09DD. The 200 m ground cable was then paid out on the seabed using the Ex-Bas 10 ton deck winch and with the ship moving at 0.2 knots. Constant checking of the tension on the cable was required by hand to ensure that the Lander was not dragging behind the ship and that the cable was streamed effectively and not coiled on the seabed. The 200 kg clump weight was then hammer locked into the ground cable and the 220 m length of 20 mm polyprop. The 20 mm polyprop was then deployed forming a u shaped mooring with 3x buff floats yellow, yellow and red, red indicating the bitter end of the recovery line.

Instrumentation

A NOC L supplied and set up 600 kHz RDI ADCP, SN2390 was added to the existing Mini Lander instrumentation.

Site 3 – (51.0433,-6.6) - Nymph Bank - CEFAS Minilander (Deployed on 22/03/2014 at 10:58, 51.04250, -6.60580, Nominal depth 106m)	
NOC,L component	**Details**
*600 kHz RDI ADCP, SN2390	One internal and two external batteries, all unused at deployment start. The top of the ADCP is 1m off the seabed and beam 1 points to the recovery spooler. Clock reset and logging set to start at 20:00 on 21/03/14, 2GB of memory installed.

* Script file/parameters available upon request

Observations, problems and recommendations.

The deployment went well

CEFAS Smart buoy

Deployed on the 22/03/2014 15:43 GMT 51.1372 -6.5673. Deployed buoy first, anchor last.

CEFAS Minilander 3

Operations Summary

The third Cefas mini Lander was deployed on 22nd March 20:00 GMT at 50.59650, -7.02570. The water depth was 109 m. The Lander was lowered into position using a 220 m length of 20 mm polyprop line (its own recovery line) from the DB winch. The ground cable was paid out simultaneously keeping minimal tension on it to stop the Lander from tipping. Once on the sea bed it was released using acoustic release IXSEA861 S/N 1502 ARM 09DD. The 200 m ground cable was then paid out on the seabed using the Ex-Bas 10 ton deck winch and with the ship moving at 0.2 knots. Constant checking of the tension on the cable was required by hand to ensure that the Lander was not dragging behind the ship and that the cable was streamed effectively and not coiled on the seabed. The 200 kg clump weight was then hammer locked into the ground cable and the 220 m length of 20 mm polyprop. The 20 mm polyprop was then deployed forming a u shaped mooring with 3x buff floats yellow, yellow and red, red indicating the bitter end of the recovery line.

Instrumentation

A NOC L supplied and set up 600 kHz RDI ADCP, SN3644 was added to the existing Mini Lander instrumentation.

Mooring Site 2 - (50.5691,-7.0223) – East of Haig Fras - CEFAS Minilander (Deployed on 22/03/2014 at 20:00, 50.59650, -7.02570, Nominal depth 109m)	
NOC,L component	**Details**
*600 kHz RDI ADCP, SN3644	One internal and two external batteries, all unused at deployment start. The top of the ADCP is 1m off the seabed and beam 4 points to the recovery spooler. Clock reset and logging set to start at 13:00 on 22/03/14, 2GB of memory installed.

* Script file/parameters available upon request.

Observations, problems and recommendations.

Before the Mini Lander could be released, insufficient battery voltage on the acoustic release deck unit delayed the release as the second back up unit had to be brought from the main lab. Before the release command was sent, buff floats from emergency recovery line were spotted on the surface, therefore the Mini Lander was recovered to deck prior to release. The recovery line was re-spooled and a second deployment attempt was made successfully.

CEFAS Smart buoy

The Smart buoy was recovered by reversing the vessel towards the buoy in DP using the 10 ton deck winch for the chain and wire. The chain was then inspected and subsequently turned around for re-deployment at the Candyfloss site.

Instrumentation

Site 4 – Celtic Deep (51.1372,-6.5673) - CEFAS smartbuoy (Deployed on 22/03/2014 at 15:43, 51.13732, -6.56748, Nominal depth 99m)	
NOC,L component	**Details**
*300 kHz RDI ADCP, SN13759 mounted on inline frame – upward facing	One internal and two external batteries, all unused at deployment start. Clock reset and logging set to start at 21:00 on 22/03/14, 2.5GB of memory installed.
SBE 39 T+P SN6761	Mounted at -10m with 300s sample interval. Clock reset and logging started at 21:55 on 22/03/14
SBE 56 T SN3593	Mounted at -20m with 300s sample interval. Clock reset and logging started at 23:00 on 22/03/14
SBE 56 T SN3590	Mounted at -30m with 300s sample interval. Clock reset and logging started at 23:00 on 22/03/14
SBE 56 T SN3592	Mounted at -40m with 300s sample interval. Clock reset and logging started at 23:10 on 22/03/14
SBE 56 T SN3596	Mounted at -60m with 300s sample interval. Clock reset and logging started at 23:10 on 22/03/14
SBE 39 T+P SN6762	Mounted at -80m with 300s sample interval. Clock reset and logging started at 21:55 on 22/03/14

* Script file/parameters available upon request.

Guard Buoy at Cadifloss site

Operations Summary

The Guard buoy was the first deployed item at the Candyfloss site. The fourth buoy was deployed on 26nd March 2014 11.12 hrs GMT at position Lat 49.3973 Long -008.6001. A 300 m run in was decided upon. The Buoy was again deployed via a single point lift (3 ton master link) using the port side crane and 3 ton Seacatch on load release. The initial ship speed was 0.2 knots. The crane had the runner removed and the 5 ton SWL hard eye was used. Two stray lines were run from the aft end of the port and stab crane pedestals. The 40 mm diameter Geosquare rope was run directly through the double barrel winch along the deck and over the stern. No block/ diverter sheave was used in the Celtic Explorer ODAS deployment method style. All rope was streamed with the buoy aft. Acoustic release S/N 1747 was used which, was depth function tested to 500m on a preceding cruise DY006.

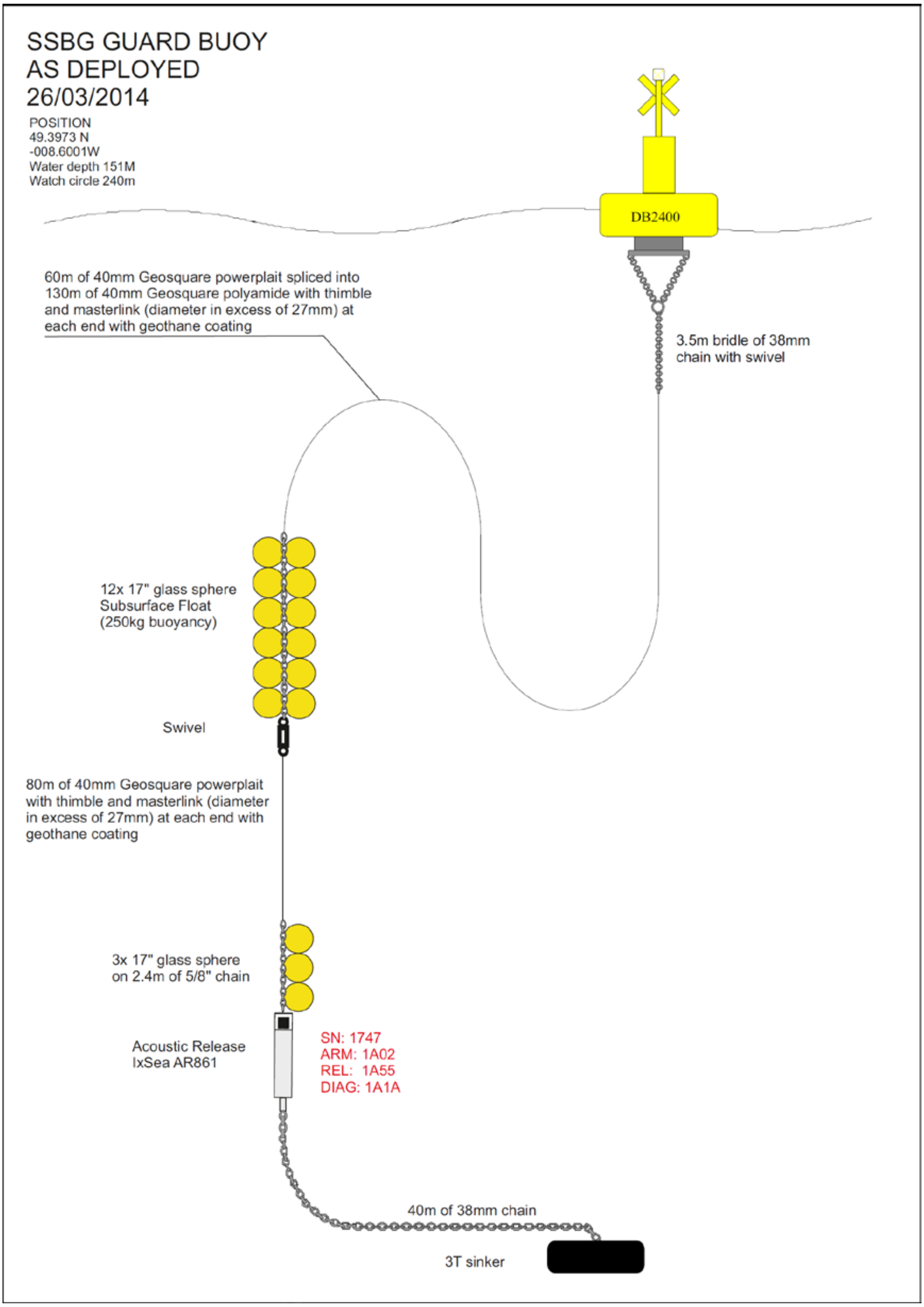


Figure 6.4. Guard bouy for Candyfloss site.

Instrumentation

Light pattern of 5 flashes in a 20 second interval was pre-programmed and the Planet Ocean watch circle monitor were enabled prior to leaving NOC, IXSEA Release S/N 1747.

Observations, problems and recommendations

Anchor release was just on deployment spot, as lay back is assumed to be arbitrary at this water depth and rope length. No problems were encountered. Double rope stoppers were used and needed to arrest the chain rove on deployment. This was made much easier by the addition of the acoustic release. Light was smashed on deployment by contact with port side crane head.

Thermister Chain Mooring Candyfloss site

Operations Summary

The thermister chain was initially planned to be deployed anchored first due to the set of the first Guard buoy. The DB winch developed a fault immediately prior to deployment. The ETO declared the Winch dead and the decision to re-wind the mooring onto the 10 ton GP deck winch and deploy conventionally was made. The mooring was deployed on 26th March 16:51 GMT. The position was 49.001N, -08.6026W All Instruments deployed as per drawing.

Acoustic Release AR861 S/N1503 was used.

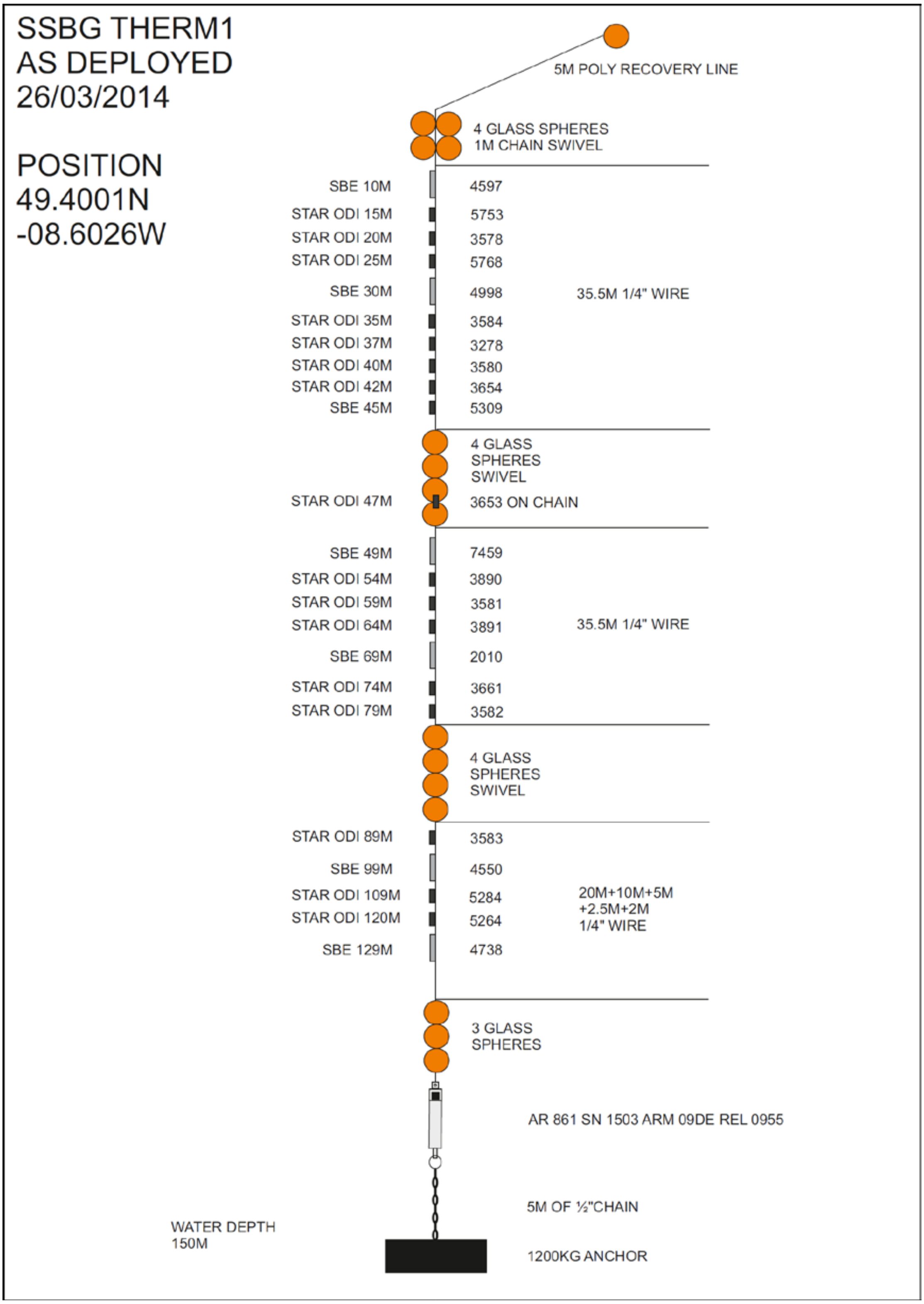


Figure 6.5. Thermistor chain for Candyfloss site.

Table 6.1. Instrumentation for thermistor chain in figure 6.5.

Mooring Site (cont) - (49.40, -8.60) Candyfloss - Long term T chain1 (Deployed on 26/03/2014 at 16:61, 49.40013, -8.60256, Nominal depth 150m)				
Depth	**Type**	**Param**	**SN**	**Details**
-10	SBE 16+	RS485+ DQ pressure CTD	4597	Clock reset and logging set for 14:00 on 26/03/14 – new batts
-15	Star Oddi DST	CT	5753	Clock reset and logging set for 22:00 on 19/03/14 – 69% batt
-20	Starmon mini	T	3578	Clock reset and logging set for 22:00 on 19/03/14 – 84% batt
-25	Star Oddi DST	CT	5768	Clock reset and logging set for 22:00 on 19/03/14 – 42% batt
-30	SBE 37	RS232 + press (unpump) CTD	4998	Clock reset and logging set for 14:00 on 26/03/14
-35	Starmon mini	T	3584	Clock reset and logging set for 22:00 on 19/03/14 – 84% batt
-37	Star Oddi DST	TP	3278	Clock reset and logging set for 22:00 on 19/03/14 – 38% batt
-40	Starmon mini	T	3580	Clock reset and logging set for 22:00 on 19/03/14 – 85% batt
-42	Star Oddi DST	TP	3654	Clock reset and logging set for 22:00 on 19/03/14 – 48% batt
-45	SBE 16+	RS232 + DQ pressure CTD	5309	Clock reset and logging set for 14:00 on 26/03/14 – new batts
-47	Star Oddi DST	TP	3653	Clock reset and logging set for 22:00 on 19/03/14 – 46% batt
-49	SBE 37	RS485+pressure (pumped) CTD	7459	Clock reset and logging set for 14:00 on 26/03/14
-54	Starmon mini	T	3890	Clock reset and logging set for 22:00 on 19/03/14 – 85% batt
-59	Starmon mini	T	3581	Clock reset and logging set for 22:00 on 19/03/14 – 84% batt
-64	Starmon mini	T	3891	Clock reset and logging set for 22:00 on 19/03/14 – 88% batt
-69	SBE 37	IM + No pressure CT	2010	Clock reset and logging set for 14:00 on 26/03/14
-74	Star Oddi DST	TP	3661	Clock reset and logging set for 22:00 on 19/03/14 – 42% batt
-79	Starmon mini	T	3582	Clock reset and logging set for 22:00 on 19/03/14 – 84% batt
-89	Starmon mini	T	3583	Clock reset and logging set for 22:00 on 19/03/14 – 84% batt
-99	SBE 37	RS232 + press (pumped) CTD	4550	Clock reset and logging set for 14:00 on 26/03/14
-109	Star Oddi DST	TP	5284	Clock reset and logging set for 22:00 on 19/03/14 – 73% batt
-120	Star Oddi DST	TP	5264	Clock reset and logging set for 22:00 on 19/03/14 – 73% batt
-129	SBE 16+	RS485 + DQ pressure CTD	4738	Clock reset and logging set for 14:00 on 26/03/14 – new batts

Observations, problems and recommendations:

The 32 inch steel sphere was replaced with 4x off 17” benthos spheres due to availability. All instruments deployed as per drawing.

ADCP Mooring at Candyfloss site

The ADCP mooring was the third deployed item at the Candyfloss site on 27th March 2014 10.35 hrs GMT at position 49.4018N -08.5998W. The 10 ton GP deck winch positioned to STAB was used for deployment. The mooring was deployed as per drawing with all shackle-link-shackles in place. An S&M supplied 8 ton SWL hanging block was suspended from the port side crane hard eye to run the mooring line through.

The serial numbers on the two ADCP syntactic floats were not distinguishable without removing the ADCPs from their housings. The pre-deployment configuration files were checked and found to be identical. Therefore the decision to identify the units from the fitted lights was made. The top ADCP syntactic float (15 m subsurface) has a Novatec Light S/N A12086. The bottom ADCP syntactic float (45 m Subsurface) has a Novatec light S/N A12087 fitted. This will confirm positive identification should they be mixed up on recovery.

Acoustic release IXSEA AR861 S/N 1501 was used.

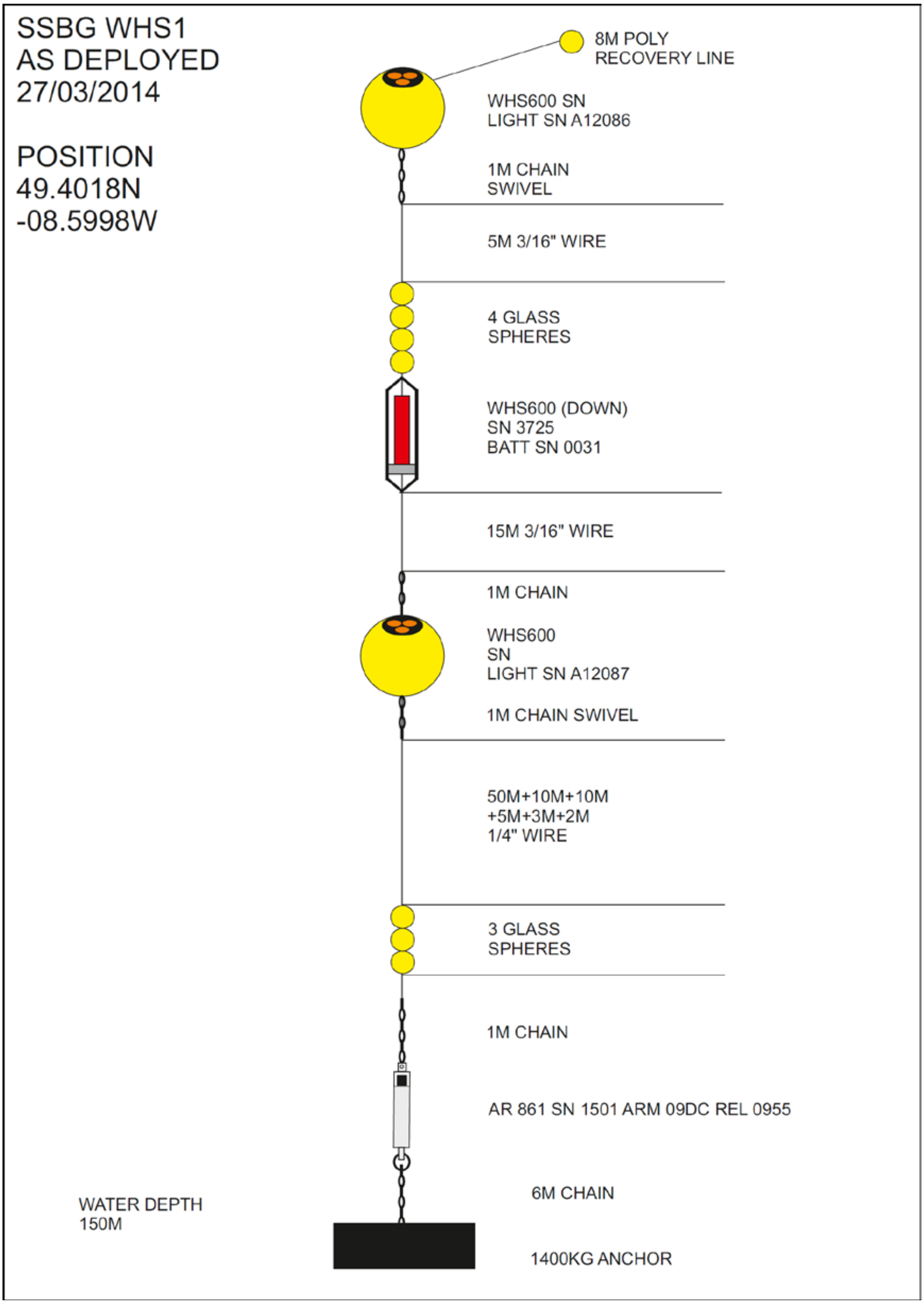


Figure 6.6. ADCP mooring for Candyfloss site.

Table 6.2. Instrumentation for ADCP mooring in figure 6.11.

Sensor	Notes	Serial#
WHS600	ADCP	4015
ExtBatPk	Battery	27843
Novalight	Light	A12086
WHS600	ADCP	7301
ExtBatPk	Battery	0031
WHS600	ADCP	3725
ExtBatPk	Battery	3095
Novalight	Light	A12087
AR861	Release	1501

Observations, problems and recommendations

No problems encountered.

SSB ODAS Buoy

Operations Summary

The ODAS buoy was deployed on 27th March 2014 16:03hrs GMT at position Lat: 49.4021N -08. 5951. 400m was decided upon for the run-in. The Buoy was deployed via a single point lift (7 ton SWL master link) using the port side amidships (main crane) and 7 ton SWL Seacatch on load release. The initial ship speed on deployment was stationary. Two stray lines were run fwd and aft of the Buoy. The 30m of chain were tied along the stab side gunwale at approximately 3 m intervals, around the stab quarter and out board of the pedestal. On deployment the ropes were cut sequentially to allow the chain to fall outboard, at which point the ship moved ahead at 0.2 knots. Once the buoy was aft of the vessel, the last fall of top chain was released.

The 40 mm diameter Geosquare rope was run directly through the non-operational double barrel winch along the deck and over the stern. Two turns of rope were used to arrest any runaway. No block/ diverter sheave was used in the Celtic Explorer ODAS deployment method style. All rope was streamed with the buoy aft. The 1.6 ton sub surface syntactic was placed mid-mooring and deployment continued. Constant control of the rope tension was maintained with the ships speed. The rope was simultaneously paid out by hand from the large Dia Reeler with two people aft of the DB winch to act as a brake if required. The rope stoppers were cut in sequence until all chain was deployed then the 3.5 ton cast sinker weight and acoustic release IXSEA AR861 S/N 1495 was deployed via port side crane and Seacatch.

Observations, problems and recommendations:

The deployment method of using the amidships crane worked well but was necessary due to the fact that the aft stab crane would not lift the (3.89 ton) rounded to 4 ton ODAS buoy during the mobilisation period. There is a sea state 4-6 limitation switch on the pedestal which may have prevented the aft crane from being able to lift the buoy at mobilization. Clarification of the buoy weight was sought and received from the Met Office at 3.89 tons dry weight. The lack of an operational DB winch also did not make the deployment straightforward. The revised method was risk assessed prior to deployment and the main consequence was the lack of ability to recover the mooring mid-deployment. The method did prove efficient, effective and safe.

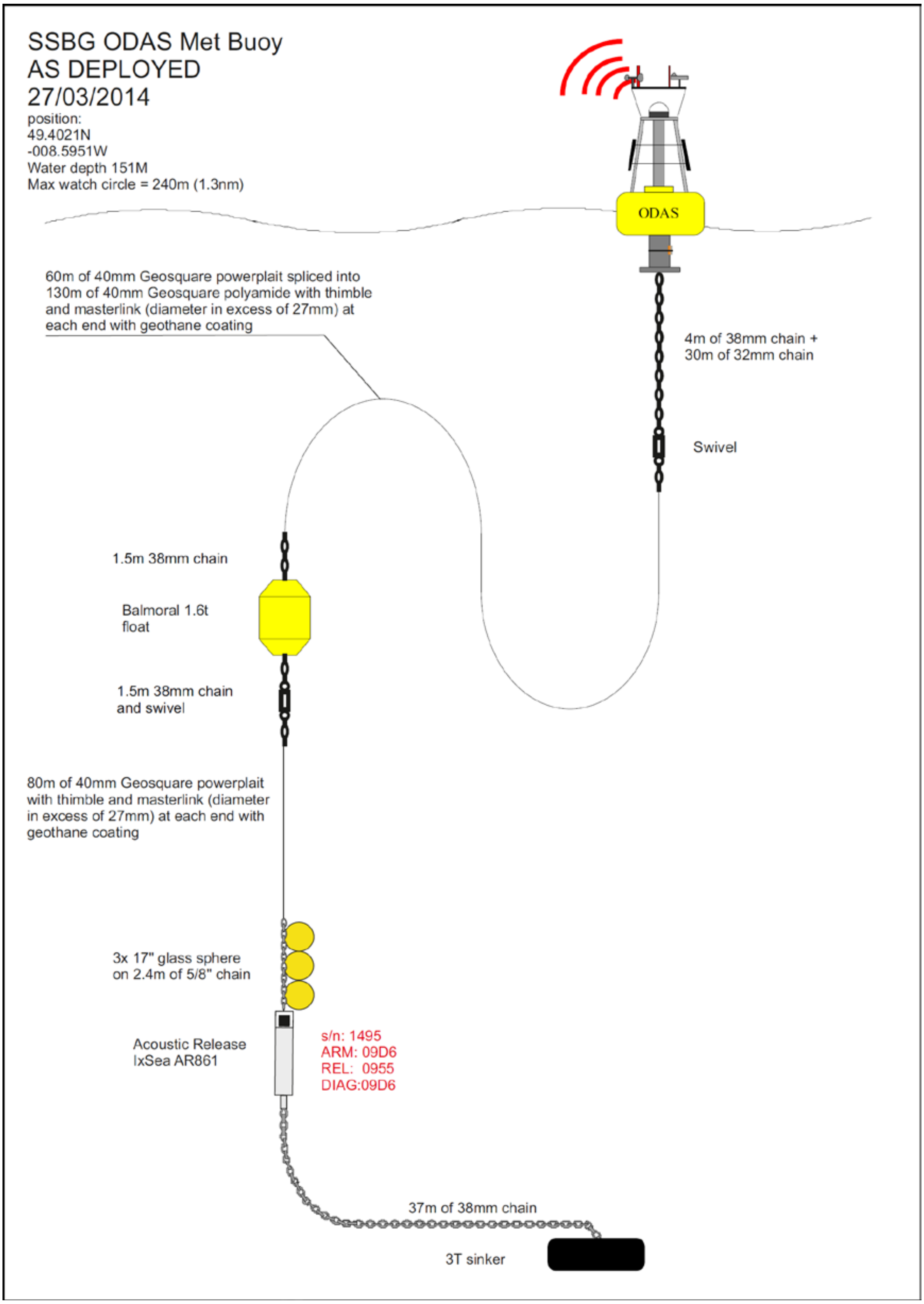


Figure 6.7. ODAS buoy for Candyfloss site.

CEFAS Smart buoy at Candyfloss

Deployed on the 27/03/2014 19:08 GMT 49.4019 -8.6037. Deployed buoy first anchor last. Mclane RAS 500 Water Sampler was deployed with boss hooks above 75 m chain section of mooring. Deployment went smoothly.

Mooring Site 1 - (49.40, -8.60) Candyfloss - CEFAS smartbuoy (Deployed on 27/03/2014 at 19:08, 49.40192, -8.60372, Nominal depth 149m)	
NOC,L component	**Details**
McLane RAS 500 Water Sampler, SNML12500-01 at ~-100m	Clock reset to 13:53 on 27/03/14. Set for 48 evenly time spaced samples of 440 ml from 21:00 on 27/03/14 to 04:00 on 09/06/14 (~37 hour interval). Bags pre-spiked with 2ml? mercuric chloride. Pre sample 10ml 10% HCL flush (500ml reservoir) + 100ml H_2O flush. Sample bottle 42 damaged before deployment and blanked off.
Starmon Mini SN3887 at -2.5m	85% of battery life left, clock reset and logging set for 300s interval starting at 22:00 on 22/03/14.
DST Cent SN3602 at -5m	49% of battery life left, clock reset and logging set for 300s interval starting at 22:00 on 22/03/14.

SSB ODAS Buoy

DY008 benthic site G (51.0720N, 6.5810W) – miniSTABLE Lander (Out 31/03/14 at 12:54, recovered at 9:09 on 07/04/14, 51.07725, -6.58765, nom. water depth 100m	
NOCL component	**Details**
Benthos XT6000 acoustic range finder (pinger)	SN70356, RX 10.5, TX 12.0, Release D. This was only used for range finding – the release function was not used.
Fiobuoy 'recovery' spooler	Clock reset to 09:05, on 31/03/14, timed backup release set to 12:00 on 02/04/14, access code 795315 – enough said!
McLane RAS 100 Water Sampler, SN ML12500-02 at ~-98m	Clock reset to 14:00, on 31/03/14. Set for 24 evenly time spaced samples of 80 ml from 14:00 on 31/03/14 to 15:00 on 01/04/14 (~1 hour interval). Bags pre-spiked with 0.4ml mercuric chloride. Pre sample 10ml 10% HCL flush (500ml reservoir) + 100ml H_2O flush. Each sample was 80ml. Also SPM filters installed inline with the sample collection lines.
*1200 kHz RDI ADCP, SN5803	One internal battery and 0.5GB of internal memory. Clock reset and logging set to start at 18:00 on 30/03/14.
Unisense Eddy Correlation System, AZA 13, Controller 17, Nortek Vector, Nortek order no P23865 with SN1370 Aanderaa Optode	Vector clock set to 22:39 on 30/03/14 and salinity parameter set to 35PSU (close to well mixed seabed readings from CTD). Eddy Correlation system clock reset to 10:30 on 31/03/14, logging started at 11:13 on 31/03/14. Calibration setup described in the metadata with the recovered measurements.
3D Ripple Profiler, This is probably a bespoke NOCL instrument.	Clock reset to 18:00 on 30/03/14 set to 120 degrees swath angle/ark, hourly sample interval, 4m maximum swath depth and ~10-15 minutes per bed scan. logging configured from 06:00 on 31/03/14 to 06:00 on 02/04/14.
LISST 100X, SN1416	Laser transmisometer that is switched on by moving the external control lever to the 1 position. Fixed sample rate mode with a sample interval of 10 seconds.
LISST HOLO, SN1416	Configured to acquire images at 60 second intervals, with logging being initiated by moving the front control lever to the 1 position.
FSI CTD SN2097 with Satlantic Suna nutrient sensor SN114.	Clock reset to 06:10 on 31/03/14 with logging started at 06:35:26 on 31/03/14. Sample measurements at 4Hz for 5 seconds and output average every 5 seconds. The Satlantic Suna optical nutrient sensor was connected to the third 0-5V analogue input channel of the bank of four analogue voltage inputs of the CTD.
Aquascat 1000 SN 910-084	Clock reset to 00:36 on 31/03/14 with logging set to start at 06:00 on 31/03/14. 1, 2, 3 and 4MHz transducers, 32Hz profiling rate.
Nortek Aquadop SN P24977-1	2MHz with 1800s burst interval, 150mm cell size, 1.799m pulse length, 4800 burst samples at 4Hz with 3 beams. Salinity parameter set to 35. Clock reset to 13:13 on 30/03/14. Logging set to start at 06:00 on 31/03/14.

* Script file/parameters available upon request

NOCL Bedframe at Candyfloss site

Operations Summary

Deployed on the 26th March 2014 19:25 GMT Position 49.39939, -8.59819. The NOC,L bed frame was deployed using the Romica winch from the STAB side aft deck using Acoustic release IXSEA 861 S/N 1502 and the bed frame was lowered into position and released using the Romica winch without incident.

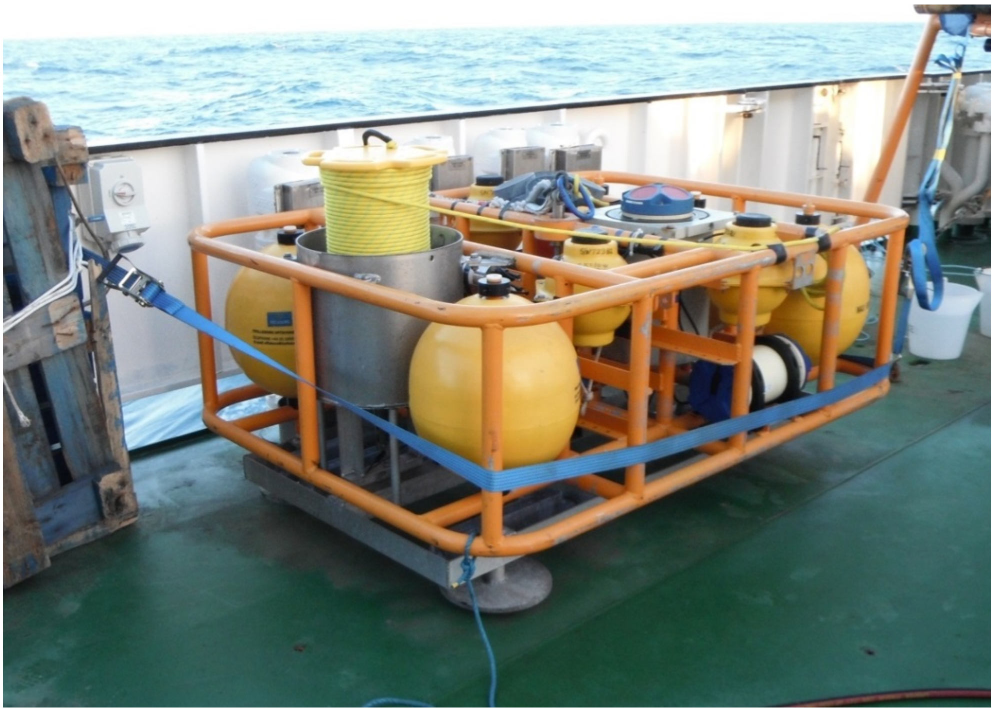


Figure 6.8. NOCL bedframe with gimballed turbulence enabled ADCP, long range 150KHz ADCP, Seabird CTD and an acoustic transponder based upper instrumentation frame recovery system.

Mooring Site - (49.40, -8.60) Candyfloss - NOCL Bedframe (Deployed on 26/03/2014 at 19:25, 49.39939, -8.59819, Nominal depth 148m)	
NOCL component	**Details**
RS485 + DQ pressure CTD, SN4596	Clock reset and logging set for 17:00 on 26/03/14 – new batteries – 77cm above seabed – horizontal mounting
*Flowquest 150 kHz ADCP, SN11043	Memory cleared on 14/03/14, clock reset and delayed start set for 22:00 on 19/03/14 – 95cm from seabed to top of sensor array
*600 kHz RDI (turbulence mode) gimbal ADCP, SN5807 2GB mem	Two batteries in external battery pack replaced – internal pack on gimbal ADCP not changed (to avoid possible electronic compass skew). 95cm above seabed - clock reset and logging set for 12:00 on 26/03/14
NOCL spooler acoustic release for frame and ballast recovery system	SN72382, RX 10.0, TX 12.0, Release A
NOCL ballast jettison acoustic release 1	SN72381, RX 11.0, TX 12.0, Release B
NOCL ballast jettison acoustic release 2	SN72858, RX 14.5, TX 12.0, Release A

* Script file/parameters available upon request.

NOCL miniSTABE lander

DY008 benthic site G (51.0720N, 6.5810W) – miniSTABLE Lander (Out 31/03/14 at 12:54, recovered at 9:09 on 07/04/14, 51.07725, -6.58765, nom. water depth 100m	
NOCL component	**Details**
Benthos XT6000 acoustic range finder (pinger)	SN70356, RX 10.5, TX 12.0, Release D. This was only used for range finding – the release function was not used.
Fiobuoy 'recovery' spooler	Clock reset to 09:05, on 31/03/14, timed backup release set to 12:00 on 02/04/14, access code 795315
McLane RAS 100 Water Sampler, SN ML12500-02 at ~-98m	Clock reset to 14:00, on 31/03/14. Set for 24 evenly time spaced samples of 80 ml from 14:00 on 31/03/14 to 15:00 on 01/04/14 (~1 hour interval). Bags pre-spiked with 0.4ml mercuric chloride. Pre sample 10ml 10% HCL flush (500ml reservoir) + 100ml H_2O flush. Each sample was 80ml. Also SPM filters installed inline with the sample collection lines.
*1200 kHz RDI ADCP, SN5803	One internal battery and 0.5GB of internal memory. Clock reset and logging set to start at 18:00 on 30/03/14.
Unisense Eddy Correlation System, AZA 13, Controller 17, Nortek Vector, Nortek order no P23865 with SN1370 Aanderaa Optode	Vector clock set to 22:39 on 30/03/14 and salinity parameter set to 35PSU (close to well mixed seabed readings from CTD). Eddy Correlation system clock reset to 10:30 on 31/03/14, logging started at 11:13 on 31/03/14. Calibration setup described in the metadata with the recovered measurements.
Acoustic 3D Ripple Profiler seabed imaging system	Clock reset to 18:00 on 30/03/14 set to 120 degrees swath angle/ark, hourly sample interval, 4m maximum swath depth and ~10-15 minutes per bed scan. logging configured from 06:00 on 31/03/14 to 06:00 on 02/04/14.
LISST 100X, SN1416	Laser transmisometer that is switched on by moving the external control lever to the 1 position. Fixed sample rate mode with a sample interval of 10 seconds.
LISST HOLO, SN1416	Configured to acquire images at 60 second intervals, with logging being initiated by moving the front control lever to the 1 position.
FSI CTD SN2097 with Satlantic Suna nutrient sensor SN114.	Clock reset to 06:10 on 31/03/14 with logging started at 06:35:26 on 31/03/14. Sample measurements at 4Hz for 5 seconds and output average every 5 seconds. The Satlantic Suna optical nutrient sensor was connected to the third 0-5V analogue input channel of the bank of four analogue voltage inputs of the CTD.
Aquascat 1000 SN 910-084	Clock reset to 00:36 on 31/03/14 with logging set to start at 06:00 on 31/03/14. 1, 2, 3 and 4MHz transducers, 32Hz profiling rate.
Nortek Aquadop SN P24977-1	2MHz with 1800s burst interval, 150mm cell size, 1.799m pulse length, 4800 burst samples at 4Hz with 3 beams. Salinity parameter set to 35. Clock reset to 13:13 on 30/03/14. Logging set to start at 06:00 on 31/03/14.

* Script file/parameters available upon request.

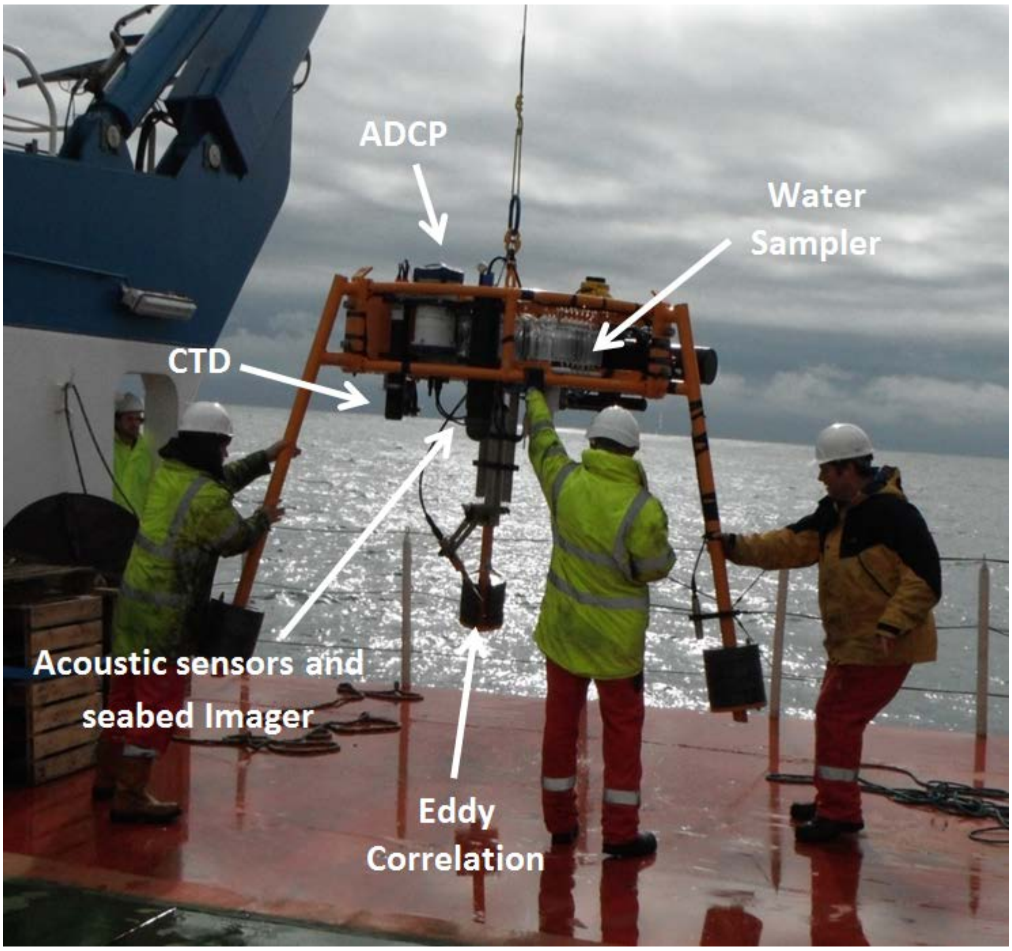


Figure 6.9. miniSTABLE benthic lander with oxygen eddy correlation measurement, McLane water sampler for nutrients + SPM, ADCP, CTD. Acoustic water velocity, acoustic suspended particle concentration and acoustic seabed imaging sensors were included with the measurement system.

Initial data check shows:

McLane RAS 100	- 22 water samples (1,3,5,7,9,11,15,17,19,21,23,27,29,31,33,35,37,39,41
	- 43,45 and 47) bags 13 and 25 damaged
	- 24 SPM filters recovered, most filters had damage to the outer edges
1200KHz RDI ADCP	– full data return
Eddy Correlation	- full data return for ~45 hour endurance of the internal batteries
3D Ripple Profiler	– full data return in proprietary format that requires post processing
LISST 100X	– full data return in proprietary format that requires post processing
LISST HOLO	- No images recorded battery supply problem identified
FSI (CTD) + Suna	– full data return for the endurance of the FSI battery of ~ 4 days
AQUASCAT 1000	- 8MB data store full in a proprietary format that requires post processing
NORTEK AQUADOP	– full data return

7. CTD casts

Peter J Statham, Fanny Chever and Anna Lichtschlag, Jeff Benson

Operations Summary

CTD system configurations

1) Two CTD systems were prepared. The first water sampling arrangement was a 24-way titanium frame system (s/n SBE CTD TITA1), and the initial sensor configuration was as follows:

Sea-Bird 9plus underwater unit, s/n 09P-71442-1142
Sea-Bird 3P temperature sensor, s/n 03P-5494, Frequency 0 (primary)
Sea-Bird 4C conductivity sensor, s/n 04C-2164, Frequency 1 (primary)
Digiquartz temperature compensated pressure sensor, s/n 124216, Frequency 2
Sea-Bird 3P temperature sensor, s/n 03P-5785, Frequency 3 (secondary)
Sea-Bird 4C conductivity sensor, s/n 04C-4140, Frequency 4 (secondary)
Sea-Bird 5T submersible pump, s/n 05T-3088, (primary)
Sea-Bird 5T submersible pump, s/n 05T-3090, (secondary)
Sea-Bird 32 Carousel 24 position pylon, s/n 32-60380-0805
Sea-Bird 11plus deck unit, s/n 11P-34173-0676 (main)
Sea-Bird 11plus deck unit, s/n 11P-24680-0589 (back-up logging)

2) The auxiliary input initial sensor configuration was as follows:

Sea-Bird 43 dissolved oxygen sensor, s/n 43-2055 (V0)
Chelsea 2-pi PAR irradiance sensor, DWIRR, s/n PAR 04 (V2)
WETLabs light scattering sensor, s/n BBRTD-1055 (V4)
Benthos PSAA-916T altimeter, s/n 59493 (V5)
Chelsea Aquatracka MKIII fluorometer, s/n 88-2615-124 (V6)
Chelsea Alphatracka MKII transmissometer, s/n 07-6075-001 (V7)
Benthos PSAA-916T altimeter, s/n 59493 (V4)

3) Sea-Bird 9plus configuration file DY000_tita_NMEA.xmlcon was used for the initial titanium frame CTD casts.

4) The second water sampling arrangement was the Zubkov 24-way stainless steel frame system (s/n 75313), and the initial sensor configuration was as follows:

Sea-Bird 9plus underwater unit, s/n 09P-46253-0869
Sea-Bird 3P temperature sensor, s/n 03P-4116, Frequency 0 (primary)
Sea-Bird 4C conductivity sensor, s/n 04C-2450, Frequency 1 (primary)

Digiquartz temperature compensated pressure sensor, s/n 100898, Frequency 2
Sea-Bird 3P temperature sensor, s/n 03P-4872, Frequency 3 (secondary)
Sea-Bird 4C conductivity sensor, s/n 04C-2580, Frequency 4 (secondary)
Sea-Bird 5T submersible pump, s/n 05T-3085, (primary)
Sea-Bird 5T submersible pump, s/n 05T-3086, (secondary)
Sea-Bird 32 Carousel 24 position pylon, s/n 32-19817-0243
Sea-Bird 11plus deck unit, s/n 11P-34173-0676 (main)
Sea-Bird 11plus deck unit, s/n 11P-24680-0589 (back-up logging)

5) The auxiliary input initial sensor configuration was as follows:
Sea-Bird 43 dissolved oxygen sensor, s/n 43-0619 (V0)
Chelsea 2-pi PAR irradiance sensor, DWIRR, s/n PAR 05 (V2)
Chelsea 2-pi PAR irradiance sensor, UWIRR, s/n PAR 06 (V3)
Benthos PSAA-916T altimeter, s/n 59494 (V4)
WETLabs light scattering sensor, s/n BBRTD-182 (V5)
Chelsea Alphatracka MKII transmissometer, s/n 161047 (V6)
Chelsea Aquatracka MKIII fluorometer, s/n 88-2020-095 (V7)

6) Sea-Bird 9plus configuration file DY008_stainless_NMEA.xmlcon was used for all stainless steel frame CTD casts.

It proved necessary to use the UCCTD titanium system to collect all water column samples as the conventional CTD cable/winch, once functioning, was used for coring operations. This meant using the10L clean OTE sampling bottles for collection of WP1 as well as trace metal samples, and drawing these waters in the clean laboratory. To ensure the integrity of the clean sampling systems standard trace metal clean handling procedures were used during both moving bottles to and from the clean lab and within the clean lab (clean suits, gloves etc.). Additionally this was an opportunity to test the new ultra-clean CTD system (UCCTD) and to take dissolved samples at the core process sites for analysis (to check for any potential contamination/ provide preliminary data for SSB).

The UCCTD allowed collection of bulk bottom water for incubation studies being done on the ship as well as sampling of WP1 and metal parameters. In total 14 profiles were done, with 30 samples collected for WP1 parameters as well as dissolved and particulate metals at several stations (see Table 7.1). WP1 parameters included oxygen, particulate and dissolved nutrients, PIC, BSi, chlorophyll, HPLC pigments, SPM, and inorganic carbon species. A series of salinity samples were taken to check the calibration of the CTD. After STNNBR 202 further water column sampling was not possible because the winch control system failed and remained inoperable for the rest of the cruise.

Table 7.1. Water column sampling done with the UCCTD.

Station number	Purpose	Date	Day number	Water depth (m)	Number of depths sampled
003	To clean bottles and CTD test	21/3/14	080	104-105	none
004	WP1	21/3/14	080	104	4
020	WP1	22/3/14	081	104	4
023	Cal of CEFAS system	22/3/14	081	111	2
037	Cal of CEFAS system	23/3/14	082	101	1
040	Cal of CEFAS system		082	99	1
041	Bottom incubation water		082	109	1 (all 24bottles)
054	WP1; Benthic D	25/3/14	084	110	4
055	WP1; Benthic A		084	111	4
073	WP1; CANDYFLOSS	27/3/14	086	148	5
078	WP1; Shelf break	28/3/14	087	205	5 depths, (16 bottles fired)
083	Bottom incubation water; Benthic A	31/3/14	090	111	1 (all 24bottles)
150	Bottom incubation water; Benthic G	2/4/14	092	104	1 (all 24bottles)
202	WP1 Benthic G	4/4/14	094	104	4
No further water column sampling by CTD was possible because of terminal problems with winch control systems					

The UCCTD system worked extremely well, with only one misfire and one broken lanyard. In the clean lab the lowering of the racks done in Southampton made putting up water bottles much easier. Further improvements will ideally include:

1) Lowering the trays beneath the bottles by 150mm to allow the positioning of plastic sample bottles and filter units within the tray. It will be necessary to check if there is enough elevation relative to the discharge point in the wall for good drainage.
2) With the dark walls, and lights aligned on the left (as you enter) when you are working on the bottles to the right you are often in your own shadow, and lighting in this area is generally poor. A possible way forward is for plastic encased fluorescent units to be attached to the overhead bulkhead and for them to be powered from conventional mains outlets.
3) The new clamps being ordered (to enable pressure filtration) should be an improvement on previous versions, but given the restricted space between bottles only every other bottle can be clamped simultaneously.
4) Other more minor issues are re-plumbing of the pressurization lines for bottles, plastic hooks for clean suits within the clean lab and ensuring MQ system set up prior to installation of UoP LFH in the lab.

Technical detail report

Titanium CTD

The first cast (DY008_001) configuration file had the PAR sensor in an incorrect voltage channel (V3 instead of V2).

The BBRTD gave suspect readings on the upcast & downcast for the first three deployments; beginning with cast DY008_004 s/n BBRTD-182 was installed in place of s/n BBRTD-1055. The altimeter cable was also changed at the start of the fourth cast, as the previous casts gave erratic, inconsistent readings. (The cause of the problems was traced to auxiliary voltage output channels interchanged. The .xmlcon file was corrected with the proper instruments in the proper channels, thus any post-processing of data for the first three deployments should be run with the default configuration file and not with the cast-generated .xmlcon file.)

Total number of casts – 14 titanium frame, 0 S/S frame.
Casts deeper than 2000m - 0 titanium frame, 0 S/S frame.
Deepest casts - 197m titanium frame, 0m S/S frame.

Titanium CTD frame configuration data

Instrument configuration file: DY008_tita_NMEA.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 : Yes
NMEA device connected to : PC
Surface PAR voltage added : No
Scan time added : Yes

1) Frequency 0, Temperature

Serial number : 03P-5494
Calibrated on : 18 October 2013
G : 4.32425698e-003
H : 6.26067324e-004
I : 1.94951264e-005
J : 1.49313273e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 04C-2164
Calibrated on : 7 August 2013
G : -1.02247601e+001
H : 1.41019320e+000
I : -2.82520683e-003
J : 2.65882173e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

Serial number : 124216
Calibrated on : 12 March 2013
C1 : -6.193577e+004
C2 : -2.149353e-001
C3 : 1.865100e-002
D1 : 2.627600e-002
D2 : 0.000000e+000
T1 : 3.027240e+001
T2 : -3.411764e-004
T3 : 4.682700e-006
T4 : 0.000000e+000
T5 : 0.000000e+000
Slope : 1.00000000
Offset : 0.00000
AD590M : 1.279600e-002
AD590B : -9.557252e+000

4) Frequency 3, Temperature, 2

Serial number : 03P-5785
Calibrated on : 28 February 2013
G : 4.33672003e-003
H : 6.27969653e-004
I : 1.96148201e-005
J : 1.46425931e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 04C-4140
Calibrated on : 21 February 2013
G : -9.84026925e+000
H : 1.48560606e+000
I : -2.53640262e-003
J : 2.77298457e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

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

Serial number : 43-2055
Calibrated on : 23 July 2013
Equation : Sea-Bird
Soc : 3.77200e-001
Offset : -7.06300e-001
A : -2.26410e-003
B : 4.08750e-005
C : -6.63740e-007
E : 3.60000e-002
Tau20 : 1.80000e+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, Free

9) A/D voltage 3, PAR/Irradiance, Biospherical/Licor

Serial number : PAR 04
Calibrated on : 21 November 2013
M : 0.43427300
B : 1.61542400
Calibration constant : 100000000000.00000000
Multiplier : 0.99950000
Offset : 0.00000000

10) A/D voltage 4, Turbidity Meter, WET Labs, ECO-BB

Serial number : BBRTD-1055

Calibrated on : 13 March 2013
ScaleFactor : 0.002365
Dark output : 0.061000

11) A/D voltage 5, Altimeter

Serial number : 59493
Calibrated on : 29 November 2012
Scale factor : 15.000
Offset : 0.000

12) A/D voltage 6, Fluorometer, Chelsea Aqua 3

Serial number : 88-2615-124
Calibrated on : 19 October 2012
VB : 0.277300
V1 : 1.956300
Vacetone : 0.356100
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

13) A/D voltage 7, Transmissometer, Chelsea/Seatech

Serial number : 07-6075-001
Calibrated on : 8 May 2012
M : 23.8843
B : -0.2580
Path length : 0.250

Scan length : 45

Date: 03/22/2014

Instrument configuration file: C:\Program Files\Sea-Bird\SeasaveV7\DY008\DY008_tita_BBRTD_NMEA.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 : Yes
NMEA device connected to : PC
Surface PAR voltage added : No
Scan time added : Yes

1) Frequency 0, Temperature

Serial number : 03P-5494
Calibrated on : 18 October 2013
G : 4.32425698e-003
H : 6.26067324e-004
I : 1.94951264e-005
J : 1.49313273e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 04C-2164
Calibrated on : 7 August 2013
G : -1.02247601e+001
H : 1.41019320e+000
I : -2.82520683e-003
J : 2.65882173e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

Serial number : 124216
Calibrated on : 12 March 2013
C1 : -6.193577e+004
C2 : -2.149353e-001
C3 : 1.865100e-002
D1 : 2.627600e-002
D2 : 0.000000e+000
T1 : 3.027240e+001
T2 : -3.411764e-004
T3 : 4.682700e-006
T4 : 0.000000e+000
T5 : 0.000000e+000
Slope : 1.00000000
Offset : 0.00000
AD590M : 1.279600e-002
AD590B : -9.557252e+000

4) Frequency 3, Temperature, 2

Serial number : 03P-5785
Calibrated on : 28 February 2013
G : 4.33672003e-003
H : 6.27969653e-004
I : 1.96148201e-005
J : 1.46425931e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 04C-4140
Calibrated on : 21 February 2013
G : -9.84026925e+000
H : 1.48560606e+000
I : -2.53640262e-003
J : 2.77298457e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

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

Serial number : 43-2055
Calibrated on : 23 July 2013
Equation : Sea-Bird
Soc : 3.77200e-001
Offset : -7.06300e-001
A : -2.26410e-003

B : 4.08750e-005
C : -6.63740e-007
E : 3.60000e-002
Tau20 : 1.80000e+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, PAR/Irradiance, Biospherical/Licor

Serial number : PAR 04
Calibrated on : 21 November 2013
M : 0.43427300
B : 1.61542400
Calibration constant : 100000000000.00000000
Multiplier : 0.99950000
Offset : 0.00000000

9) A/D voltage 3, Free

10) A/D voltage 4, Turbidity Meter, WET Labs, ECO-BB

Serial number : BBRTD-182
Calibrated on : 5 September 2013
ScaleFactor : 0.002931
Dark output : 0.068000

11) A/D voltage 5, Altimeter

Serial number : 59493
Calibrated on : 29 November 2012
Scale factor : 15.000
Offset : 0.000

12) A/D voltage 6, Fluorometer, Chelsea Aqua 3

Serial number : 88-2615-124
Calibrated on : 19 October 2012
VB : 0.277300
V1 : 1.956300
Vacetone : 0.356100
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

13) A/D voltage 7, Transmissometer, Chelsea/Seatech

Serial number : 07-6075-001
Calibrated on : 8 May 2012
M : 23.8843
B : -0.2580
Path length : 0.250

Scan length : 45

Stainless CTD frame:

Date: 03/20/2014

Instrument configuration file: C:\Program Files\Sea-Bird\SeasaveV7\DY008\DY008_stainless_NMEA.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 : Yes
NMEA device connected to : PC
Surface PAR voltage added : No
Scan time added : Yes

1) Frequency 0, Temperature

Serial number : 03P-4116
Calibrated on : 7 August 2013
G : 4.42583109e-003
H : 6.84138469e-004
I : 2.42750475e-005
J : 1.97553870e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 04C-2450
Calibrated on : 2 July 2013
G : -1.04363828e+001
H : 1.66284028e+000
I : -1.77694390e-003
J : 2.69569913e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

Serial number : 100898
Calibrated on : 6 January 2012
C1 : -4.405863e+004
C2 : -6.206030e-002
C3 : 1.337540e-002
D1 : 3.669100e-002
D2 : 0.000000e+000
T1 : 2.990734e+001
T2 : -3.493620e-004
T3 : 4.061200e-006
T4 : 3.043880e-009
T5 : 0.000000e+000
Slope : 0.99995000
Offset : -1.59900
AD590M : 1.288520e-002
AD590B : -8.271930e+000

4) Frequency 3, Temperature, 2

Serial number : 03P-4872

Calibrated on : 7 August 2013
G : 4.34360165e-003
H : 6.37626941e-004
I : 2.03875671e-005
J : 1.60425917e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 04C-2580
Calibrated on : 7 August 2013
G : -1.04741424e+001
H : 1.53984673e+000
I : 3.62532081e-004
J : 5.74983647e-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 : 43-0619
Calibrated on : 7 August 2013
Equation : Sea-Bird
Soc : 5.35400e-001
Offset : -5.00600e-001
A : -3.24860e-003
B : 1.53720e-004
C : -2.63000e-006
E : 3.60000e-002
Tau20 : 1.31000e+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, PAR/Irradiance, Biospherical/Licor

Serial number : PAR 05
Calibrated on : 29 July 2013
M : 0.47978800
B : 1.02237800
Calibration constant : 100000000000.00000000
Multiplier : 0.99930000
Offset : 0.00000000

9) A/D voltage 3, PAR/Irradiance, Biospherical/Licor, 2

Serial number : PAR 06
Calibrated on : 21 November 2013
M : 0.44047800
B : 1.71821500
Calibration constant : 100000000000.00000000
Multiplier : 0.99970000
Offset : 0.00000000

10) A/D voltage 4, Altimeter

Serial number : 59494
Calibrated on : 29 November 2012
Scale factor : 15.000
Offset : 0.000

11) A/D voltage 5, Turbidity Meter, WET Labs, ECO-BB

Serial number : BBRTD-1055
Calibrated on : 13 March 2013
ScaleFactor : 0.002365
Dark output : 0.061000

12) A/D voltage 6, Transmissometer, Chelsea/Seatech

Serial number : 161047
Calibrated on : 18 March 2008
M : 23.9758
B : -0.2637
Path length : 0.250

13) A/D voltage 7, Fluorometer, Chelsea Aqua 3

Serial number : 88-2050-095
Calibrated on : 25 July 2012
VB : 0.369800
V1 : 1.921300
Vacetone : 0.389100
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

Scan length : 45

CTD sensor and rig geometry information sheet

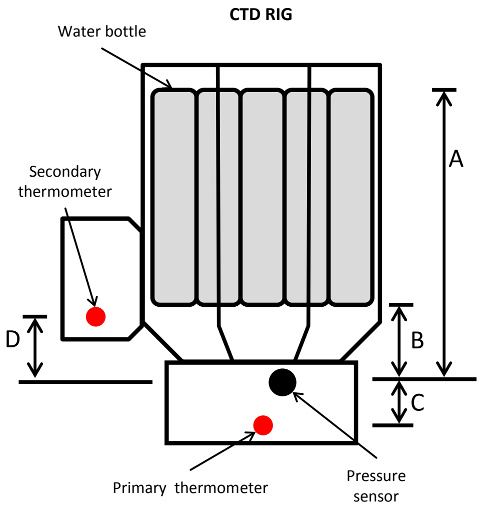
Cruise	DY008
Technician	J. Benson
Date	13 April 2014
CTD type	24-way s/s frame, 24-way titanium frame, SBE 9/11+

Forwarding instructions/additional information:

Titanium frame in bold.

See cruise report for other details.

Rig geometry:



ID	Vertical distance from pressure sensor (m)
A	1.50
B	0.30
C**	0.07
D	0.00

**NOTE: C & D may be minimal.

Table 7.2. Fitted Sensors:

Manufacturer	Sensor/Instrument	Serial No.	Comments (Casts installed)	Calibration applied?**	Last calibration date
SBE 11plus V2	CTD deck unit	11P-34173-0676	All casts	Y	10 March 2004
SBE 9plus	CTD Underwater Unit	09P-46253-0869	All stainless casts	Y	6 January 2012
NOCS/Zubkov	Stainless steel 24-way frame	75313	All stainless casts	N/A	N/A
Paroscientific	Digiquartz Pressure sensor	100898	All stainless casts	Y	6 January 2012
SBE 3P	Primary Temperature Sensor	3P-4116	All stainless casts	Y	7 August 2013
SBE 4C	Primary Conductivity Sensor	4C-2450	All stainless casts	Y	2 July 2013
SBE 5T	Primary Pump	5T-3085	All stainless casts	N/A	6 August 2013
SBE 3P	Secondary Temperature Sensor	3P-4872	All stainless casts	Y	7 August 2013
SBE 4C	Secondary Conductivity Sensor	4C-2580	All stainless casts	Y	7 August 2013
SBE 5T	Secondary Pump	5T-3086	All stainless casts	N/A	5 November 2013
SBE 32	24-way Carousel	32-19817-0243	All stainless casts	N/A	2 December 2011
SBE 43	Dissolved Oxygen Sensor	43-0619	All stainless casts	Y	7 August 2013
CTG 2-pi PAR	Irradiance Sensor (DWIRR)	PAR 05	All stainless casts	Y	29 July 2013
CTG 2-pi PAR	Irradiance Sensor (UWIRR)	PAR 06	All stainless casts	Y	21 November 2013
Benthos PSA-916T	Altimeter	59494	All stainless casts	Y	29 November 2012
WETLabs BBRTD	Light Scattering Sensor	BBRTD-1055	All stainless casts	Y	13 March 2013
CTG Alphatracka MKII	Transmissometer	161047	All stainless casts	Y	18 March 2008
CTG Aquatracka MKIII	Fluorometer	88-2050-095	All stainless casts	Y	25 July2012
OTE	10L Water Samplers	1C through 24C	All stainless casts	N/A	N/A
SBE 9plus	CTD Underwater Unit	09P-71442-1142 (Ti)	All titanium casts	Y	19 March 2013
NOCS	Titanium 24-way frame	SBE CTD TITA1	All titanium casts	N/A	N/A
Paroscientific	Digiquartz Pressure sensor	124216	All titanium casts	Y	12 March 2013
SBE 3P	Primary Temperature Sensor	3P-5494 (Ti)	All titanium casts	Y	19 October 2013
SBE 4C	Primary Conductivity Sensor	4C-2164 (Ti)	All titanium casts	Y	7 August 2013
SBE 5T	Primary Pump	5T-3088	All titanium casts	N/A	5 November 2013
SBE 3P	Secondary Temperature Sensor	3P-5785 (Ti)	All titanium casts	Y	28 February 2013
SBE 4C	Secondary Conductivity Sensor	4C-4140 (Ti)	All titanium casts	Y	21 February 2013
SBE 5T	Secondary Pump	5T-3090	All titanium casts	N/A	5 November 2013
SBE 32	24-way Carousel	32-60380-0805 (Ti)	All titanium casts	N/A	17 October 2013
SBE 43	Dissolved Oxygen Sensor	43-2055	All titanium casts	Y	23 July 2013
CTG 2-pi PAR	Irradiance Sensor (DWIRR)	PAR 04 (Ti)	All titanium casts	Y	21 November 2013
Benthos PSA-916T	Altimeter	59493	All titanium casts	Y	29 November 2012
WETLabs BBRTD	Light Scattering Sensor	BBRTD-1055	Titanium casts 001 - 003	Y	13 March 2013
WETLabs BBRTD	Light Scattering Sensor	BBRTD-182	Titanium casts 004 - 014	Y	5 September 2013
CTG Alphatracka MKII	Transmissometer	07-6075-001	All titanium casts	Y	8 May 2012
CTG Aquatracka MKIII	Fluorometer	88-2615-124	All titanium casts	Y	19 October 2012
OTE	10L TMF Water Samplers	1T through 24T	All titanium casts	N/A	N/A

** Were the manufacturer's calibrations applied during NMF-run Sea-Bird processing?

Table 7.3. Spare Sensors:

Manufacturer	Sensor/Instrument	Serial No.	Comments (Casts installed)	Calibration applied?**	Last calibration date
SBE 11plus	CTD deck unit	11P-24680-0589	N/A	Y	10 March 2004
SBE 9plus	CTD Underwater Unit	09P-54047-0943	N/A	Y	29 October 2013
Paroscientific	Digiquartz Pressure sensor	110557	N/A	Y	29 October 2013
SBE 3P	Temperature Sensor	3P-4782	N/A	Y	2 July 2013
SBE 3P	Temperature Sensor	3P-5495 (Ti)	N/A	Y	18 October 2013
SBE 4C	Conductivity Sensor	4C-2231	N/A	Y	2 July 2013
SBE 4C	Conductivity Sensor	4C-3874 (Ti)	N/A	Y	24 October 2013
SBE 5T	Pump	5T-4513	N/A	N/A	5 November 2013
SBE 5T	Pump	5T-6916	N/A	N/A	21 December 2012
SBE 32	24-way Carousel	32-71442-0940 (Ti)	N/A	N/A	19 March 2013
SBE 43	Dissolved Oxygen Sensor	43-1624	N/A	Y	17 May 2013
Biospherical QCP Cosine PAR	Irradiance Sensor	70510	N/A	Y	1 March 2013
WETLabs ECO	Fluorometer	FLRTD-2986	N/A	Y	17 January 2013
WETLabs C-Star	Transmissometer	CST-1602DR	N/A	Y	20 March 2013
Guildline Autosal 8400B	Salinometer	71126	N/A	N/A	Service 15 January 2014 & Alignment 25 January 2013
Guildline Autosal 8400B	Salinometer	71185	N/A	N/A	Service 14 February 2014 & Alignment 26 February 2013
Challenger MKII	Stand Alone Pump System	02-002	N/A	N/A	N/A
Challenger MKII	Stand Alone Pump System	02-004	N/A	N/A	N/A
Challenger MKIII	Stand Alone Pump System	03-03	N/A	N/A	N/A

** Are the manufacturer's calibrations applied during NMF-run Sea-Bird processing?

Table 7.4. Sea-Bird processing: The table below lists the Sea-Bird processing routines run by NMF staff (if any). Note this is only the modules that were run by NMF, not by scientific staff.

Module	**Run?**	**Comments**
Configure	N	
Data Conversion	Y	As per BODC guidelines Version1.0 October 2010
Bottle Summary	Y	As per BODC guidelines Version1.0 October 2010
Mark Scan	N	
Align CTD	N	
Buoyancy	N	
Cell Thermal Mass	Y	As per BODC guidelines Version1.0 October 2010
Derive	Y	As per BODC guidelines Version1.0 October 2010
Bin Average	N	
Filter	Y	As per BODC guidelines Version1.0 October 2010
Loop Edit	N	
Wild Edit	N	
Window Filter	N	
ASCII In	N	
ASCII Out	N	
Section	N	
Split	N	
Strip	Y	As per BODC guidelines Version1.0 October 2010
Translate	N	
Sea Plot	N	
SeaCalc II	N	

8. Dissolved and particulate organic matter

Louise Darroch[1], Claire Mahaffey[2] and Clare Davis

[1]Author, [2]Dataset PI

Background and objectives

Dissolved and particulate organic matter discrete samples were collected by Louise Darroch (cruise participant) on behalf of Claire Mahaffey and Clare Davis at the University of Liverpool. Samples were collected from CTD casts as part of WP1 in order to characterise the water column of the study area (pre-bloom) and to calibrate the sensors on deployed gliders and the CEFAS Smart buoy.

Sampling strategy

Discrete samples for dissolved organic carbon, nitrate and phosphate (DOC, DOP, DON), particulate organic carbon and nitrate (POC, PON), and particulate organic phosphate (POP) were collected from 7 CTD casts carried out with the titanium CTD package. Samples were withdrawn from 4 to 5 depths, spanning the entire water column (Table 8.1). Samples were also collected from the non-toxic, pumped seawater supply (Table 8.2).

Methods

Samples were collected in 5 L high density polyethylene (HDPE) bottles. Samples were withdrawn from CTD niskin bottles and from the non-toxic, pumped seawater supply using silicone tubing, ensuring the same end was attached to the taps each time. For dissolved organic matter (DOC, DOP, DON), 175 ml samples were gently filtered through a 47 mm GF/F filter using a low vacuum (< 12 mbar). The filter had been combusted and acidified using 10 % (v/v) conc. HCl. The filtrate was then dispensed into a 175 ml HDPE bottle and immediately stored in the dark at -20 ˚C for analysis back at UoL. For particulate organic carbon and nitrate, 1.8 – 1.5 L samples were gently filtered through a combusted 25 mm GF/F filter using a low vacuum (< 12 mbar). The resulting filters were immediately placed into a sterile petri-dish and stored face up, in dark at -20 ˚C for analysis back at UoL. Particulate organic phosphate (POP) samples were prepared and stored similarly, except 1 – 0.5 L samples were filtered and filters were initially acidified using 10 % (v/v) conc. HCl.

Data quality notes

Bottom water samples generally took longer to filter (10-20 min more) due to high sediment loading at STNNBR 004, 054, 055 and 083.

Table 8.1. DOM and POM samples withdrawn from CTD casts (note: rosette positions with a slash denotes that water from 2 niskin bottles were combined to create one sample).

STNNBR	CASTNO	SITE	NMFID	ROSETTE POSITION
003	01	East of Celtic Deep	CTD001	
004	01	East of Celtic Deep	CTD002	8,14,17,21
020	01	Nymph Bank	CTD003	1,2,3,4
023	01	East of Haig Frais	CTD004	
037	01	Celtic Deep	CTD005	
040	01	Celtic Deep	CTD006	
041	01		CTD007	
054	01	Benthic D	CTD008	1/13,14,15,16
055	01	Benthic A	CTD009	5,14,16,18
073	01	Candyfloss	CTD010	7,15,17,19
078	01	Shelf break area	CTD011	7,17,18,19,20
083	01	Benthic A	CTD012	
150	01	Benthic G	CTD013	
202	01	Benthic G	CTD014	1/13,2/14,3/15,4/16

Table 8.2. DOM and POM samples withdrawn from the non-toxic, pumped water supply.

DATE (UTC)	TIME (UTC)	Sample ID (SAMPNO)			Uncorrected water column depth (m)	COMMENTS
		DOC/DON/DOP	POC/PON	POP		
06/04/2014	16:08	UW1	UW1	UW1	98	Nutrients taken (Woodward)
07/04/2014	15:54	UW2	UW2	UW2	99	Nutrients taken (Woodward)
08/04/2014	10:09	UW3	UW3	UW3	98	Nutrients taken (Woodward)
08/04/2014	13:15	-	-	-	109	Nutrients taken (Woodward)
08/04/2014	16:02	UW5	UW5	UW5	98	Nutrients taken (Woodward)
09/04/2014	10:20	UW6	UW6	UW6	106	Nutrients taken (Woodward)
09/04/2014	16:50	UW7	UW7	UW7	107	Nutrients taken (Woodward)
10/04/2014	10:10	UW8	UW8	UW8	105	Nutrients taken (Woodward)
10/04/2014	16:15	UW9	UW9	UW9	111	Nutrients taken (Woodward)

9. Chlorophyll, PIC and PSi, and Lugols samples.

Introduction

Samples were collected from the TiCTD at a 10 stations for the pelagic consortium and also to enable instrument sensors to be calibrated both on the CTD and on the smart buoys and mini-landers. These were Chlorophyll *a* and also PIC and PSi.

Data and analysis

Chlorophyll *a* samples were extracted and analysed on board using a Turner Trilogy Fluorometer. The raw data has been passed onto Alex Poulton for further calibration. Samples for PIC and PSi were filtered and stored frozen for subsequent analysis by the pelagic team.

Table 9.1. Sample dates, event numbers and types collected.

Date	Event	Chla	PIC	PSi	Lugols
21-03-14	4	x	x	x	x
22-03-14	20	x	x	x	
22-03-14	23	x			
23-03-14	37	x			
23-03-14	40	x			
25-03-13	54	x	x	x	x
25-03-14	55	x	x	x	x
27-03-14	73	x	x	x	x
28-03-14	78	x	x	x	x
04-0-14	202	x	x	x	x

10. Suspended Particulate Matter

Methodology

A known volume of water (~1000ml) was sub-sampled from the clean CTD bottles from 4 different depths. This was filtered through pre-weighed GFF filters to extract suspended particulate matter (SPM).

Table 10.1. Event metadata for suspended particulate matter samples.

Date	Event Number	Site Name	CTD bottle	Position (m)	Filter number	Filter weight	Volume filtered (ml)
21/03/2014	004	**East of Celtic Deep Lander Site**	7	90	A6	0.12829	700
			16	40	A2	0.12913	760
			12	70	A3	0.12744	750
			20	10	A4	0.12636	750
22/03/2014	020	**Nymph Bank Lander Site**	13	94	A8	0.13039	1000
			14	64	A9	0.12909	1000
			15	40	A10	0.12993	900
			16	11	A11	0.12917	1000
22/03/2014	023	**East of Haigh Fras Lander Site**	12	98	A13	0.12654	1000
			24	21	A14	0.12892	980
23/03/2014	037	**Celtic Deep Smart Buoy (Pre Recovery)**	23	Surface	A16	0.12769	1000
23/03/2014	040	**Celtic Deep Smart Buoy Post Deployment**	22	Surface	A17	0.12764	1000
23/03/2014	041	**Celtic Deep Benthic A Processes Site (bottom water sampling)**	5	98	A18	0.12795	990
25/03/2014	054	**Benthic D Process Site**	3	70	A19	0.12599	1000
			1	10	A20	0.12696	1000
			2	40	A21	0.129	1000
			4	100	A22	0.12919	980
25/03/2014	055	**Benthic A Process Site**	6	100	A12	0.12788	980
			13	85	A23	0.12668	930
			17	10	A24	0.12953	970
			15	50	A25	0.12943	980
27/03/2014	73	**Candyfloss Smart Buoy Deployment**	14	100	A26	0.12717	900
			16	50	A28	0.12831	990
			13	135	A29	0.12748	950
			18	10	A30	0.12772	890
28/03/2014	78	**Shelf Break Glider Deployment**	7		A32	0.12679	900
			15		A33	0.12941	970
			14		A36	0.12635	1000
			8		A38	0.12634	1000
04/04/2014	202	**Benthic G**	1	90	A39	0.13044	930
			4	10	A40	0.13013	970
			2	50	A42	0.12734	1000
			3	20	A43	0.12746	960

11. Dissolved inorganic carbon and total alkalinity

Louise Darroch[1], Sue Hartman[2] and Caroline Kimivae

[1]Author, [2]Dataset PI

Background and objectives

Dissolved inorganic carbon (DIC) and total alkalinity (TA) discrete samples were collected by Louise Darroch (cruise participant) on behalf of Sue Hartman and Caroline Kimivae at the National Oceanography Centre, Southampton (NOC). Samples were collected from CTD casts as part of WP1 in order to characterise the water column of the study area (pre-bloom) and to calibrate the sensors on deployed gliders and the CEFAS Smart buoy. Samples were also collected underway. CTD and underway samples were collected as part of the Shelf Wide monitoring programme.

Sampling strategy

Discrete samples were collected from 7 CTD casts carried out with the titanium CTD package. Samples were withdrawn from 4 to 5 depths, spanning the entire water column (Table 11.1). Sample triplicates were collected at one depth per cast. Samples were also collected from the non-toxic, pumped seawater supply (Table 11.2). The non-toxic, pumped seawater intake was located approximately 6 m below sea level.

Methods

Samples were collected in 250 ml glass stoppard bottles. Samples were withdrawn from CTD niskin bottles and the non-toxic, pumped seawater supply using silicone tubing. The tubing was inserted into the base of bottle and slowly filled (and over-filled) from the bottom to avoid and remove air bubbles. Samples were immediately poisoned by removing 2.5 ml volume and adding 50 µl saturated mercuric chloride solution. The samples were then stored in the dark at room temperature for analysis back at NOC.

Data quality notes

No issues were found during sample collection.

Table 11.1. Discrete DIC and TA samples withdrawn from the CTD.

STNNBR	CASTNO	SITE	NMFID	ROSETTE POSITION
003	01	East of Celtic Deep	CTD001	
004	01	East of Celtic Deep	CTD002	7 (x3),12,16,20
020	01	Nymph Bank	CTD003	13,14,15,16 (x3)
023	01	East of Haig Frais	CTD004	
037	01	Celtic Deep	CTD005	
040	01	Celtic Deep	CTD006	
041	01		CTD007	
054	01	Benthic D	CTD008	13 (x3),14,15,16
055	01	Benthic A	CTD009	6 (x3),13,15,17
073	01	Candyfloss	CTD010	7 (x3),14,16,18
078	01	Shelf break area	CTD011	7,8 (x3),13,14,20
083	01	Benthic A	CTD012	
150	01	Benthic G	CTD013	
202	01	Benthic G	CTD014	13 (x3),14,15,16

Table 11.2. Discrete DIC and TA samples withdrawn from the non-toxic, pumped seawater supply.

DATE (UTC)	TIME (UTC)	Sample ID (SAMPNO)	SBE45 readings		Uncorrected water column depth (m)	COMMENTS
		DIC/TA	SST (deg C)	Salinity (PSU)		
23/03/2014	12:40	400	14.11	35.217	101	SST probe faulty
24/03/2014	12:26	402	10.79	35.229	105	
25/04/2014	14:02	415	9.30	35.163	110	Nutrients taken (Woodward)
25/03/2014	22:07	419	9.30	35.243	106	Nutrients taken (Woodward)
26/03/2014	03:11	424	9.46	35.299	109	Nutrients taken (Woodward)
26/03/2014	07:15	429	9.56	35.321	142	Nutrients taken (Woodward)
26/03/2014	11:18	418	9.96	35.314	150	Nutrients taken (Woodward)
01/04/2014	12:55	433	9.55	35.235	104	
06/04/2014	16:08	432/UW1	10.35	35.216	98	Nutrients taken (Woodward)
07/04/2014	15:54	431/UW2	10.63	35.190	99	Nutrients taken (Woodward)
08/04/2014	10:09	436/UW3	10.60	35.201	98	Nutrients taken (Woodward)
08/04/2014	13:15	441/UW4	9.79	35.189	109	Nutrients taken (Woodward)
08/04/2014	16:02	446/UW5	10.45	35.197	98	Nutrients taken (Woodward)
09/04/2014	10:20	430/UW6	9.88	35.214	106	Nutrients taken (Woodward)
09/04/2014	16:50	435/UW7	10.20	35.222	107	Nutrients taken (Woodward)
10/04/2014	10:10	440/UW8	10.00	35.218	105	Nutrients taken (Woodward)
10/04/2014	16:15	334/339/329/UW9	10.41	35.234	111	Nutrients taken (Woodward)

12. Salinity sample analysis

Louise Darroch[1], Jo Hopkins[2] Maeve Guilfoyle, Peter Statham, Jeff Benson[3]
[1]Author, [2]Dataset PI, [3]Technical contact

Background and objectives

Discrete salinity samples were collected by Louise Darroch, Maeve Guilfoyle and Peter Staham (cruise participants) on behalf of Jo Hopkins at the National Oceanography Centre, Liverpool (NOC). Samples were analysed on board by Jeff Benson (NMF-SS). Samples were collected from CTD casts in order to calibrate CTD sensors on the titanium CTD package (UCCTD) for WP1 and WP3. Samples were also collected underway to calibrate the Sea-Bird MicroTSG SBE45 sensor.

Sampling strategy

Discrete samples were collected from 9 CTD casts carried out with the titanium CTD package (Table 12.1). Two to four samples were withdrawn from each CTD cast. Samples were also collected 3-5 times a day from the non-toxic, pumped seawater supply (Table 12.2). A total of 85 samples were collected. The seawater intake pipe was located approximately 6 m below sea level.

Methods

Discrete salinity samples were collected directly from CTD bottles and the non-toxic, pumped seawater supply using 200 ml glass medicine bottles with plastic lids and low density polyethylene (LDPE) plastic inserts to prevent evaporation and salt formation inside the lid. All bottles were rinsed 2-3 times with sample prior to water collection. Samples were then equilibrated to laboratory temperature (20-21 ˚C) for at least 24 hours prior to analysis. Each sample was analysed in triplicate on a Guildline 8400B Autosal salinometer (s/n 71126) by the NMF-SS technician on board. Samples were analysed as double conductivity ratio and converted to practical salinity using the UNESCO 1983 algorithm. The water bath temperature for analysis was set to 21˚C. The salinometer was standardised to an IAPSO 35 PSU seawater standard at the beginning of the cruise. Subsequently, a standard was run for every 24 bottles analysed and the correction in drift (from the beginning of the cruise) was applied to those samples. The software was configured with a standard deviation limit of 0.00001 in double conductivity ratio.

Data quality notes

Salinities from stations CTD003 (STNNBR 020) and CTD009 (STNNBR 055) were suspect for deeper depths.

Table 12.1. Discrete salinity samples withdrawn from CTD casts.

STNNBR	CASTNO	SITE	NMFID	ROSETTE POSITION
003	01	East of Celtic Deep	CTD001	
004	01	East of Celtic Deep	CTD002	7,13,16,20
020	01	Nymph Bank	CTD003	1,2,3,4
023	01	East of Haig Frais	CTD004	
037	01	Celtic Deep	CTD005	
040	01	Celtic Deep	CTD006	
041	01		CTD007	9 (x2)
054	01	Benthic D	CTD008	1,2,3,4
055	01	Benthic A	CTD009	1,2,3,4
073	01	Candyfloss	CTD010	7,18
078	01	Shelf break area	CTD011	2,3,5,6
083	01	Benthic A	CTD012	
150	01	Benthic G	CTD013	8,19
202	01	Benthic G	CTD014	1,2,3,4

Table 12.2. Discrete salinity samples withdrawn from the non-toxic, pumped, seawater supply.

DATE (UTC)	GEARCODE	TIME (UTC)	CRATE	BTL ID (SAMPNO)	COMMENTS
22/03/2014	GPUMP	11:04	22	548	
22/03/2014	GPUMP	15:00	22	549	
22/03/2014	GPUMP	19:00	22	550	
22/03/2014	GPUMP	23:10	22	551	
23/03/2014	GPUMP	07:15	22	552	
23/03/2014	GPUMP	11:05	22	553	
23/03/2014	GPUMP	15:10	22	554	
23/03/2014	GPUMP	19:10	22	555	
23/03/2014	GPUMP	23:10	22	556	
24/03/2014	GPUMP	07:20	22	557	
24/03/2014	GPUMP	11:15	22	558	
24/03/2014	GPUMP	15:10	22	559	
24/03/2014	GPUMP	19:05	22	560	
25/03/2014	GPUMP	03:58	22	561	
25/03/2014	GPUMP	08:15	22	562	
25/03/2014	GPUMP	12:10	22	563	
25/03/2014	GPUMP	16:02	22	564	
25/03/2014	GPUMP	20:14	22	565	
26/03/2014	GPUMP	00:10	22	566	
26/03/2014	GPUMP	10:30	22	567	
26/03/2014	GPUMP	15:30	22	568	
26/03/2014	GPUMP	18:30	22	569	

26/03/2014	GPUMP	22:30	22	570	
27/03/2014	GPUMP	02:30	22	571	
27/03/2014	GPUMP	11:30	19	476	
27/03/2014	GPUMP	16:20	19	477	
27/03/2014	GPUMP	20:10	19	478	
28/03/2014	GPUMP	00:00	19	479	
28/03/2014	GPUMP	04:05	19	480	
28/03/2014	GPUMP	11:58	19	481	Time might be 10:58
28/03/2014	GPUMP	16:00	19	482	
28/03/2014	GPUMP	20:10	19	483	
28/03/2014	GPUMP	23:58	19	484	
29/03/2014	GPUMP	06:30	19	485	
29/03/2014	GPUMP	11:34	19	486	
31/03/2014	GPUMP	11:10	19	487	
31/03/2014	GPUMP	15:08	19	488	
31/03/2014	GPUMP	19:08	19	489	
31/03/2014	GPUMP	23:20	19	490	
01/04/2014	GPUMP	02:01	19	491	
01/04/2014	GPUMP	07:06	19	492	
01/04/2014	GPUMP	13:08	19	493	
01/04/2014	GPUMP	18:33	19	494	
01/04/2014	GPUMP	21:12	19	495	
02/04/2014	GPUMP	05:50	19	496	
02/04/2014	GPUMP	09:26	19	497	
02/04/2014	GPUMP	13:23	19	498	
02/04/2014	GPUMP	16:47	19	499	
03/04/2014	GPUMP	04:54	10	260	
03/04/2014	GPUMP	09:22	10	261	
03/04/2014	GPUMP	13:42	10	262	
03/04/2014	GPUMP	17:30	10	263	
03/04/2014	GPUMP	20:34	10	264	
04/04/2014	GPUMP	00:00	10	265	
04/04/2014	GPUMP	07:45	10	266	
04/04/2014	GPUMP	13:22	10	267	
04/04/2014	GPUMP	17:01	10	268	
04/04/2014	GPUMP	21:15	10	274	
05/04/2014	GPUMP	01:10	10	275	
05/04/2014	GPUMP	08:28	10	276	suspect numbering
05/04/2014	GPUMP	12:04	10	277	suspect numbering
05/04/2014	GPUMP	21:38	10	278	suspect numbering
06/04/2014	GPUMP	07:53	10	269	
06/04/2014	GPUMP	12:36	10	268	
06/04/2014	GPUMP	15:58	10	276	
07/04/2014	GPUMP	07:15	10	277	

07/04/2014	GPUMP	11:30	10	278	
07/04/2014	GPUMP	15:54	10	279	
07/04/2014	GPUMP	20:34	10	280	
08/04/2014	GPUMP	03:35	10	281	Time may be off
08/04/2014	GPUMP	07:23	10	282	
08/04/2014	GPUMP	10:03	10	283	
08/04/2014	GPUMP	13:09	17	428	
08/04/2014	GPUMP	15:58	17	429	
08/04/2014	GPUMP	21:29	17	430	
09/04/2014	GPUMP	02:35	17	431	
09/04/2014	GPUMP	07:45	17	432	
09/04/2014	GPUMP	10:05	17	433	
09/04/2014	GPUMP	16:42	17	435	
09/04/2014	GPUMP	21:47	17	434	
10/04/2014	GPUMP	10:05	17	443	
10/04/2014	GPUMP	16:05	17	442	
10/04/2014	GPUMP	19:35	17	441	
10/04/2014	GPUMP	22:32	17	440	
11/04/2014	GPUMP	12:43	17	439	

13. Nutrients

Malcolm Woodward

Objectives

To investigate the spatial and temporal variations of the micromolar nutrient species; Nitrate, Nitrite, Silicate, Ammonium and Phosphate during the DY008 research voyage in the Celtic Sea and Western Approaches off the West coast of the UK. To work alongside the benthic biogeochemists investigating nutrient pore water distributions of the major nutrients and to sample for overlying waters and benthic re-suspension of the nutrients over various time-series experiments (Main, Sivyer, Silburn, Thompson, Hale). Carry out nutrient analysis from benthic experiments for the WP3 trace metals group as part of the SSB programme (Statham and Chever). Also take samples from the Benthic Flume (Fones) and the Benthic Lander (Balfour). Please see the other relevant sections of the cruise report as to the individual sampling protocols.

Cruise Summary

The 5-channel autoanalyser worked very well throughout all of the cruise. Sediment pore waters were diluted where required with Low Nutrient Seawater (Taken in the North Atlantic Gyre in 2008) and overlying water analysed as taken. Samples analysed in HDPE sample bottles, acid cleaned and rinsed thoroughly. KANSO nutrient reference materials (Batch BU) were run each day to check analyser integrity and analytical continuity from one day to the next. Very good continuity in sensitivity for all 5 channels was found, demonstrating excellent analytical performance.

Sampling and Methods

There was minimal storage of the Underway non-toxic and CTD water column samples except for the time waiting to be analysed in the laboratory. These samples were always run at lab temperature and were not filtered. 60m ml HDPE Nalgene bottles were used for all the nutrient sampling, these were aged, acid washed and cleaned initially, and stored with a 10% acid solution between sampling. Samples were taken from the Trace Metal CTD system from within the trace metal laboratory on-board the RRS *Discovery*. The sample bottle was washed 3 times before taking the final sample, and capping tightly. This was then taken immediately to the analyzer in the lab and analysis conducted as soon as possible after sampling. Nutrient free gloves were used and other clean handling protocols were adopted as close to those according to the GO-SHIP protocols, (2010). Samples from the Benthic Lander were preserved in Mercuric Chloride. Samples from re-suspension experiments and pore-water extractions were, where required, diluted using low nutrient seawater.

The micro-molar segmented flow auto-analyser used was the PML 5 channel (nitrate, nitrite, phosphate, silicate and ammonium) Bran and Luebbe AAIII system, using classical proven analytical techniques. The instrument was calibrated with home produced nutrient standards and then compared regularly against Nutrient Reference Materials, from KANSO Technos, Japan. The results from this also being part of a global nutrient programme (the INSS, International Nutrient Scale System) to improve nutrient analysis data quality world-wide. The analytical chemical methodologies used were according to Brewer and Riley (1965) for nitrate, Grasshoff (1976) for nitrite, Kirkwood (1989) for silicate, Zhang and Chi (2002) for Phosphate, and Mantoura and Woodward (1983).

Water samples were taken from the 24 x 10 litre titanium CTD/Rosette system (SeaBird). Clean handling techniques were employed to avoid any contamination of the samples, particularly for the ammonium samples. Gloves used were Dura-Touch to minimise nutrient contamination. Samples were kept tightly closed until just before analysis for the ammonium, this to avoid any contamination from external sources.

References:

Jia-Zhong Zhang and Jie Chi, 2002.Automated Analysis of Nanomolar Concentrations of Phosphate in Natural Waters with Liquid Waveguide. Environ. Sci. Technol., 36 (5), pp 1048-1053

Brewer P.G. and Riley J.P., 1965. The automatic determination of nitrate in seawater. Deep Sea Research, 12, 765-72.

Grasshoff K., 1976. Methods of seawater analysis. Verlag Chemie, Weinheim and New York, 317pp.

Kirkwood D., 1989. Simultaneous determination of selected nutrients in seawater. ICES CM 1989/C:29.

Mantoura, R.F.C and Woodward E.M.S, 1983. Estuarine, Coastal and Shelf Science, 17, 219-224.

Table 13.1. CTD Samples Analysed by AAIII Micromolar analysis.

Date	CTD	Position	CTD bottle analysed
21/03/14	CTD_002	51^{0}07.261'N 6^{0}09.974'W	Bottles 1 to 6 (depths: 90, 91.71, 42, 13, 12m)
22/03/14	CTD_003	51^{0}02.540'N 6^{0}36.438'W	Bottles 4,16,3,15,2,14,1,13 (depths: 11, 11, 41, 41, 65, 64, 96, 94m)
22/03/14	CTD_004	50^{0}35.824'N 7^{0}04.80'W	Bottles 12 and 24 (depths: 98 and 21m)
23/03/14	CTD_005	51^{0}07.694'N 6^{0}33.739'W	Bottle 23 (depths: 7m)
23/03/14	CTD_006	51^{0}08.275'N 6^{0}34.178'W	Bottle 22 (depths: 7m)
23/03/14	CTD_007	51^{0}12.810'N 6^{0}08.224'W	Bottle 21 (depths: 98m)
25/03/14	CTD_008	50^{0}30.22'N 7^{0}03.485'W	Bottles 16, 15, 14, 13 (depths: 100, 71, 41, 13m)
25/03/14	CTD_009	51^{0}12.58'N 6^{0}08.327'W	Bottles 4, 17, 3, 15, 2, 13, 1, 6 (depths: 11, 11, 51, 50, 85, 85, 101, 100m)
27/03/14	CTD_010	49^{0}24.151'N 8^{0}36.192'W	Bottles 6, 5, 4, 3, 2, 1 (depths: 11, 51, 76, 100, 120, 140m)
28/03/14	CTD_011	48^{0}34.267'N 9^{0}30.760'W	Bottles 6, 5, 4, 3, 2, 16 (depths: 12, 63, 111, 161, 178, 195m)
31/03/14	CTD_012	51^{0}12.823'N 6^{0}08.223'W	Bottles 1 and 13 (depths: 100, 100m)
02/04/14	CTD_013	51^{0}04.372'N 6^{0}34.870'W	Bottles 8 and 19 (depths: 93, 93m)
04/04/14	CTD_014	51^{0}04.356'N 6^{0}34.816'W	Bottles 4 to 1 (depths: 11, 21, 51, 90m)

Table 13.2. Underway non-toxic water system samples analysed by AAIII Micromolar analysis.

Date:Time	**Sample#**	**Latitude, Longitude**
21/03/14: 1630	Non Toxic 1	51^{0}.1208N 6^{0}.166W
21/03/14: 1745	Non Toxic 2	51^{0}.1208N 6^{0}.188W
22/03/14: 1238	Non Toxic 3	51^{0}.023N 6^{0}.626W
22/03/14: 1354	Non Toxic 4	51^{0}.8515N 6^{0}.788W
23/03/14: 1719	Non Toxic 5	51^{0}.1738N 6^{0}.373W
25/03/14: 0914	Non Toxic 6	50^{0}.693N 6^{0}.8067W
25/03/14: 1044	Non Toxic 7	50^{0}.906N 6^{0}.521W
25/03/14: 1120	Non Toxic 8	50^{0}.989N 6^{0}.419W
25/03/14: 1155	Non Toxic 9	51^{0}.073N 6^{0}.314W
25/03/14: 1242	Non Toxic 10	51^{0}.176N 6^{0}.183W
25/03/14: 1345	Non Toxic 11	51^{0}.208N 6^{0}.141W
25/03/14: 2207	Non Toxic 12	50^{0}.854N 6^{0}.841W
26/03/14: 0307	Non Toxic 13	50^{0}.196N 7^{0}.651W
26/03/14: 0715	Non Toxic 14	49^{0}.598N 8^{0}.363W
26/03/14: 1118	Non Toxic 15	49^{0}.398N 8^{0}.600W
26/03/14: 1404	Non Toxic 16	49^{0}.399N 8^{0}.602W
01/04/14: 2035	Non Toxic 17	51^{0}.213N 6^{0}.137W
02/04/14: 1803	Non Toxic 18	51^{0}.073N 6^{0}.579W
03/04/14: 0917	Non Toxic 19	50^{0}.611N 6^{0}.202W
03/04/14: 1248	Non Toxic 20	49^{0}.967N 6^{0}.002W
03/04/14: ??	Non Toxic 21	Lost
06/04/14: 1435	Non Toxic 22	50^{0}.750N 6^{0}.730W
06/04/14: 1608	Non Toxic 22a	
06/04/14: 1627	Non Toxic 23	51^{0}.026N 6^{0}.381W
07/04/14: 1207	Non Toxic 24	51^{0}.073N 6^{0}.581W
07/04/14: 1604	Non Toxic 25	51^{0}.074N 6^{0}.577W
08/04/14: 1009	Non Toxic 26	51^{0}.235N 6^{0}.144W
08/04/14: 1315	Non Toxic 27	51^{0}.235N 6^{0}.144W
08/04/14: 1602	Non Toxic 28	51^{0}.091N 6^{0}.585W
09/04/14: 1002	Non Toxic 29	50^{0}.520N 7^{0}.032W
09/04/14: 1600	Non Toxic 30	50^{0}.520N 7^{0}.032W
10/04/14: 1010	Non Toxic 31	50^{0}.625N 6^{0}.932W
10/04/14: 1617	Non Toxic 32	50^{0}.480N 7^{0}.036W
09/04/14:	Non Toxic 2	51^{0}.235N 6^{0}.144W
09/04/14:	Non Toxic 2	51^{0}.235N 6^{0}.144W
09/04/14:	Non Toxic 2	51^{0}.235N 6^{0}.144W
09/04/14:	Non Toxic 2	51^{0}.235N 6^{0}.144W
09/04/14:	Non Toxic 2	51^{0}.235N 6^{0}.144W

Nutrient Analysis of Experimental samples:

28th March: WP3 test for pore water Benthic 'A'

31st March: Briony Silburn, NIOZ core overlying water =22 samples

1st April: Silburn:NIOZ core overlying = 11 samples

: Charlie Main: 20 overlying water 'A' samples

: WP3 resuspension expts: 29 samples

2nd April: WP3: Pore Waters: 24 samples

: Charlie Main: 20 overlying waters 'B' samples

3rd April: Gary Fones Resuspension Expt: 24 samples

: Briony Silburn Flux Expt: 70 samples

4th April: Rachel Hale: t0: 5 samples

5th April: Gary Fones Resuspension Expt: 10 samples

: Rachel Hale: t0: 5 samples

: Charlie Main: 14 overlying water 'A' samples

: Briony Silburn Flux Expt: 56 samples

: Charlie Main: 5 overlying water 'B' samples

6th April: Charlie Main: 9 overlying water 'B' samples

: Gary Fones Resuspension Expt: 10 samples

7th April: WP3 Samples: 41 samples

: Benthic Lander Samples: 22 samples

8th April: WP3 Pore waters: 36 samples

9th April: Rachel Hale: 5+5 samples

: Charlie Main: 12 'A' samples

: Briony Silburn: 32 Pore water samples Station H, NIOZ #1,#2,#3 cores.

10th April: Gary Fones Resuspension Expt 303 1-10

: Gary Fones Resuspension Expt 295 1-7

: Gary Fones Resuspension Expt 293 1-7

: Gary Fones Resuspension Expt 290 1-7

: Rachel Hale Samples G3, G6, G7, G9. G15 All T5

: Rachel Hale Samples H7, H8, H10, H13, H15, All T0

: Briony Flux Experiments Site H: 56 samples

11th April: Briony 33 Pore water samples from 3 NIOZ cores

: WP3 pore waters and one overlying = 9 samples

12th April: Gary Flume: 20 samples, Resus 385

: CM= 12 'B' samples

: Underway from Station H, the way home around the Scilies and The Channel.

: Flume Resus 380 = 7 samples

14. High-resolution ammonium

Matthew Bone

FloWave

Three whole cores and their overlying water were taken from three sites (Table 14.1) to simulate the effect of tidal and wave forcing upon the bed and examine the release and uptake of $NH4^+$ using a novel high time resolution data collection method. The first core was discarded due to no effective sampling design. The subsequent two cores were taken 'whole' (still within the NIOZ core casing) and succeeded to undergo the experiment. The FloWave was placed directly on top of the core and left for a period ranging from 30minutes (Station D) to two hours (Station A) to determine the optimum settings. Further improvements to the design are now planned.

Mini-flume

Using the Mini-flume (Figure 14.1), three cores were analysed from three separate sites looking at the bed in relation to shear stress. A high temporal resolution change in $NH4^+$ concentration through re-suspension was measured over the course of the two hour period using a HPLC (Figure 14.1, top left) connected to a peristaltic pump. A ratio of 70% sample and 30% Working Reagent (composed of OPA, Sodium Tetra borate, Sodium Sulphite and Ethanol) was drawn at a rate of 0.5 ml/min continuously. Several issues were experienced with pressure and blockages. The method was adapted and proved to overcome the issues experienced.

Figure 14.1. Mini-flume on bottom right and HPLC on top left.

Incubations

Two incubation experiments were carried out (Site A and Site G). It involved taking three 1.5 l bottles of bottom water: the first left with only the bottom water, the second: 28 cm^3 of sediment added, and the third: 28 cm3 of sediment added and then spiked with 2 ml of ATU. The sediment was taken from a NIOZ core at recorded depths using a syringe sub-corer. The bottles were then incubated at 10ºC for a period between 24 – 48 hours depending upon transit time between sites. Ten ml of water was taken at three hourly intervals from a syringe and then ejected. A second 10 ml sample was then taken: 5 ml pushed through a 0.45 µm syringe filter and discarded, and the final 5 ml drawn through the syringe into a 6 ml vial. One ml of this sample was taken and combined with 100 µl of Working Reagent in a 1.5 ml brown vial. $NH4^+$ was measured at three hour intervals using the HPLC running in discreet mode and compared to standards.

Re-suspension experiments

Four re-suspension experiments were carried out (one per site). It involved taking three 1.5 l bottles of bottom water and adding a set depth of sediment (28 cm^3) taken from the core; 10 cm, 20 cm and 30 cm. The sediment was taken from a NIOZ core at recorded depths using a syringe sub-corer. The bottles were placed on a magnetic stirrer for 15 minutes and then incubated at room temperature (20ºC) for a period between 24 – 48 hours depending upon transit time between sites; however for the final experiment (Station I), the bottles were incubated at 15ºC and air was continuously bubbled through to prevent anoxic conditions from developing. 10 ml of water was taken at three hourly intervals from a syringe and then ejected. A second 10 ml sample was then taken: 5 ml pushed through a 0.45 µm syringe filter and discarded, and the final 5 ml drawn through the syringe into a 6 ml vial. 1 ml of this sample was taken and combined with 100 µl of Working Reagent in a 1.5 ml brown vial. $NH4^+$ was measured at three hour intervals using the HPLC running in discreet mode and compared to standards.

15N/18O

Fifteen ml of sample were taken from the FloWave experiment at 20 minute intervals, filtered using a 0.25 µm syringe filter and frozen at -80ºc for future analysis.

Table 14.1. Metadata on sample types by station.

	Station A	Station I	Station D	Station G
Date	02/04/14	11/04/14	04/04/14	05/04/14
Sediment Type	Mud	Muddy Sand	Sandy Mud	Sand
Incubation	x3			x3
Re-suspension	x3	x3	x3	x3
FloWave	1 Core		1 Core	N/A
Mini-flume	1 Core	1 Core	1 Core	N/A
$^{15}N/^{18}O$	1 Sample Set			

15. Shelf sources of Fe to the Ocean

Peter J Statham, Fanny Chever and Anna Lichtschlag

This section summaries the contributions of SSB WP3 - Shelf sources of Fe to the Ocean. The main WP3 objectives of this first SSB cruise were to collect seafloor material from stations with different sediment types at key process sites and either incubate on the ship, or recover material (coarser sandy material) to be processed on shore using flow through reactors (TFRs). Further lower profile target were to collect large particles using stand-alone pump systems (SAPS), and to test the clean underway-sampling system (fish). The CTD sampling is summarised above and the related sediment sampling, sediment profile imaging, stand alone pumping, and underway sampling are described in this section.

Sediment sampling and onboard experiments.

The problems with the winch system resulted in no usable cores being collected in the first part of the cruise. Once coring started again, useful megacore samples were collected at site A (cohesive), H (muddy sand) and I (sandy mud) that were used for shipboard incubation and some resuspension experiments using the specially designed and manufactures rack and stirrer system from Southampton. Note that after station Benthic H had been sampled the CTD/coring winch again failed and there was a gap before further sampling was possible.

Table 15.1. Sediment samples collected.

Station number	location	Coring device	Experiments with sediments
085 31/3/14	Benthic A Cohesive /muddy site	Megacore	Oxygen profiles. Oxic water incubation (diffusive and resuspension) Porewater extraction; sectioning for solid phase geochemistry
157 2/4/14	Benthic G Sandy site	NIOZ core	Bulk sand sample collected for return to Southampton and lab experiments (TFRs)
226 6/4/14	Benthic H Muddy sand	Megacore	Oxygen profiles. Oxic water incubation (diffusive and resuspension) Porewater extraction; sectioning for solid phase geochemistry
332 10/04/14	Benthic I Sandy mud	Megacore	Oxygen profiles for 3 cores. Porewater extraction 1 core; sectioning for solid phase geochemistry 1 core

Site G sediments were too coarse to allow sub-cores to be taken and used in incubation studies. This sediment will be returned to Southampton for flow through reactor experiments (collaboration with University of Portsmouth, Fones).

Geochemical characterization of SPI (sediment profile imager) data

In discussion with Cefas colleagues (Dr Ruth Parker) it was planned to compare SPI images with geochemical properties of collected cores. A 10 cm core tube was modified to have a flat Perspex face on one side. This modified tube was pushed into collected sediment material and on retrieval and cleaning of the exterior, the flat face was offered up to the image plate on the SPI system. The intention was then to extract pore waters with Rhizon samplers (analysed for sulfide and iron species) and to section the core material for laboratory analysis of carbon and metal species. A direct comparison of image and geochemistry should then be possible.

Unfortunately the poor quality images obtained by SPI with this modified tube (used with mixed grab material; the only sediment material available at the time) and reduced sampling capability caused by winch malfunction, meant that only preliminary work was possible at sea. Changes to the focal length of the camera will be needed for future work.

Stand Alone Pump Systems (SAPS)

In situ filtration samples were collected at 4 stations (see Table 15.2), at approximate depths of 5 and 15 m above the seafloor. In these relatively turbid waters pumping times of up to an hour and a half were still possible with the 53 micron Nytex mesh used. Samples were de-ionised water rinsed and then stored frozen for further analysis on shore.

Two SAPS were configured for deployment on the CTD wire (s/n 02-002 & 02-004), with s/n 03-03 as a spare. 4 casts were conducted, to a maximum depth of 95m. Upon recoveryof the first deployment s/n 02-002 pumped only 3L. The timer board had the total time of 0.5 hours left to pump, and after evaluation the battery power connection was found to be intermittent. The connection was removed and re-worked. S/n 03-03 was deployed on the next cast and all following casts in place of s/n 02-002.

Table 15.2. Stations and depths for SAPS samples; note that for all stations the bottom sampler was circa 5-7 m above bottom (difference in depths due to echo sounder depth not being corrected).

Station (STNNBR) and date	Water depth (m)	Depths below surface (m)	Time pumped (h)	Water volume (L)	Notes
204 4/4/14	104	90, 80	0.5	73, 3.5	Problem with battery on shallow pump
223 5/4/14	110	95, 85	1	145.1; 135.7	New pump worked well
302 9/4/14	106	95, 85	1.5	211.9; 161.3	Benthic H
384 11/4/14	101	95, 85	1.5	214.0; 178.2	Benthic I

Underway clean pumping system

The underway clean pumping system initially was not going to be deployed, as it was felt better not to expose the trace metal cleaned system to seawater during a test. However with all other water column systems inoperable towards the end of the cruise it was decided to deploy the system to collect trace metals and nutrient samples on the way back to Southampton. The intention was to mainly sample the open shelf zone and only the start of English Channel waters. Samples collected are shown in Table 15.3. For some parameters the number available bottles limited the number of samples collected.

Table 15.3. Samples collected using underway tow fish.

Parameter	Number of samples	Comments
Dissolved Fe	30	For Plymouth
Dissolved Trace metals	15	For Dagmara R.
Complexed Fe	15	For Martha Gledhill
Ligands	15	For Stan van den Berg
Fe isotopes	12	For Rachael James
Nutrients	30	Unfiltered, EMSW to measure

The system was located just aft of midships on the starboard side, and when towed was circa 1-2 m below surface in calm conditions, and typically 1-2 m away from the hull. The data from the metal samples should show if any hull contamination is present in samples when the fish is in its current position. The system proved reliable with a consistent flow rate of about 3.6 L/min. Note that a long length of tubing (circa 130m) was required to direct water into the clean lab from the fish in this starboard-side position. Thus the flushing time of the tubing is on the order of 4.3 minutes.

16. Sediment porewater profiles

Briony Silburn and David Sivyer

Samples for sediment characterisation were collected from the NIOZ corer at the four main sites. Particle size analysis (PSA)/organic carbon and nitrogen (OCN) and Porosity/Chlorophyll sub-cores were sliced to depths of 0-5cm and 5-10cm and will be processed in the Cefas labs. Rapid fines assessment (RFA) was collected at a depth of 0-5cm using a syringe and processed onboard giving an initial indication of the percentage of fines to sand at each site. A sub-core was profiled using a Unisense 500µm Oxygen Microelectrode to find the oxygen penetration depth. These methods will be used in conjunction with the SPI to assess the physical and biogeochemical parameters of the sediment.

Pore water was collected directly from a NIOZ core using sipper probes. These were inserted into the core to known depths and water was extracted using a vacuum motor. Samples range from 0-20cm, providing a profile of the sediment. Once extracted, the water was syringe filtered (0.2µm) and analysed for nutrients using the onboard scalar. Please see Malcolm Woodward for preliminary results.

A 24 hour nutrient flux incubation was run at three of the main sites. This involved taking a sub core from 5 different NIOZ cores, as well as 3 litres of the overlying water. These 5 sub-cores were then sealed, aerated and submerged in a water filled incubation tank set to 9.5°C, along with three 1 litre bottles of aerated overlying water. 20 ml of the cores surface water, and from the bottles of overlying water, was extracted using a syringe at known times along a logarithmic time series. These were then syringe filtered (0.2 µm) and analysed for nutrients using the onboard scalar. Please see Malcolm Woodward for preliminary results. At the end of the 24 period, all cores were photographed and the depth of the sediment, remaining overlying water and air space were noted. From this we can determine the flux of nutrients out of the sediment and into the water column over time.

Benthic A Pore Water Sippers												
Station Number	**Sample ID**	**Sample Depth (cm)**										
88	NIOZ #1	0	1	2	3	4	5	7.5	10	14	17	20
92	NIOZ #2	0	1	2	3	4	5	7.5	10	14	17	20
96	NIOZ #3	0	1	2	3	4	5	7.5	10	14	17	20
Sediment Characterisation												
Station Number	**Sample ID**	**Sample(s) taken**										
98	PSA/OCN	0-5cm, 5-10cm										
	RFA	2 x 0-5cm										
	Porosity/ Chlorophyll	0-5cm, 5-10cm										
	Oxygen Penetration	3 x profile										

Benthic G Pore Water Sippers												
Station Number	**Sample ID**	**Sample Depth (cm)**										
162	NIOZ #1	1	2	3	4	5						
174	NIOZ #2	1	2	3	4	5	7.5	10				
179	NIOZ #3	1	2	3	4	5	7.5					
Sediment Characterisation												
Station Number	**Sample ID**	**Sample(s) taken**										
185	PSA/OCN	0-5cm										
	RFA	2 x 0-5cm										
	Porosity/ Chlorophyll	0-5cm										
	Oxygen Penetration	3 x profile										

Benthic H Pore Water Sippers												
Station Number	**Sample ID**	**Sample Depth (cm)**										
272	NIOZ #1	0	1	2	3	4	5	7.5	10	14	17	
276	NIOZ #2	0	1	2	3	4	5	7.5	10	14	17	20
279	NIOZ #3	0	1	2	3	4	5	7.5	10	14	17	20
Sediment Characterisation												
Station Number	**Sample ID**	**Sample(s) taken**										
282	PSA/OCN	0-5cm, 5-10cm										
	RFA	2 x 0-5cm										
	Porosity/ Chlorophyll	0-5cm, 5-10cm										
	Oxygen Penetration	3 x profile										

Benthic I Pore Water Sippers												
Station Number	**Sample ID**	**Sample Depth (cm)**										
360	NIOZ #1	0	1	2	3	4	5	7.5	10	14	17	20
363	NIOZ #2	0	1	2	3	4	5	7.5	10	14	17	20
365	NIOZ #3	0	1	2	3	4	5	7.5	10	14	17	20
Sediment Characterisation												
Station Number	**Sample ID**	**Sample(s) taken**										
367	PSA/OCN	0-5cm, 5-10cm										
	RFA	2 x 0-5cm										
	Porosity/ Chlorophyll	0-5cm, 5-10cm										
	Oxygen Penetration	3 x profile										

Benthic A Nutrient Flux Incubation								
Station Number	Sample ID	Date and Time sampled						
112	Flux #1	T=0 01/04/14 23:30	T=1 02/04/14 00:34	T=2 02/04/14 01:35	T=3 02/04/14 03:33	T=4 02/04/14 07:28	T=5 02/04/14 16:15	T=6 02/04/14 23:35
113	Flux #2							
115	Flux #3							
116	Flux #4							
117	Flux #5							
n/a	H_2O #1							
n/a	H_2O #2							
n/a	H_2O #3							

Benthic G Nutrient Flux Incubation								
Station Number	Sample ID	Date and Time sampled						
205	Flux #1	T=0 05/04/14 00:10	T=1 05/04/14 01:15	T=2 05/04/14 02:15	T=3 05/04/14 04:15	T=4 05/04/14 08:10	T=5 05/04/14 16:50	T=6 06/04/14 00:15
206	Flux #2							
208	Flux #3							
209	Flux #4							
210	Flux #5							
n/a	H_2O #1							
n/a	H_2O #2							
n/a	H_2O #3							

Benthic H Nutrient Flux Incubation								
Station Number	Sample ID	Date and Time sampled						
284	Flux #1	T=0 09/04/14 13:30	T=1 09/04/14 14:30	T=2 09/04/14 15:30	T=3 09/04/14 17:20	T=4 09/04/14 21:30	T=5 10/04/14 06:15	T=6 10/04/14 13:30
285	Flux #2							
286	Flux #3							
287	Flux #4							
288	Flux #5							
n/a	H_2O #1							
n/a	H_2O #2							
n/a	H_2O #3							

17. Sediment core experiments - Bioturbation

Rachel Hale and Christina Wood

Replicate sediment cores (n = 15) of size 20 cm by 20 cm and depth 12 cm were collected from NIOZ cores taken at 4 sites (Muddy, site A; Sandy Mud, site G; Muddy Sand, site H; and Sand, site I) in the Celtic Sea. These sediment cores were transferred to clear perspex mesocosms and placed in randomised locations in the controlled temperature laboratory on board the RRS *Discovery* and covered with 20 cm of unfiltered seawater. All cores were aerated and maintained at approximately 10 °C in the dark. The sediment was allowed to settle out of the overlying seawater over 24 hours. After this the water was replaced with fresh unfiltered seawater to remove the mesocosm assembly nutrient flux due to sediment disturbance.

Each core was allocated to one of three treatments. Ten cores from each site will be taken back to the Biodiversity and Ecosystem Futures Facility at the National Oceanography Centre in Southampton for future experimentation. On board these cores were fed with fish food and the overlying water was changed weekly.

Five cores from each site were allocated to ship-board incubations. Nutrient samples of 30 ml were taken and filtered through a 0.45 µm syringe filter and transferred to labelled LDPE bottles. These samples were analysed on board by Malcolm Woodward. Following this 275 g dry weight of luminophores, fluorescently labelled sand-based particulate tracers, were added to a depth of 2 – 3 mm to assess bioturbation. The luminophores were pre-soaked 48 hours prior to distribution and vigorously shaken to prevent particle aggregation and flotation during application.

After 5 days, T5 nutrient samples were taken as described above along with 10 ml iron samples filtered through a 0.2 µm syringe filter and transferred to 20 ml blood vials. Iron samples were analysed by Peter Statham and Fanny Chever on board. The mesocosms were then inoculated with sodium bromide to enable bioirrigation analysis. 8.231 g of sodium bromide was added to each core dissolved in 20 ml of seawater. Overlying water samples were then taken after 0, 4 and 6 hours and filtered to remove suspended particles and allow colorimetric analysis. Seawater samples were transferred to 20 ml blood vials for later analysis. The samples will be analysed for the change in Br^- concentration ($\Delta[Br^-]$, mgl^{-1}) using a Tecator flow injection auto-analyser (FIA Star 5010 series).

After 6 days, faunal mediated sediment particle reworking in the square cores was estimated non-invasively using a sediment profile imaging camera (Canon 400D set to ISO 400, 10 second exposure, aperture f5.6; image size 3888 × 2592 pixels, i.e. 10.1 megapixels effective resolution 56 × 56 µm per pixel). The camera was optically modified to allow preferential imaging of the luminophores under ultra-violet (UV) light. Images of all four sides of each core were taken in a UV illuminated imaging box. The redistribution of the tracers can be determined from stitched composite images (RGB colour, JPEG compression) using a custom-made semi-automated macro that runs within ImageJ (Version 1.47), a java-based public domain computer program developed at the US National Institutes of Health. The macro returns a binary value depending on whether luminophores are present at each pixel (value = 1) or absent (value = 0) using the sediment water interface as the uppermost row. From these data, the total luminophores in each row are summed to obtain the vertical mixing profile. The median (${}^{f\text{-}SPI}L_{med}$, typical short-term depth of mixing), maximum (${}^{f\text{-}SPI}L_{max}$, maximum extent of mixing over the long-term), and mean (${}^{f\text{-}SPI}L_{mean}$, time dependent indication of mixing) mixed depth of particle redistribution can then be calculated from this profile. In addition, the maximum vertical deviation of the sediment-water interface (upper – lower limit = surface boundary roughness, SBR) can provide an indication of surficial activity. After photographing the sediment was transferred to labelled 5 litre buckets and preserved in 4 % formalin for sieving and community analysis upon return to Southampton.

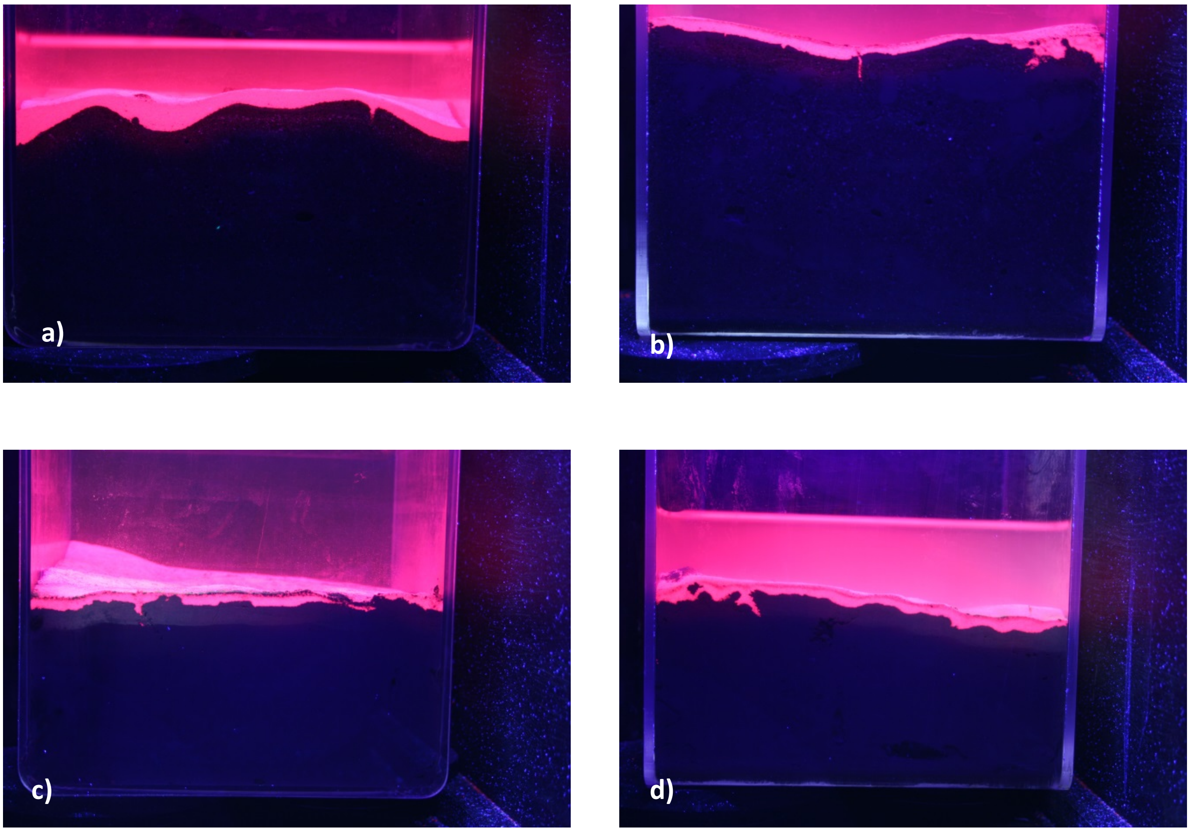


Figure 17.1. Representative pre-processing luminophore images showing limited sediment reworking in sand (images a and b) and mud (images c and d). Small burrows and shallow sediment bioturbation is clearly visible in the mesocosms where the luminophores have been buried within the sediment.

Table 17.1. Sediment core bioturbation experiment metadata.

STNNBR	SITE	COMMENTS	Core picture	Mesocosm picture	Core	Allocation	Other collections from core
100	Benthic A	Core 1	101-0518	101-0519	A1	Boat	
101	Benthic A	Core 2	101-0520	101-0521	A2	Boat	
102	Benthic A	Core 3	101-0522	101-0523	A3	Boat	
103	Benthic A	Core 4	101-0524	101-0525	A4	Boat	
104	Benthic A	Core 5	101-0526	101-0527	A5	Boat	
126	Benthic A	Core 6	101-0530	101-0531	A6	Ambient	
128	Benthic A	Core 7	101-0532	101-0533	A7	Future	
129	Benthic A	Core 8	101-0534	101-0535	A8	Future	
132	Benthic A	Core 9	101-0536	101-0537	A9	Ambient	
134	Benthic A	Core 10	101-0538	101-0539	A10	Future	
135	Benthic A	Core 11	101-0540	101-0541	A11	Future	
136	Benthic A	Core 12	101-0542	101-0543	A12	Ambient	
138	Benthic A	Core 14	101-0544	101-0545	A14	Future	
139	Benthic A	Core 13	101-0546	101-0547	A13	Ambient	
140	Benthic A	Core 15	101-0548	101-0549	A15	Ambient	Fones
153	Benthic G	Core 1	101-0565	101-0566	G1	Future	Kitidis microbial abundance and pigments
154	Benthic G	Core 2	101-0567	101-0568	G2	Ambient	Kitidis microbial abundance and pigments
155	Benthic G	Core 3	101-0569	101-0570	G3b	Future	Kitidis microbial abundance and pigments
158	Benthic G	Core 5	101-0573	101-0574	G3a	Boat	Kitidis pigments/Lichtschlag
159	Benthic G	Core 4	101-0575	101-0576	G4	Ambient	
160	Benthic G	Core 6	101-0577		G6	Boat	
169	Benthic G	Core 7	101-0578	101-0579	G7	Boat	
170	Benthic G	Core 8	101-0580	101-0581	G8	Ambient	
173	Benthic G	Core 9	101-0582	101-0583	G9	Boat	
174	Benthic G	Core 10	101-0586	101-0587/101-0588	G10	Future	Silburn pore waters
176	Benthic G	Core 11	101-0584	101-0585	G11	Ambient	
177	Benthic G	Core 12	101-0589	101-0590	G12	Future	
178	Benthic G	Core 13	101-0591	101-0593	G13	Future	
179	Benthic G	Core 14	101-0594	101-0595	G14	Ambient	Silburn pore waters
186	Benthic G	Core 15	101-0596	101-0597	G15	Boat	
247	Benthic H	Core 1			H1	Future	
250	Benthic H	Core 2			H2	Ambient	
253	Benthic H	Core 3			H3	Future	
255	Benthic H	Core 4			H4	Ambient	
257	Benthic H	Core 5			H5	Future	
259	Benthic H	Core 6			H6	Ambient	
261	Benthic H	Core 7			H7	Boat	
262	Benthic H	Core 8			H8	Boat	
263	Benthic H	Core 9			H9	Future	
264	Benthic H	Core 10			H10	Boat	
265	Benthic H	Core 11			H11	Ambient	
266	Benthic H	Core 12			H12	Future	
268	Benthic H	Core 13			H13	Boat	
269	Benthic H	Core 14			H14	Ambient	
270	Benthic H	Core 15			H15	Boat	
339	Benthic I	Core 1			I1	Ambient	Microbial

							abundance, pigments
340	Benthic I	Core 2			I2	Boat	Microbial abundance, pigments
342	Benthic I	Core 3			I3	Boat	Microbial abundance, pigments
343	Benthic I	Core 4			I4	Future	Molecular biomass
345	Benthic I	Core 5			I5	Ambient	
348	Benthic I	Core 6			I6	Future	
349	Benthic I	Core 7			I7	Ambient	
351	Benthic I	Core 8			I8	Future	
352	Benthic I	Core 9			I9	Boat	
353	Benthic I	Core 10			I10	Boat	
354	Benthic I	Core 11			I11	Ambient	
355	Benthic I	Core 12			I12	Future	
357	Benthic I	Core 13			I13	Ambient	
358	Benthic I	Core 14			I14	Future	
359	Benthic I	Core 15			I15	Boat	

18. Sediment microprofile incubations

Henrik Stahl

Introduction

Benthic carbon cycling plays a disproportionally important role on the continental margins. Intense recycling of organic matter in the sediment supply the overlying water with nutrients and inorganic carbon which can be re-used for primary production. Furthermore, continental shelf sediments have been proven to be one of the most important sinks for carbon globally. Once buried in the sediment, carbon is removed from the marine carbon cycle over geological time scale.

The aim with the work carried out on DY008 (and subsequent cruises) is to quantify how much of the inorganic and organic carbon is remineralized in the sediments and released back into the overlying water, and how much is buried in the sediments. This will be done for 4 different sediment types in the Celtic Sea (mud, sandy mud, muddy sand and sand) as their different properties will affect their sequestering and remineralization capacity.

Methods

Sediment incubations – 6 NIOZ cores (10 cm i.d.) were collected from each of the 4 main stations (Benthic A, G, H, I) and incubated for ~24hr at in situ temperature in the CT room (Figure 18.1). The cores where closed with a tight fitting lid and incubated, with individual stirring of overlying water, and the oxygen uptake (Total Oxygen Uptake – TOU) was measured over time by an internal oxygen optode in each of the 6 cores to estimate respiration rates at the respective site. Water samples where also taken from each core for Dissolved Inorganic Carbon (DIC) and Dissolved Organic Carbon (DOC) to quantify the efflux of these parameters from the sediment to the overlying water.

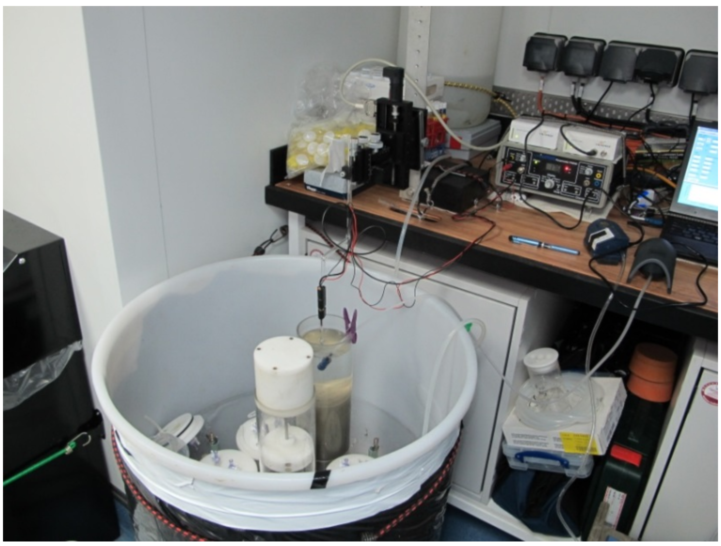


Figure 18.1. Showing the sediment incubation and profiling setup in the CT room.

Microprofiling -After the flux incubations, the cores where re-aerated for oxygen micro-profiling. 3-4 oxygen microprofiles (Figure 18.2), where recorded in each of the 6 sediment cores, to study the penetration depth and distribution of oxygen in the respective sediment type. From these profiles a Diffusive Oxygen Uptake (DOU) will be calculated, reflective of the microbial contribution to the oxygen uptake. Comparison of the DOU and TOU will quantify the importance of the faunal contribution to the overall oxygen flux.

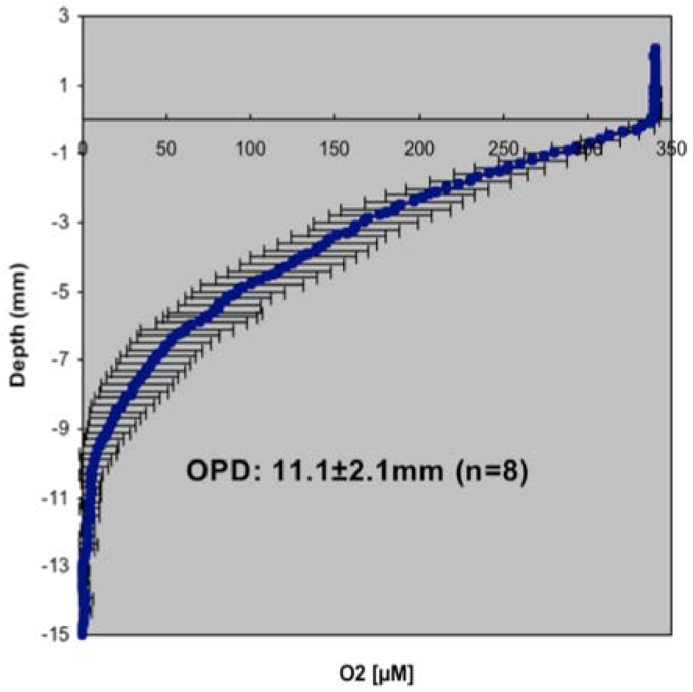


Figure 18.2. Example of average sediment oxygen micro-profile showing the average oxygen penetration and distribution.

Sediment solid phase – 3 undisturbed megacores (10 cm i.d.) where collected from each of the 4 process stations using Bowers & Connolly megacore. The cores where immediately sliced down to 20 cm depth (Interval: 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, 10-12, 12-14, 14-16, 16-18, 18-20) and frozen in plastic (polyethylene) bags for later analysis of solidphase POC, PIC, ^{210}Pb and grainsize back at SAMS. These parameters will be used to sediment accumulation rates (from ^{210}Pb), and ultimately burial rates of organic and inorganic carbon in the sediments (using the sediment accumulation rates together with the downcore POC and PIC concentrations).

For detailed specification of collected samples see Table 18.1 - Sampling list for SAMS/H. Stahl on DY008.

Table 18.1. Sampling list for SAMS/H. Stahl on DY008.

Station	Gear	Event	Core #	Sampling activity	Parameter measured	Notes
Benthic A/mud	Megcorer	84		Slicing: sediment solid phase	PIC, POC, 210Pb, Grainsize	Interval: 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, 10-12, 12-14, 14-16, 16-18, 18-20
Benthic A/mud	Megcorer	84		Slicing: sediment solid phase	PIC, POC, 210Pb, Grainsize	Interval: 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, 10-12, 12-14, 14-16, 16-18, 18-20
Benthic A/mud	Megcorer	84		Slicing: sediment solid phase	PIC, POC, 210Pb, Grainsize	Interval: 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, 10-12, 12-14, 14-16, 16-18, 18-20
Benthic A/mud	NIOZ corer	105	1	Incubation 1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic A/mud	NIOZ corer	106	1	Incubation 1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic A/mud	NIOZ corer	107	1	Incubation 1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic A/mud	NIOZ corer	108	1	Incubation 1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic A/mud	NIOZ corer	109	1	Incubation 1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic A/mud	NIOZ corer	110	1	Incubation 1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic G/sand	NIOZ corer	187	1	Incubation 1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic G/sand	NIOZ corer	187	1	Incubation 1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic G/sand	NIOZ corer	188	1	Incubation 1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic G/sand	NIOZ corer	188	1	Incubation 1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic G/sand	NIOZ corer	189	1	Incubation 1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic G/sand	NIOZ corer	189	1	Incubation 1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic G/sand	NIOZ corer		1	Slicing: sediment solid phase	PIC, POC, 210Pb, Grainsize	Interval: 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, 10-12, 12-14, 14-16, 16-18, 18-20
Benthic G/sand	NIOZ corer		1	Slicing: sediment solid phase	PIC, POC, 210Pb, Grainsize	Interval: 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, 10-12, 12-14, 14-16, 16-18, 18-20
Benthic G/sand	NIOZ corer		1	Slicing: sediment solid phase	PIC, POC, 210Pb, Grainsize	Interval: 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, 10-12, 12-14, 14-16, 16-18, 18-20
Benthic H	Megcorer	226	3	Incubation 3: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic H	Megcorer	226	4	Incubation 3: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic H	Megcorer	226	6	Incubation 3: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic H	Megcorer	226	7	Incubation 3: Benthic flux,	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling

				microprofiling		
Benthic H	Megcorer	226	10	Incubation 3: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic H	Megcorer	226	12	Incubation 3: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic H	Megcorer	226	3	Slicing: sediment solid phase profile	PIC, POC, 210Pb, Grainsize	Interval: 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, 10-12, 12-14, 14-16, 16-18, 18-20
Benthic H	Megcorer	226	4	Slicing: sediment solid phase profile	PIC, POC, 210Pb, Grainsize	Interval: 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, 10-12, 12-14, 14-16, 16-18, 18-20
Benthic H	Megcorer	226	12	Slicing: sediment solid phase profile	PIC, POC, 210Pb, Grainsize	Interval: 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, 10-12, 12-14, 14-16, 16-18, 18-20
Benthic H	NIOZ corer	273	1	Incubation 3.1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic H	NIOZ corer	274	1	Incubation 3.1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic H	NIOZ corer	275	1	Incubation 3.1: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic I	Megcorer	332	4	Slicing: sediment solid phase profile	PIC, POC, 210Pb, Grainsize	Interval: 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, 10-12, 12-14, 14-16, 16-18, 18-20
Benthic I	Megcorer	332	10	Slicing: sediment solid phase profile	PIC, POC, 210Pb, Grainsize	Interval: 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, 10-12, 12-14, 14-16, 16-18, 18-20
Benthic I	Megcorer	332	11	Slicing: sediment solid phase profile	PIC, POC, 210Pb, Grainsize	Interval: 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, 10-12, 12-14, 14-16, 16-18, 18-20
Benthic I	NIOZ corer	362	1	Incubation 4: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic I	NIOZ corer	364	1	Incubation 4: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic I	NIOZ corer	366	1	Incubation 4: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling
Benthic I	NIOZ corer	367	1	Incubation 4: Benthic flux, microprofiling	O2, DIC, DOC, TA	O2 microprofiling 200um resolution x 4 profiling

19. Pulse chase sediment cores incubations experiments

Charlotte Main

At stations A, G and H a 'pulse chase' sediment cores incubations experiment was performed. Sediment cores were collected in 10 cm internal diameter tubes (sub-coring from the NIOZ), topped up with bottom seawater and acclimated to experimental conditions in the dark.

Freeze-dried algae (*Chaetocerous decipiens*) that had previously been cultured in isotopically enriched (^{13}C and ^{15}N) artificial seawater were resuspended using a small amount of seawater and then gently pipetted onto the sediment surface of the cores. Water samples were taken at the start and at the end of the experiment and were preserved for later analysis of $DI^{13}C$, $DI^{15}N$ and nutrients. The sediment core microcosms were sealed and incubated for a period determined by their oxygen uptake rate (measured using non-invasive sensor spots). Experiments were ended at or before cores reached approximately 80% of starting total oxygen levels. Samples for $DI^{13}C$ analysis were also taken during the experiments where time allowed.

Sediment horizons (0-1 cm; 1-2 cm; 2-5 cm) were also preserved at the experiment end. From these, prokaryote and macrofauna biomass, and the uptake of isotopically labelled carbon and nitrogen will be determined.

The water in the microcosms was stirred with a rotating disc powered by electric motors. As a further treatment, two stirring speeds (40 rpm and 80 rpm) were assigned to the microcosms. Both treatments of algae and stirring speed were controlled for with microcosms stirred at each speed that did not have the addition of organic carbon.

Analysis of start and end samples of nutrients was carried out on board immediately following the experiments (Woodward).

Table 19.1. Summary of cores incubated indicating samples taken.

			Samples		
Site	**Cores incubated**	**Treatments (number of replicates)**	**Start**	**Intermediate**	**End**
A	20	CH (5) CL (5) AH (5) AL (5)	DIC (20) DIN (20) Nutrients (20)	Oxygen	DIC (20) DIN (20) Nutrients (20) Prokaryote (12) Fauna (12)
G	14	CH (4) CL (4) AH (3) AL (3)	DIC (14) DIN (14) Nutrients (14)	Oxygen DIC (14); 1 each core	DIC (14) DIN (14) Nutrients (14) Prokaryote (14) Fauna (14)
H	12	CH (3) CL (3) AH (3) AL (3)	DIC (12) DIN (12) Nutrients (12)	Oxygen DIC (36); 3 each core	DIC (12) DIN (12) Nutrients (12) Prokaryote (12) Fauna (12)

CH = Control high speed (80 rpm); CL = Control low speed (40 rpm); AH = Algae high speed (80 rpm); AL = Algae low speed (40 rpm).

Table 19.2. Further details of incubated cores; Site A.

Core ID	Event	Depth (m)	Lat	Lon	Treatment
1	087	109	51.2133	-6.1374	CL
2	087	109	51.2133	-6.1374	CH
3	087	109	51.2133	-6.1374	AL
4	090	106	51.2134	-6.1373	AH
5	090	106	51.2134	-6.1374	CL
6	090	106	51.2134	-6.1374	CH
7	090	106	51.2134	-6.1374	AL
8	091	106	51.2134	-6.1373	AH
9	091	106	51.2134	-6.1373	CL
10	091	106	51.2134	-6.1373	CH
11	091	106	51.2134	-6.1373	AL
12	093	106	51.2134	-6.1373	AH
13	093	106	51.2134	-6.1373	CL
14	093	106	51.2134	-6.1373	CH
15	093	106	51.2134	-6.1373	AL
16	094	106	51.2134	-6.1373	AH
17	094	106	51.2134	-6.1373	CL
18	094	106	51.2134	-6.1373	CH
19	094	106	51.2134	-6.1373	AL
20	097	106	51.2134	-6.1373	AH

CH = Control high speed (80 rpm); CL = Control low speed (40 rpm); AH = Algae high speed (80 rpm); AL = Algae low speed (40 rpm)

Table 19.3. Further details of incubated cores; Site G.

Core ID	Event	Depth (m)	Lat	Lon	Treatment
21	194	104	51.07503	-6.57731	AL
22	194	104	51.07503	-6.57731	CH
23	195	104	51.07503	-6.57753	AH
24	195	104	51.07503	-6.57753	CH
25	196	104	51.07503	-6.57753	AL
26	196	104	51.07503	-6.57753	AH
27	197	104	51.07489	-6.57753	AH
28	197	104	51.07489	-6.57753	CL
29	198	104	51.07489	-6.57753	AL
30	198	104	51.07489	-6.57753	CL
31	199	105	51.07491	-6.57752	CH
32	206	104	51.07626	-6.57914	AH
33	212	103	51.07626	-6.57915	CH
34	213	102	51.07626	-6.57916	CL

CH = Control high speed (80 rpm); CL = Control low speed (40 rpm); AH = Algae high speed (80 rpm); AL = Algae low speed (40 rpm)

Table 19.4. Further details of incubated cores; Site H.

Core ID	Event	Depth (m)	Lat	Lon	Treatment
41	248	101	50.51998	-7.0325	CH
42	248	101	50.51998	-7.0325	AL
43	248	101	50.51998	-7.0325	CL
44	251	101	50.91998	-7.03247	CH
45	251	101	50.91998	-7.03247	AL
46	251	101	50.91998	-7.03247	AH
47	251	101	50.91998	-7.03247	CL
48	254	101	50.52003	-7.03251	CH
49	254	101	50.52003	-7.03251	AH
50	254	101	50.52003	-7.03251	AH
51	254	101	50.52003	-7.03251	AL
52	258	101	50.20066	-7.0325	CL

CH = Control high speed (80 rpm); CL = Control low speed (40 rpm); AH = Algae high speed (80 rpm); AL = Algae low speed (40 rpm)

20. Infaunal and microbial community structure and biomass

Steve Widdicombe and Vas Kitidis

Faunal sampling from 0.1 m^2 NIOZ box corer

At stations A, G, H and I, 5 x 0.1 m^2 sediment cores were collected using the NIOZ corer. The overlying water was drained off through a 1mm mesh to reveal the sediment surface. In each core, three 50 ml syringe corers were then pushed into the sediment to a depth of approximately 10 cm. The sediment from these 3 x 50 ml cores was pooled into a pot and preserved with 10% buffered (borax) formaldehyde solution. These samples will be returned to PML where the ***meiofauna*** (organisms >63 µm) will be extracted, identified and biomassed. Once the meiofauna cores had been extracted, the remainder of the NIOZ core was sieved over a 0.1 m^2 sieve and the residue placed into a pot and preserved with 10% buffered formaldehyde solution. This reside will be returned to PML where the ***macrofauna*** (organisms >1 mm) will be extracted, identified and biomassed.

Faunal sampling from 0.5m^2 SMBA boxer corer

At stations A, G, H and I, 5 x 0.5 m^2 sediment cores were collected using the SMBA boxer corer. Each sample was sieved through a 1 cm mesh and the residue placed into a pot and preserved with 10% buffered formaldehyde solution. This reside will be returned to PML where the ***megainfauna*** (organisms >1 cm) will be extracted, identified and biomassed. From initial inspection all sites appeared to be impoverished with respect to megafauna.

Microbial community structure sampling from 0.1 m^2 NIOZ box corer

At stations A, G, H and I, 8 samples were taken for ***microbial community structure*** analysis. Once the overlying water had been gently drained off the NIOZ core, a 50 ml syringe (which had been previously sprayed with ethanol) was pushed into the sediment to a depth of approximately 10 cm. The microbial cores were then extracted from the sediment, sealed and immediately frozen at -80°C.

Microbial biomass sampling from 0.1 m^2 NIOZ box corer

Five replicate samples were taken at stations A, G, H and I. Each sample was split into 4 depths to yield a total of 20 ***microbial biomass*** samples per site. Once the overlying water had been gently drained off the NIOZ core, 30ml syringes (which had been previously sprayed with ethanol) were pushed into the sediment to a depth of approximately 10 cm. Each syringe core was sectioned into 4 depths: surface sediment (0 – 1 cm), 1 – 2.5 cm, 2.5 – 5 cm and 5 – 10 cm. From each of the 20 sediment samples, approximately 0.5 ml of sediment was added to a 2 ml tube and mixed with a spatula. Then, 1 ml of 5 mM CTC was added to sediment in each tube, this was vortex mixed and incubated at sediment temperature for 1 hour. The tubes were then centrifuged at 5000 g for 1 minute.

The CTC solution was then removed from each tube and replaced with 1 ml 4 % paraformaldehyde. The tubes were then sealed with parafilm and stored at – 20°C.

Pigment sampling from 0.1 m^2 NIOZ box corer

At stations A, G, H and I, 6 replicate samples were taken. Once the overlying water had been gently drained off the NIOZ core, a 50 ml taped (blacked out) syringe was pushed into the sediment to a depth of approximately 10 cm. The sediment ***pigment cores*** were then extracted from the sediment, sealed and immediately frozen at -80°C.

Epifauna sampling from 2 m Jennings Beam

It was planned to quantify the community structure and biomass of large epifaunal organisms by deploying 3 x 2 m Jennings beam trawls at each of the 4 main benthic sites. It was planned to tow the trawl for between 200 m and 500 m depending on the nature of the sediment. Unfortunately, *Discovery*'*s* winch problems on DY008 prevented deployment of this trawl so no samples could be collected.

Nitrification rates from NIOZ cores

At stations A, G, H and I, 12 replicate samples of surface sediment were collected in pre-weighed, 14 mL glass vials (surface scrapings of top 0.5 cm). Approximately 2-3 mL of sediment was collected in each vial and filled with bottom water to create a slurry. Subsets of the slurries were ammended with 0.1 mL of 1M zinc chloride ($ZnCl_2$; n=3), 0.1 mL of 1M allylthiourea (ATU; n=3) and 0.1 mL of 1M sodium chlorate ($NaClO_3$; n=6) and incubated in the CT-room at bottom temperature for ca. 24 hours. A parallel incubation without sediment (bottom water + treatments) was conducted at the same time. At the end of the incubation period, 0.1 mL of 1M $ZnCl_2$ was added to all the bottles for preservation. Ammonium oxidation rates will be measured as rates of nitrite accumulation in the $NaClO_3$-treated samples compared to the ATU-treated samples. The initial $ZnCl_2$-treatment acts as the starting point. Sediment rates will be corrected for ammonium oxidation in bottom water.

Denitrification/Anammox rates from NIOZ cores

At stations A, G, H and I, 12 replicate cores were collected (i.d. 7 cm) from 5-6 separate NIOZ cores. Each core-tube had approximately 15-20 cm of sediment and 10-15 cm of overlying water. Overlying water was discarded from each core and replaced with bottom water ammended with $^{15}NO_3^-$ (Three treatments: +0 μM, +50 μM, +200 μM $^{15}NO_3^-$). The +0 treatment was homogenized with a power tool and the slurry decanted into 125 mL glass bottles. 1 mL of 1M ZnCl2 was added for preservation and the bottles were sealed with Teflon-lined rubber septa and Al-crimps. The remaining two treatments were incubated in the CT-room, at bottom water temperature for ca. 24 hours. Magnetic flees were suspended in the core tubes and agitated by an external electromagnetic circuit. After the incubation period, the cores were homogenized and preserved as above. Denitrification and Anammox rates will be determined post-cruise by membrane inlet mass spectrometry.

Table 20.1. Samples collected for further analysis at Plymouth Marine Laboratory on DY008.

Station	**STN A**	**STN H**	**STN I**	**STN G**
Sediment type	Mud	Muddy sand	Sandy Mud	Sand
Date sampled	1/2 April	9 April	10 April	2/3/4 April
Microbial community structure	6 reps	6 reps	6 reps	6 reps
Microbial biomass	5 reps (4 depths	5 reps (4 depths	5 reps (4 depths	5 reps (4 depths)
Meiofauna (>63 µm)	5 reps	5 reps	5 reps	5 reps
Macrofauna (>1 mm	5 reps	5 reps	5 reps	5 reps
Megainfauna (>1 cm)	5 reps	5 reps	5 reps	
Epifauna	No samples on DY008 due to *Discovery* winch problems			
Sediment pigments	8 reps	8 reps	8 reps	8 reps
Nitrification	6 reps	6 reps	6 reps	6 reps
Denitrification	4 reps	4 reps	4 reps	4 reps

21. Ecological mapping

Henry Ruhl, Kirsty Morris, Maaten Furlong, James Perrett, Ella Richards

Introduction

The Autosub6000 was used on the DY008 campaign for multi-beam, side-scan and photographic surveys. It was the first deployment of the vehicle since the JC077 cruise in August 2012, and occurred after a significant rebuild. As a result a number of issues arose during the cruise, and thus the AUV was not initially as effective as hoped. However, as these issues were resolved the AUV performance improved. At the end of the campaign the AUV had collected ~37,000 images, surveyed over 50 km of EM2000 multi-beam track and had collected low frequency side scan data on 24.5 km of track. Data had been gathered at Benthic sites A, G, H & I. However, due to limited battery capacity, an issue associated with the rebuild, the area surveyed was not as large as originally hoped. The data gathered should form the basis for further investigation at these sites and will be extended in subsequent campaigns. During the cruise high water turbidity was observed. To produce useful images it was necessary to stretch the AUVs operational envelope by flying very close to the seabed. After examining the flight performance of the AUV, the altitude for camera runs was reduced from the more standard 3 m to 2.2 m for Benthic sites H and I. This is very close for an AUV of this size, but due to the flat nature of the site it was deemed safe and the marked improvement in image quality justified the slight increase in risk.

Table 21.1. For DY008 Autosub6000 was configured as follows:

Sensors used	***Sub configuration***
1) RDI workhorse ADCP 300kHz downwards. 2) Kongsberg EM2000 multi-beam 3) EdgeTech 2200-M 120-425kHz side scan and 2-16kHz sub-bottom profiler 4) 2 x Point Grey Grasshopper 2 cameras + Flash (1 x downwards, 1 x forward) 5) 1 x colour forward camera and flash [Not used on the mission] 6) Seabird 911 CTD with 2 x SBE3plus, 2 x SBE4C, 1 x SBE43	1) Rear winglets set at 5º pitched downwards. 2) Autosub 6k recovery line retention system with nylon springer lines 3) 10.1kg positive buoyancy. 4) 3 x new battery packs. 5) New Autosub6000 launch and recovery system (LARS)

Notes

- The forward camera was ineffective due to the water turbidity and problems associated with the logger image capture. Thus, no useful images were captured.
- The port transducer of the EdgeTech high frequency sidescan sonar was faulty thus no useful data was gathered from this.

Table 21.2. Mission result notes.

Mission	Area	Date	Distance	Notes on the data
69	G	04/04/2014	46.5 km	EM2000 data was gathered at 50 m altitude on a 150 m line spacing 4.5 km line length. HF sidescan + sub-bottom data was gathered over the same area at 50 m altitude, but with the port transducer broken. No image data
70	A	06/04/2014	51.2 km	EM2000 data was gathered at 50 m altitude on a 150 m line spacing with 4.5 km line length. No SS or image data collected.
71	A	08/04/2014	25.0 km	Camera images were captured at 2.9 m altitude on a 75m line spacing with 4.5km line length. The water was too turbid for useful images
72	G	08/04/2014	24.3 km	~12,000 Camera images were captured at 2.8 m altitude on a 75 m line spacing with 4.5 km line length. Although the water was turbid useful images were captured.
73	H	10/04/2014	31.5 km	EM2000 & LF side scan + sub-bottom data was gathered at 50 m altitude on a 150 m line spacing with ~3 km line length. ~9,000 images were captured at ~2.2 m altitude on a 75 m line spacing of ~3 km line length.
74	I	11/04/2014	52.8 km	EM2000 & LF side scan + sub-bottom data was gathered at 50 m altitude on a 150 m line spacing with 4.5 km line length. ~16,000 images were captured at ~2.2 m altitude on a 75 m line spacing of 4.5 km line length.

Area	EM2000	Sidescan + sub bottom	Images
A	3 x 4.5 km lines 150 m spacing	None	No useful images.
G	3 x 4.5 km lines 150 m spacing	8 x 4.5 km lines various spacing – High Freq. Starboard side only	12,000 @2.8 m altitude. 5 x 4.5 km lines 75 m spacing. Image problems towards the end as logging slowed.
H	3 x ~3 km lines 150 m spacing	3 x ~3 km lines 150 m spacing – Low Freq.	9,000 @2.2 m altitude. 5 x ~3 km lines 75 m spacing
I	3 x 4.5 km lines 150 m spacing	3 x 4.5 km lines 150 m spacing – Low Freq.	16,000 @2.2 m altitude. 5 x 4.5 km lines 75 m spacing

In total the AUV ran:

•60 km of camera survey capturing ~37,000 images in

•50 km of multi-beam surveys

•22.5 km of LF side scan survey [+ 36 km of HF side scan survey, but of limited use]

Autosub600 surveys: Kirsty Morris

Objectives

Throughout the cruise Autosub6000 completed 6 missions (Table 21.2) covering the four Celtic Sea benthic sites (A,G,H and I) previously identified. The main objectives of the study where to collect both bathymetric and side scan data of the study site and beyond to allow further characterisation of the site. A photographic survey was also completed to aid the characterisation of sediments both within the survey box and in its surrounding area, and to assess the benthic megafaunal community. Ultimately this will aid in the assessment of the carbon utilisation of the benthic community within the area.

Bathymetric survey

For each site a bathymetric swath survey was completed. This was carried out using Autosub6000 at an altitude of 50m above the seabed, with a line spacing of 150m. Three lines were completed at all of the four Sites, allowing full coverage of the designated 500 by 500m box. Line length at Site A,G, and I were 4.5 km with site H only having a line length of 3 km as a result of an underlying cable in the vicinity. Side scan surveys were also carried out during missions 69, 73 and 74 (Table 21.2). Following a failure of one of the high frequency beams during mission 69 the a switch was made to the low frequency system for missions 73 and 74 using the low frequency side scan, with a swath width of approximately 300 m. Full coverage of the box was achieved by surveying a line though the middle of the box in both directions.

Photographic survey

The AESA downward facing camera systems developed during D377 was run continuously during Autosub6000 missions with 5 lines with a spacing of 75m. The forward facing camera was switched on for missions 69-71 but due to the amount of resuspended material in the water column no usable images were collected leading to the decision to switch it off for the remaining missions. Missions 71-74 were successful in producing downward facing images with Missions 69 and 70 having issues with the camera system failing during the dive. A preliminary assessment of the usability of the images was carried out by converting a subsection (1 from each minute of the photographic leg of the mission) of the images into JPGs using IrfanView (V 4.33) software where it appeared that the majority of images from mission 71 would be unsuitable for analysis as a result of a large nephaloid layer preventing the images from visualising the seabed. The number of usable images from mission 71 is yet to be determined. In total an estimated 38,000 usable images were recorded throughout missions 72-74 (Table 21.2). Examples of invertebrates and fish encountered are shown in Figure 21.1.

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Figure 21.1. Selected examples of the benthic invertebrates and fish observed during Autosub6000 mission 73 (images 1-6 reading left to right, top to bottom). 1 = Nephrops, 2=Octopus, 3= Seven armed starfish, 4 = Cushion star, 5= Small spoted catshark, 6 = flat fish.

Table 21.3. Autosub mission metadata for DY008.

Mission No	Station no	Site	date	Start lat	Start long	End lat	End long	Bathymetry collected	Side scan collected	No of ‘usable’ images	Image Altitude set	comments
69	201	Benthic G	4/4/14	51.10332	-6.58320	51.0559	-6.57230	Y	Y	0	50m	Test mission and deployment– side scan beam failed
70	228	Benthic A	6/4/14	51.23188	-6.13872	51.18901	-6.13185	Y	N	0	2.9m	Camera stopped functioning
71	243	Benthic A	8/4/14	51.189115	-6.13497	51.23102	-6.13623	N	N	TBC	2.9m	images not usable too much suspended sediment
72	245	Benthic G	8/4/14	51.09263	-6.58392	51.052138	-6.58248	N	N	~12,000	2.8m	
73	315	Benthic H	10/4/14	50.52051	-7.01688	50.52777	-7.01618	Y	Y	~9,000	2.2m	Lines a bit shorter than others due to cable but good images
74	368	Benthic I	11/4/14	50.6043	-7.10898	50.5558	-7.1058	Y	Y	~17,000	2.2m	

Faults/issues

There were a number of issues and faults associated with this campaign. A large portion of these were associated with the limited time available to complete a full rebuild of Autosub6000 just prior to the start of DY008. The major faults and issues are listed below:

Insufficient batteries for the cruise. The AUV's battery packs were upgraded and as part of this upgrade new battery boxes were manufactured by an external company. Unfortunately the supplier failed to make the boxes to specification, and also failed to rectify the situation prior to the cruise. This left the AUV with only three battery packs instead of the planned six. The only solution was to reduce the AUV mission time to around 12 hours.

Depth Sensor Failure. A failure in the depth sensor was identified just prior to shipping the AUV. The spare sensor was not a drop in replacement, and as a result of a different output message structure the software for receiving the depth information failed. The problem was solved after several days of investigation on the ship.

Camera Logging Problems. The camera logging software was slowing and/or stopping during the writing of images to disk. These problems were associated with an upgraded camera driver. After much investigation the logging software was reverted to its original form, and the camera then functioned properly.

EdgeTech SideScan Failure. The port high frequency side scan element either failed during or prior to the first mission. This meant that only low frequency side scan data could be gathered for the survey areas.

22. Resuspension experiments and *in situ* measurements

Charlotte EL Thompson and Gary Fones

In-Core Resuspensions

The Core MiniFlume (CMF) is a small annular flume designed to fit into a NIOZ box core barrel. It is 20 cm in diameter, and consists of two acrylic tubes that form a 4.5 cm working channel with water depth of 20-25 cm. A rotating lid turns 4 equidistant paddles, which are used to induce a flow within the flume. Fully calibrated, the flume is used to apply a shear stress to the bed in an increasing step-wise manner until and beyond the point where the bed begins to erode and resuspension occurs.

During the cruise, 6 cores were taken from each site where possible. Of these, one core was used to establish the physical stability of the bed and determine the critical erosion threshold. Once established, three cores were used to determine fluxes of inorganic nutrients (see M. Woodward) during the resuspension event. Before the reuspension experiments, DET probes were inserted into the NIOZ cores (avoiding the resuspension area), see below for details. The additional two cores are used as backups in case of core-collapse/unsuitable surface. In-core resuspension cannot be carried out for Benthic G, as a head of water cannot be maintained on advective sediments.

Table 22.1. Tables showing resuspension event summaries.

<u>Event 121 – Benthic A</u>

DY008 – BOXCORE – 121 – 01 - Benthic A - NIOZ corer

On-Bed: 01/04/2014, 22:30; 51.21309 -6.13748

Depth: 107

SPM Filters and DOC/POC Filters

Time Step	Filter Number (SPM)	Amount Filtered	Filter Number (DOC/POC)	Amount Filtered
T_{zero}	8	30	1	20
T_{20}	6	30	2	20
T_{40}	-	-	3	50
T_{60}	7	30	4	20
T_{80}	-	-	5	30
T_{100}	9	15	6	15
T_{120}	10	15	7	15

Event 118 – Benthic A

DY008 – BOXCORE – 118 – 01 - Benthic A - NIOZ corer

On-Bed: 01/04/2014, 21:34; 51.21315 -6.13747

Depth: 109

SPM Filters and DOC/POC Filters

Time Step	Filter Number (SPM)	Amount Filtered	Filter Number (DOC/POC)	Amount Filtered
T_{zero}	11	20	26	15
T_{20}	12	20	28	15
T_{40}	13	20	29	15

* Flume run aborted due to slumped core and CMF

Event 122 – Benthic A

DY008 BOXCORE – 122 – 01 - Benthic A - NIOZ corer

On-Bed: 01/04/2014, 22:49; 51.21309 -6.13748

Depth: 108

SPM Filters and DOC/POC Filters

Time Step	Filter Number (SPM)	Amount Filtered	Filter Number (DOC/POC)	Amount Filtered
T_{zero}	14	20	30	15
T_{20}	15	20	31	15
T_{40}	-	-	32	30
T_{60}	16	15	33	15
T_{80}	-	-	27	30
T_{100}	17	20	34	15
T_{120}	18	15	40	15

Event 123 – Benthic A

DY008 – BOXCORE – 123 – 01 - Benthic A - NIOZ corer

On-Bed: 01/04/2014,   23:05; 51.21309 -6.13749

Depth: 107

SPM Filters and DOC/POC Filters

Time Step	Filter Number (SPM)	Amount Filtered	Filter Number (DOC/POC)	Amount Filtered
T_{zero}	19	20	35	15
T_{20}	20	20	36	15
T_{40}	-	-	37	30
T_{60}	21	18	38	15
T_{80}	22	20	8	16
T_{100}	-	-	9	15
T_{120}	23	15	39	15

Event 295 – Benthic H

DY008 – BOXCORE – 295 – 01 - Benthic H - NIOZ corer

On-Bed: 09/04/2014, 13:39; 50.52029 -7.03249

Depth: 107

SPM Filters and DOC/POC Filters

Time Step	Filter Number (SPM)	Amount Filtered
T_{zero}	60	30
T_{20}	61	30
T_{40}	62	30
T_{60}	63	30
T_{80}	64	30
T_{100}	65	30
T_{120}	66	30

Event 293 – Benthic H

DY008 – BOXCORE – 293 – 01 - Benthic H - NIOZ corer

On-Bed: 09/04/2014, 13:01; 50.52038 -7.03248

Depth: 107

SPM Filters and DOC/POC Filters

Time Step	Filter Number (SPM)	Amount Filtered
T_{zero}	67	30
T_{20}	68	30
T_{40}	69	30
T_{60}	70	30
T_{80}	71	20
T_{100}	72	15
T_{120}	73	6
T_{120}	74	9

Event 290 – Benthic H

DY008 – BOXCORE – 290 – 01 - Benthic H - NIOZ corer

On-Bed: 09/04/2014, 12:20; 50.52040 -7.03250

Depth: 107

SPM Filters and DOC/POC Filters

Time Step	Filter Number (SPM)	Amount Filtered
T_{zero}	75	30
T_{20}	76	29
T_{40}	77	30
T_{60}	78	30
T_{80}	79	12
T_{100}	80	7
T_{120}	81	6

NIOZ Cores

Gel Probe Deployments for 1 and 2D pore water profiles

Introduction:

In-situ gel probes have been used over the last 20 years to determine high vertical resolution (200 µm to mm's) pore water profiles in soft sediments in a number of aquatic environments (shelf, coastal, estuarine and lake). Recent advancements in colourmetric techniques have also enabled the determination of 2D images of certain determinants on an mm^2 scale. During this project two types of DET gel probe were deployed (i) constrained DET to determine mm 1D profiles for the major macronutrients and (ii) 1D/2D DET for colourmetric determination of Fe(II), PO_4^- and alkalinity.

Methodology:

Constrained DET probes and 1D DET probes were deployed in collected whole NIOZ cores (before resuspension experiments) to determine high-resolution macronutrient pore water profiles to use to calculate diffusive and for comparison to resuspension flux's of macronutrients and also to determine 1D profiles of alkalinity, PO_4^- and Fe(II). Constrained DET and 1D DET probes were also deployed in sub-cores (10 cm diameter) from collected NIOZ cores. 2D DET probes were deployed in collected whole NIOZ cores and also in laboratory microcosms to check the technique.

Table 22.2. Table with suspension related NIOZ core sample metadata.

NIOZ Core Event	Type of Probe	NIOZ Core Event	Type of Probe	NIOZ Core Event	Type of Probe
NIOZ 69	2D1 (PO_4 &Alkalinity)	NIOZ 139	2D3 (PO_4 & Alkalinity)	NIOZ 295	Constrained C10
NIOZ 69	2D2 (Fe[II] & Alkalinity)	NIOZ 139	2D4 (Fe[II] & PO_4)	NIOZ 293	Constrained C11
NIOZ 112	C1 (Fe & Mn)	NIOZ 205	C6 (MCN)	NIOZ 290	Constrained C12
NIOZ 113	C2 (MCN)	NIOZ 206	C7 (Fe & Mn)	NIOZ 295	1D10 (PO_4 & Alkalinity)
NIOZ 115	1D3 (PO_4 & Alkalinity)	NIOZ 209	1D6 (PO_4 & Alkalinity)	NIOZ 293	1D11 (Fe[II] & Alkalinity)
NIOZ 116	1D5 (Fe[II] & Alkalinity)	NIOZ 210	1D7 (Fe[II] & Alkalinity)	NIOZ 290	1D12 (PO_4 &Alkalinity)
NIOZ 121	C3 (MCN)	NIOZ 227	2D5 (Fe[II] & Alkalinity)	NIOZ 379	Constrained C13
NIOZ 122	C5 (MCN)	NIOZ 227	2D6 (PO_4 & Alkalinity)	NIOZ 379	Constrained C14
NIOZ 123	C4 (MCN)	NIOZ 282	C8 (MCN)	NIOZ 381	1D13 (Fe(II) & Alkalinity)
NIOZ 121	1D4 (PO_4 & Alkalinity)	NIOZ 284	C9 (MCN)	NIOZ 381	1D14 (Fe[II] & Alkalinity)
NIOZ 122	1D1 (Fe[II] & Alkalinity)	NIOZ 285	1D8 (PO_4 & Alkalinity)		
NIOZ 123	1D2 (PO_4 &Alkalinity)	NIOZ 277	1D9 (Fe[II] & Alkalinity)		

Table 22.3. DET Probe deployments – NIOZ whole cores.

Benthic H

DY008 – BOXCORE – 227 – 01 - Benthic H - NIOZ corer

On-Bed: 06/04/2014, 11:23; 50.52003 -7.03259

Depth: 108 (Muddy sand)

NIOZ Core Event	Gel Probe Number (Constrained or 1D)
NIOZ 227	2D5 (Fe[II] and Alkalinity)
NIOZ 227	2D6 (PO_4 and Alkalinity)

DET Probe Deployments – sub-core

Benthic A

NIOZ Core Event	Gel Probe Number (Constrained or 1D)
NIOZ 112	Constrained C1
NIOZ 113	Constrained C2
NIOZ 115	1D3 (PO_4 and Alkalinity)
NIOZ 116	1D5 (Fe[II] and Alkalinity) Interface – 100mm up from bottom of gel
NIOZ 117	Frozen

Benthic G

NIOZ Core Event	Gel Probe Number (Constrained or 1D)
NIOZ 205	Constrained C6
NIOZ 206	Constrained C7
NIOZ 209	1D6 (PO_4 and Alkalinity)
NIOZ 210	1D7 (Fe[II] and Alkalinity)

Benthic H

NIOZ Core Event	Gel Probe Number (Constrained or 1D)
NIOZ 282	Constrained C8
NIOZ 284	Constrained C9
NIOZ 285	1D8 (PO_4 and Alkalinity)
NIOZ 277	1D9 (Fe[II] and Alkalinity)
NIOZ 280	Frozen

DET Probe Deployments – Microcosms

Candyfloss

DY008 – DGRAB – 069 – 01 - Day grab

In: 26/03/2014, 23:21; 49.40394 -8.59295

On-Bed: 26/03/2014, 23:25; 49.40394 -8.59294

Depth: 150

NIOZ Core Event	Gel Probe Number (Constrained or 1D)
NIOZ 69	2D1 (PO_4 and Alkalinity)
NIOZ 69	2D2 (Fe[II] and Alkalinity)

Benthic A

DY008 – BOXCORE – 139 – 01 - Benthic A - NIOZ corer

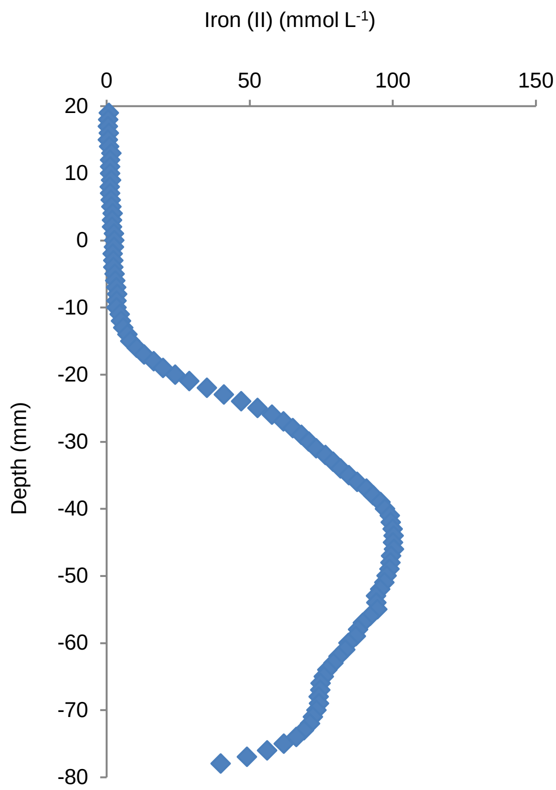
On-Bed: 02/04/2014, 02:57; 51.21292 -6.13748

Depth: 108

NIOZ Core Event	Gel Probe Number (Constrained or 1D)
NIOZ 139	2D3 (PO_4 and Alkalinity)
NIOZ 139	2D4 (Fe[II] and PO_4)

Analysis & Data:

1D and 2D gel probes were scanned on-board and initial data processing has begun. Further data analysis on all the scans will be undertaken at UoP. High resolution 1D pore water profiles for Fe(II) and alkalinity are shown below along with an example of a 2D alkalinity pore water image.



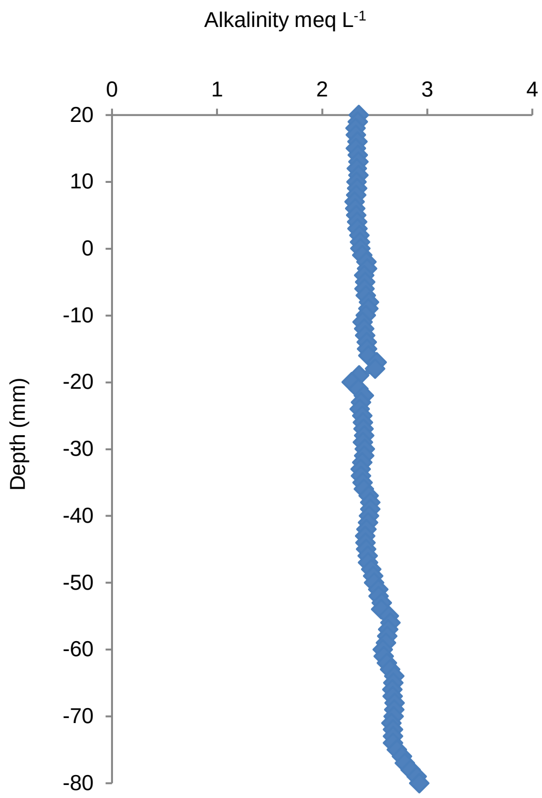


Figure 22.1. One-dimensional depth profile of pore-water iron(II) concentrations (left) and alkalinity (right) at Benthic A.

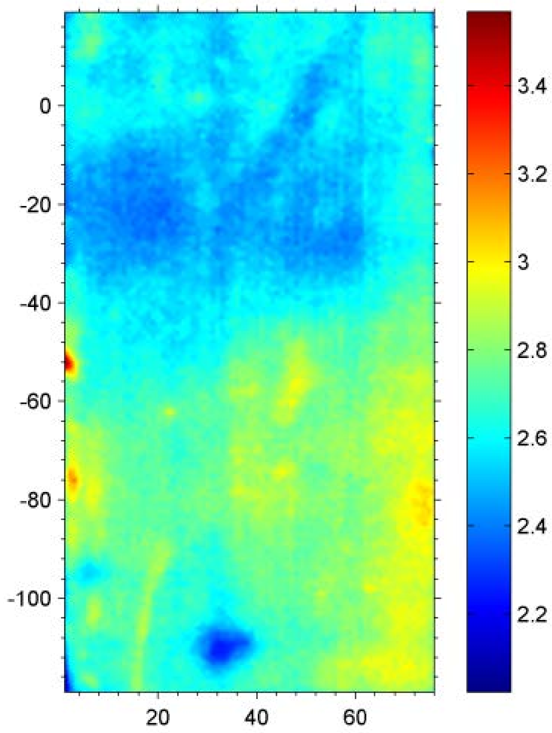


Figure 22.2 Two-dimensional alkalinity pore water image (meq L^{-1}).

FTR – Permeable Sediments

Introduction:

Permeable sediment was collected at Benthic G to use in the FTR to determine nutrient, oxygen and carbon fluxes in these sediments. Unfortunately problems with the reactors leaking mean that no experiments could be set up. Modifications were made on ship but further laboratory modifications are required to get the system up operational for future SSB cruises.

CTD Pelagic samples

Introduction:

Samples were collected from the TiCTD at a 10 stations for the Pelagic consortium and also to enable instrument sensors to be calibrated both on the CTD and on the smart buoys and mini-landers. These were Chlorophyll *a* and also PIC and PSi.

Data and analysis:

Chla samples were extracted and analysed on board using a Turner Trilogy Fluorometer. The raw data has been passed onto Alex Poulton for further calibration. Samples for PIC and PSi were filtered and stored frozen for subsequent analysis by the Pelagic team.

See Table 9.1 for Chlorophyll, PIC and PSi, and Lugols sample information.

Table 22.4. DET Probe Deployments – NIOZ whole cores (CMF).

Before Resuspension events on same cores

Benthic A

NIOZ Core Event	Gel Probe Number (Constrained or 1D)
NIOZ 121	Constrained C3
NIOZ 122	Constrained C5
NIOZ 123	Constrained C4
NIOZ 121	1D4 (PO_4 and Alkalinity) - Broken
NIOZ 122	1D1 (Fe[II] and Alkalinity)
NIOZ 123	1D2 (PO_4 and Alkalinity)

Benthic H

NIOZ Core Event	Gel Probe Number (Constrained or 1D)
NIOZ 295	Constrained C10
NIOZ 293	Constrained C11
NIOZ 290	Constrained C12
NIOZ 295	1D10 (PO_4 and Alkalinity)
NIOZ 293	1D11 (Fe[II] and Alkalinity)
NIOZ 290	1D12 (PO_4 and Alkalinity)

***In Situ* Resuspensions**

Voyager II, an *in situ* benthic annular flume provided by Partrac Ltd, undertook a series of controlled resuspension events in situ. The flume consists of a working channel 0.15 m wide, and 0.2 m deep and has a total diameter of 2.2 m. Eight equidistantly spaced paddles on a rotating lid induce a current via a chain drive, driven by a 0.6 hp, 24 V DC submarine motor and gearbox. The flume is instrumented with 3 optical backscatter sensors (OBS) which measure turbidity at three different heights, a Nortek Vectrino Velocimeter measuring velocity in the along channel (u), across channel (v) and vertical (w) directions 0.15 m above the nominal bed level, and an automated syringe sampling system taking calibration samples for the OBS. Data are logged directly to an onboard data logger, and an inboard computer controls the lid rotation and direction. The flume was lowered to the seabed, and the ship kept on station with the use of dynamic positioning and position holding confirmed via an attached drop-camera. A settling period of 90 min was given to allow for settling of any material resuspended by deployment. The flume was pre-programmed with lid rotations in a stepwise increasing fashion, designed to resuspend and erode the bed. Water samples were filtered on recovery and analysed for inorganic nutrients (see M. Woodward for details).

Table 22.5. Summary of *in situ* resuspension events.

<u>Event 220 – Benthic G</u>

DY008 – BENFLUME – 220 – 01 - Benthic G - In-situ bed flume

In: 05/04/2014, 13:05; 51.07313 -6.58024

On-Bed: 05/04/2014, 13:10; 51.07312 -6.58024

Out: 05/04/2014, 16:05; 51.07313 -6.58025

Depth: 103

SPM Filters

Syringe Number	Filter Number	Amount Filtered
1	24	55
2	25	55
3	26	54
4	27	53
5	28	53
6	29	54
7	30	52
8	31	55
9	32	27
10	33	37

<u>Event 224 – Benthic A</u>

DY008 – BENFLUME – 224 – 01 - Benthic A - In-situ bed flume

In: 05/04/2014, 22:34; 51.21098 -6.13398

On-Bed: 05/04/2014, 22:47; 51.21099 -6.13395

On-Deck: 05/04/2014, 01:27

Depth: 110

SPM Filters and DOC/POC Filters

Syringe Number	Filter Number (SPM)	Amount Filtered	Filter Number (DOC/POC)	Amount Filtered
1	34	35	12	20
2	35	34	41	20
3	36	34	42	20
4	37	34	13	20
5	38	34	10	20
6	39	34	43	20
7	40	33	14	20
8	41	20	11	20
8	42	14	-	-
9	43	20	15	20
9	-	-	16	13
10	44	33	17	20

<u>Event 303 – Benthic H</u>

DY008 – BENFLUME – 303 – 01 - Benthic H - In-situ bed flume

On-Bed: 09/04/2014, 19:37; 50.52007 -7.03954

Depth: 105

SPM Filters and DOC/POC Filters

Syringe Number	Filter Number (SPM)	Amount Filtered	Filter Number (DOC/POC)	Amount Filtered
1	50	34	18	20
2	51	34	19	20
3	52	34	22	20
4	53	34	20	20
5	54	34	21	20
6	55	32	23	20
7	56	32	24	20
8	57	32	25	20
9	58	32	44	20
10	59	35	45	19

<u>Event 385 – Benthic I</u>

DY008 – BENFLUME – 385 – 01 - Benthic H - In-situ bed flume

On-Bed: 11/04/2014, 20:57; 50.57614 -7.10668

Depth: 108 - Still to complete station info

SPM Filters and DOC/POC Filters

Syringe Number	Filter Number (SPM)	Amount Filtered	Filter Number (DOC/POC)	Amount Filtered
1	91	34	46	20
2	92	34	47	19
3	93	34	48	20
4	94	30	49	20
5	95	32	50	20
6	96	31	51	20
7	97	34	52	18
8	98	33	53	19
9	99	30	54	20
10	100	32	55	20

23. Day grab

C. E. L. Thompson et al.

Bulk sediment samples were taken for classification purposes using a Day grab. This is a triggered grab formed of two 'buckets' mounted within a steel frame, which samples on contact with the seabed. This ensures minimal disturbance of the seabed. Day grabs are designed for all sediment types, although are less successful in: gravels, which can prevent proper closure of the buckets; and loosely consolidated fine sediments that can be washed out of the grab during recovery. Day grabs were used for two purposes on DY008, as a visual determination of broad sediment type, and secondly to collect samples for particle size analysis (PSA) for full sediment classification. PSA samples averaged 100-200g in dry weight.

Table 23.1. List of stations for day grab samples.

Event Number	Site Name	Date	Time (at bottom)	Latitude	Longitude	Water Depth (m)	Visual Description	PSA subsample taken
005	East of Celtic Deep	21/03/2014	17:32	51.12087	-6.16600	107	Mud	
006	Benthic A1	21/03/2014	19:44	51.21358	-6.13700	110	Silty mud	x
007		21/03/2014	20:47	51.21292	-6.13628	110	Mud	
008		21/03/2014	21:09	51.21219	-6.13543	112	Failure	
009		21/03/2014	21:23	51.21219	-6.13541	101	Silty mud	
010		21/03/2014	21:44	51.21151	-6.13448	111	Failure	
011	Benthic A2	21/03/2014	21:56	51.21149	-6.13448	110	Silty mud	x
012		21/03/2014	22:15	51.21084	-6.13354	109	Silty mud	
013		21/03/2014	22:34	51.21026	-6.13247	107	Silty mud	
014		21/03/2014	22:52	51.20970	-6.13131	110	Silty mud	
015	Benthic A3	21/03/2014	23:12	51.20905	-6.13003	108	Silty mud	x
016	Benthic A4	21/03/2014	23:41	51.21357	-6.13008	109	Silty mud	x
017	Benthic A5	22/03/2014	00:11	51.20903	-6.13728	109	Silty mud	x
024	Benthic D1	22/03/2014	22:31	50.50369	-7.05816	112	Sandy mud	x
025		22/03/2014	22:55	50.50369	-7.05120	111	Failure	
026		22/03/2014	23:05	50.50370	-7.05122	111	Failure	
027	Benthic D2	22/03/2014	23:19	50.50369	-7.05120	111	Sandy mud	x
028	Benthic D3	22/03/2014	23:57	50.49918	-7.05109	112	Sandy mud	x
029	Benthic D4	23/03/2014	00:37	50.49915	-7.05826	111	Sandy mud	x
030		23/03/2014	01:10	50.50011	-7.05994	112	Failure	
031		23/03/2014	01:24	50.50000	-7.05488	110	Failure	
032	Benthic D5	23/03/2014	01:36	50.50098	-7.05485	112	Sandy mud	x

033	Benthic C1a	23/03/2014	03:23	50.61072	-6.88333	105	Big rock	
034		23/03/2014	03:36	50.61069	-6.88334	107	Failure	
035		23/03/2014	04:18	50.61068	-6.87720	106	Failure	
036	Benthic C2	23/03/2014	04:30	50.61070	-6.87723	106	Muddy gravelly sand (no subsample)	
068		26/03/2014	23:10	49.40394	-8.59294	151	Failure	
069		26/03/2014	23:25	49.40394	-8.59294	150		
080	Benthic G1	31/03/2014	13:40	51.07260	-6.58110	100	Muddy sand	**x**
081	Benthic G1	31/03/2014	14:15	51.07260	-6.58110	100	Muddy sand	**x**
082	Benthic G1	31/03/2014		51.07260	-6.58110	103	Meteorite like rock	
225	Benthic H	06/04/2014	09:57	50.52002	-7.03261	104	Failure	
309	Benthic I1	10/04/2014	02:58	50.51999	-7.08150	109	WP1 line 1	
310	Benthic I2	10/04/2014	03:26	50.51998	-7.08864	108	WP2 line 1	
311	Benthic I3	10/04/2014	03:49	50.51997	-7.09581	109	WP3 line 1	
312	Benthic I4	10/04/2014	04:11	50.51997	-7.10297	109	WP4 line 1	
313	Benthic I5	10/04/2014	04:31	50.51997	-7.11015	111	WP5 line 1	
314	Benthic I6	10/04/2014	04:47	50.52447	-7.09575	106	500 m north WP3 line 1	
316	Benthic I7	10/04/2014	10:14	50.62505	-6.93297	105	muddy sand	
317	Benthic I8	10/04/2014	10:36	50.62489	-6.92655	106	muddy sand	
318	Benthic I9	10/04/2014	11:00	50.62475	-6.91871	106	muddy sand	
319	Benthic I10	10/04/2014	11:25	50.62476	-6.91170	106	muddy sand	
320	Benthic I11	10/04/2014	11:51	50.62484	-6.90450	107	muddy sand	
321	Benthic I12	10/04/2014	12:37	50.61580	-6.90461	106	muddy sand	
322	Benthic I13	10/04/2014	14:20	50.47380	-7.05076	109	muddy sand	
323	Benthic I14	10/04/2014	14:44	50.47380	-7.04369	110	muddy sand	
324	Benthic I15	10/04/2014	15:15	50.46927	-7.04351	111	muddy sand	
325	Benthic I16	10/04/2014	18:06	50.57366	-7.08058	111	muddy sand/sandy mud	
326	Benthic I17	10/04/2014	18:29	50.57365	-7.08764	111	muddy sand/sandy mud	
327	Benthic I18	10/04/2014	18:57	50.57366	-7.10677	111	sandy mud	**x**
328	Benthic I19	10/04/2014	19:17	50.57365	-7.10884	111	sandy mud	**x**
329	Benthic I20	10/04/2014	19:49	50.57815	-7.10883	106	sandy mud	**x**
330	Benthic I21	10/04/2014	20:14	50.57815	-7.10177	107	sandy mud	**x**
331	Benthic I22	10/04/2014	20:38	50.57594	-7.10519	107	sandy mud	**x**

24. Sediment Profile Imaging (SPI)

Briony Silburn and David Sivyer

Sediment Profile Imagery (SPI) was collected at all four main sites, as well as additional sites around the Celtic Sea area. The images produced are a slice through the sediment, showing the sediment water interface and undisturbed layering below the sediment surface. These images will be analysed at both Cefas and NOC for penetration depth, apparent redox potential depth (aRPD) and changing grain size with depth.

Table 24.1. SPI camera deployment metadata.

SPI Camera		
Station number	Sample ID	Number of photos
42	B1	6
43	B2	6
44	B3	6
45	B4	6
46	B5	6
47	B6	6
48	B7	6
49	F1	6
50	F2	6
51	F3	6
52	F4	6
53	F5	6
56	G1	6
57	G2	6
58	G3	6
59	G4	6
60	G5	6
64	CF1	6
65	CF2	6
66	CF3	6
67	CF4	6
147	A1	6
148	A2	6
149	A3	6
221	A4	6
222	A5	6
229	G6	10
230	G7	10
231	G8	10
232	G9	10

SPI Camera		
Station number	Sample ID	Number of photos
233	G10	10
234	G11	10
235	G12	10
236	G13	10
237	G14	10
238	G15	10
239	G16	10
240	G17	10
241	G18	10
242	G19	10
369	H1	6
370	H2	6
371	H3	6
372	H4	6
373	H5	6
374	I1	6
375	I2	6
376	I3	6
377	I4	6
378	I5	6

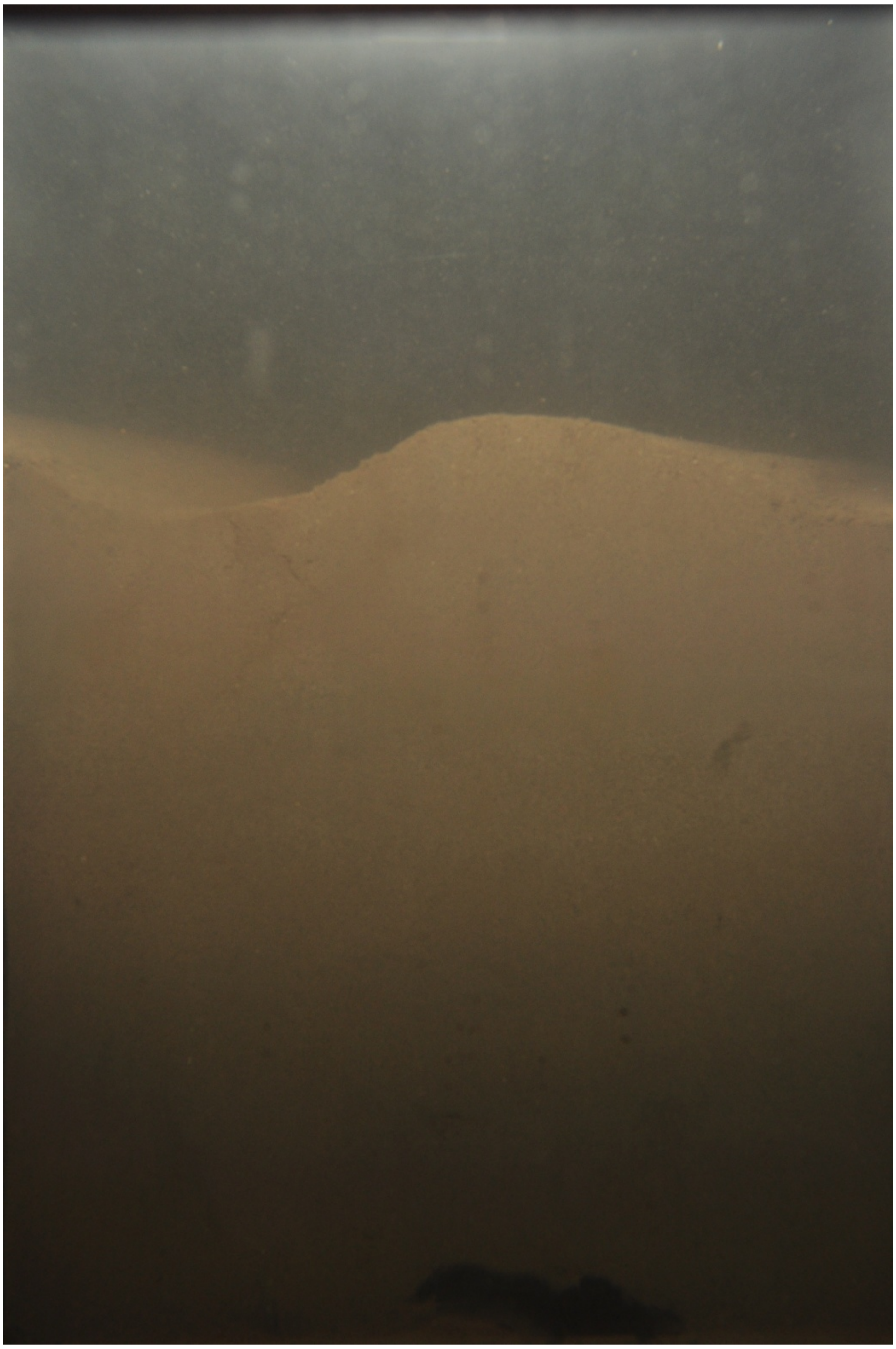


Figure 24.1 SPI image of Benthic A.

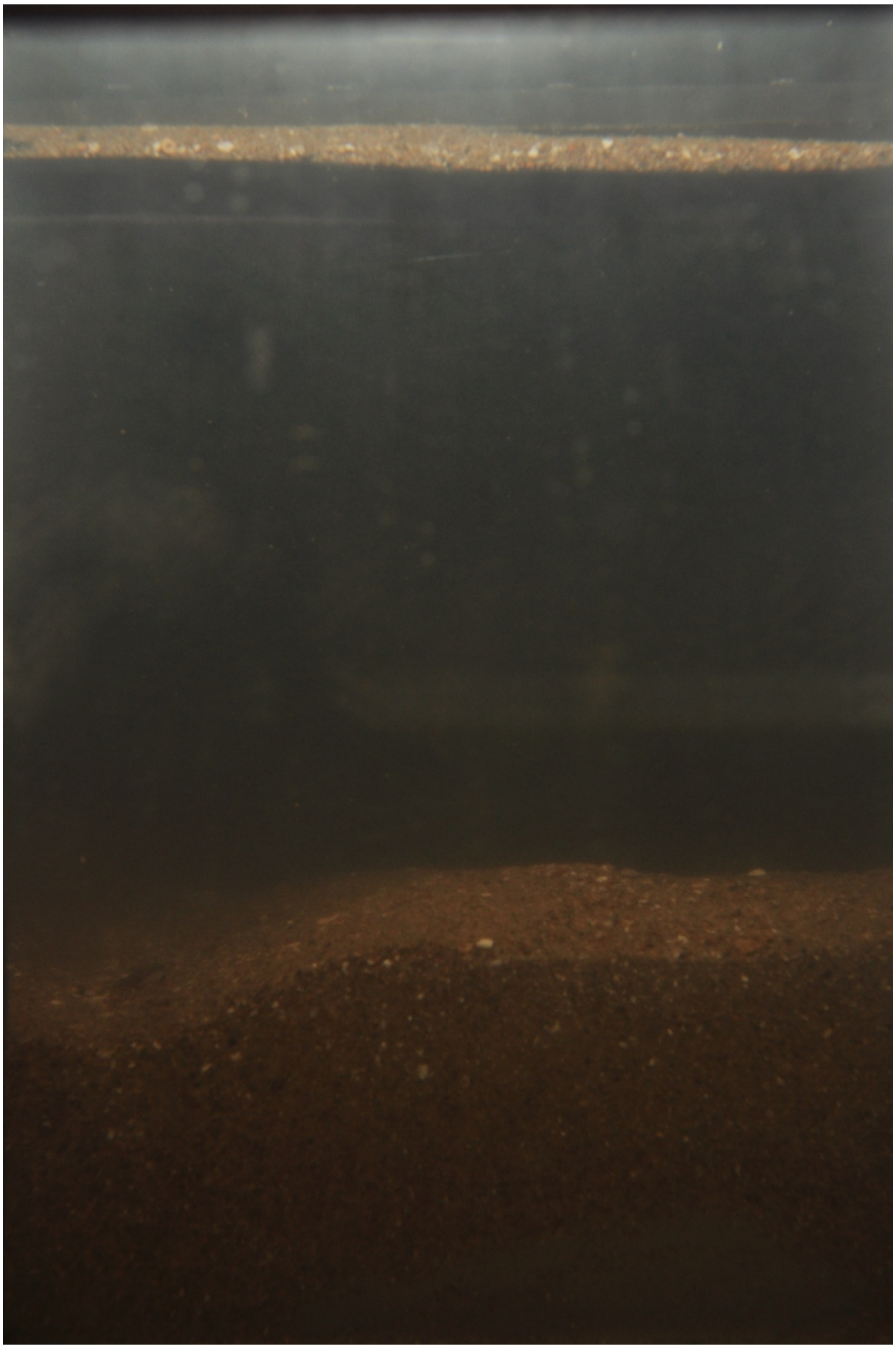


Figure 24.2 SPI image of Benthic G.

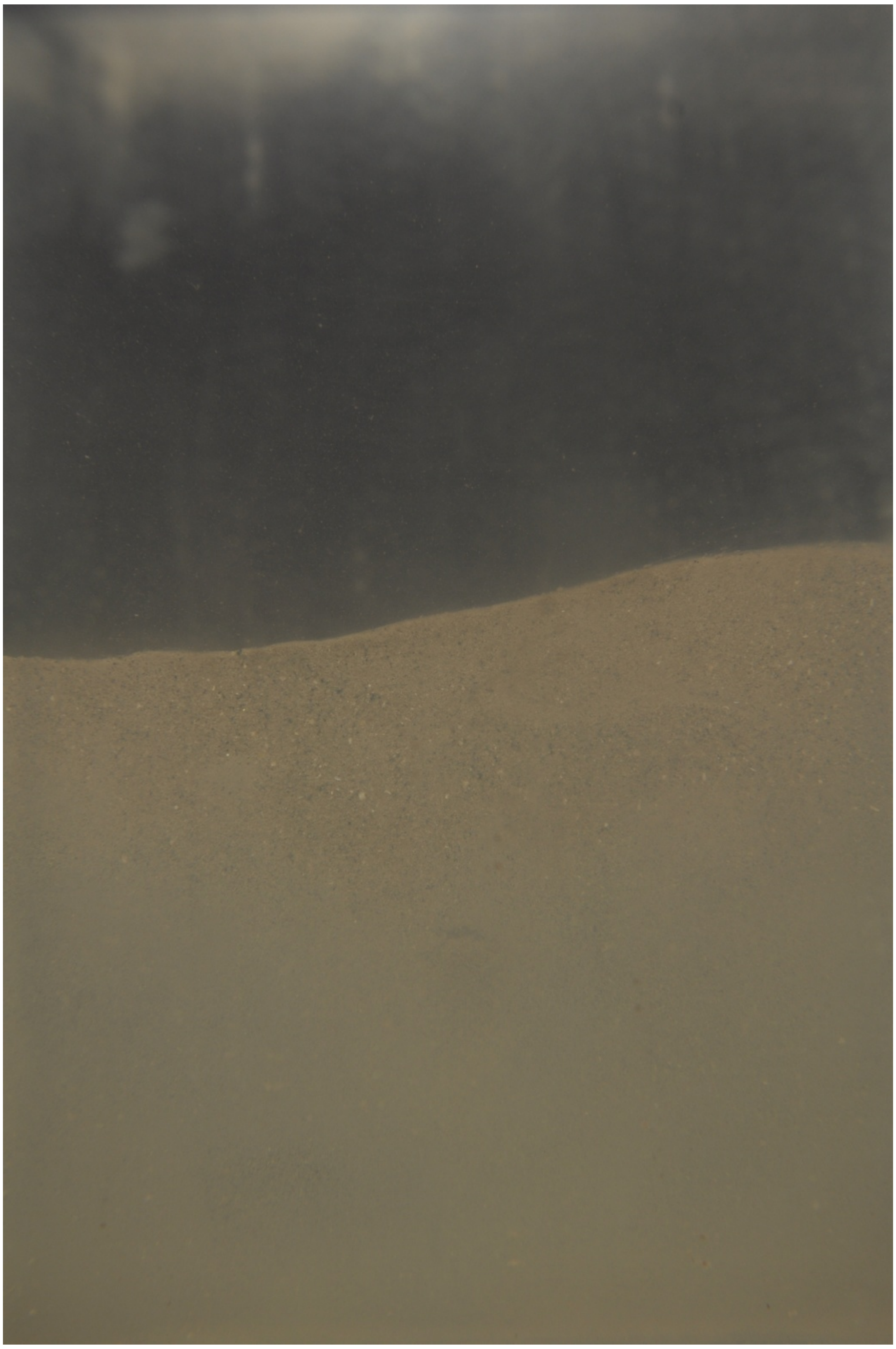


Figure 24.3 SPI image of Benthic H.

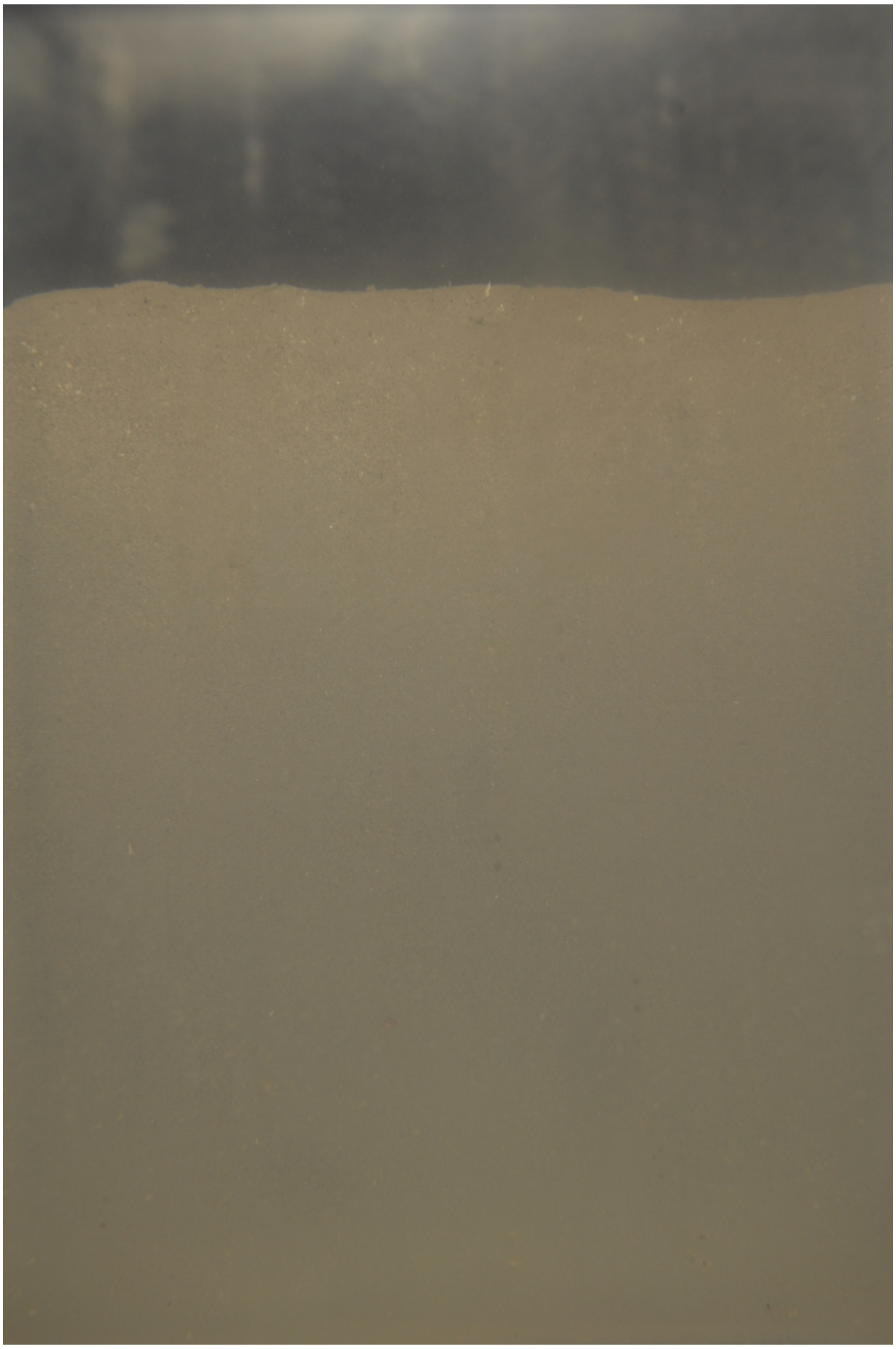


Figure 24.4 SPI image of Benthic I.

25. Acknowledgements

We would like to thank the officers and engineers of RRS *Discovery*, the NMF technicians and crew who all when to great lengths to try to make things work for us and keep them working, and of course the catering team for excellent food to raise our spirits. NMF personnel provided excellent support under challenging conditions with the aim of delivering the maximum level of capability.

GEAR CODE	STN NBR	SITE	Description	STATION START				At BOTTOM				STATION END				SEA FLOOR DEPTH at bottom (not applicable to transects)	CONTACT for event	COMMENTS	NMF ID
				Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Uncorr. (m)			
MOOR	001	East of Celtic Deep	Guard buoy	21/03/2014	09:30	51.12890	-6.15210	-	-	-	-	21/03/2014	00:43	51.12630	-6.15920	105	Sivyer	Deployment (end = anchor in)	
BL	002	East of Celtic Deep	CEFAS mini lander	21/03/2014	14:05	51.12370	-6.16300	-	-	-	-	21/03/2014	14:26	51.12190	-6.16510	103	Sivyer	Delayed deployment (start = lander in)	
UCCTD	003	East of Celtic Deep	Titanium	21/03/2014	15:10	51.12100	-6.16622	21/03/2014	15:18	51.12100	-6.16620	21/03/2014	15:32	51.12100	-6.16627	103	Statham	Test	CTD001
UCCTD	004	East of Celtic Deep	Titanium	21/03/2014	15:52	51.12115	-6.16623	21/03/2014	15:56	51.12100	-6.16623	21/03/2014	16:17	51.12100	-6.16623	105	Statham	WP1/WP3	CTD002
DGRAB	005	East of Celtic Deep	Day grab	-	-	-	-	21/03/2014	17:32	51.12087	-6.16600	-	-	-	-	107	Fones	Mud	
DGRAB	006	Benthic A1	Day grab	-	-	-	-	21/03/2014	19:44	51.21358	-6.13700	-	-	-	-	?	Fones	Silty mud	
DGRAB	007		Day grab	-	-	-	-	21/03/2014	20:47	51.21292	-6.13628	-	-	-	-	110	Fones	Mud	
DGRAB	008		Day grab	-	-	-	-	21/03/2014	21:09	51.21219	-6.13543	-	-	-	-	112	Fones	Failure	
DGRAB	009		Day grab	-	-	-	-	21/03/2014	21:23	51.21219	-6.13541	-	-	-	-	101	Fones	Silty mud	
DGRAB	010		Day grab	-	-	-	-	21/03/2014	21:44	51.21151	-6.13448	-	-	-	-	111	Fones	Failure	
DGRAB	011	Benthic A2	Day grab	-	-	-	-	21/03/2014	21:56	51.21149	-6.13448	-	-	-	-	110	Fones	Silty mud	
DGRAB	012		Day grab	-	-	-	-	21/03/2014	22:15	51.21084	-6.13354	-	-	-	-	109	Fones	Silty mud	
DGRAB	013		Day grab	-	-	-	-	21/03/2014	22:34	51.21026	-6.13247	-	-	-	-	107	Fones	Silty mud	
DGRAB	014		Day grab	-	-	-	-	21/03/2014	22:52	51.20970	-6.13131	-	-	-	-	110	Fones	Silty mud	
DGRAB	015	Benthic A3	Day grab	-	-	-	-	21/03/2014	23:12	51.20905	-6.13003	-	-	-	-	108	Fones	Silty mud	
DGRAB	016	Benthic A4	Day grab	-	-	-	-	21/03/2014	23:41	51.21357	-6.13008	-	-	-	-	109	Fones	Silty mud	
DGRAB	017	Benthic A5	Day grab	-	-	-	-	22/03/2014	00:11	51.20903	-6.13728	-	-	-	-	109	Fones	Silty mud	
MOOR	018	Nymph Bank	Guard buoy	22/03/2014	00:31	51.04500	-6.59400	-	-	-	-	22/03/2014	08:11	51.04400	-6.59740	105	Fones	Deployment (end = anchor in)	
BL	019	Nymph Bank	CEFAS mini lander	22/03/2014	10:04	51.04330	-6.59990	-	-	-	-	22/03/2014	10:58	51.04250	-6.60580	106	Sivyer	Deployment (start = lander in)	
UCCTD	020	Nymph Bank	Titanium	22/03/2014	11:57	51.04233	-6.60730	22/03/2014	12:02	51.04232	-6.60733	22/03/2014	12:16	51.04230	-6.60732	104	Statham	WP1/WP3	CTD003
MOOR	021	East of Haig Frais	Guard buoy	22/03/2014	16:56	50.59400	-7.16100	-	-	-	-	22/03/2014	17:20	50.59500	-7.01900	109	Sivyer	Deployment (end = anchor in)	
BL	022	East of Haig Frais	CEFAS mini lander	22/03/2014	19:43	50.59610	-7.02210	22/03/2014	19:51	50.59600	-7.02210	22/03/2014	20:00	50.59650	-7.02570	109	Sivyer	Deployment (start = lander in)	
UCCTD	023	East of Haig Frais	Titanium	22/03/2014	20:57	50.59707	-7.03000	22/03/2014	21:02	50.59710	-7.02993	22/03/2014	21:10	50.59708	-7.02993	111	Statham/Sivyer	Calibration for mini lander	CTD004
DGRAB	024	Benthic D1	Day grab	-	-	-	-	22/03/2014	22:31	50.50369	-7.05816	-	-	-	-	112	Fones	Sandy mud	
DGRAB	025		Day grab	-	-	-	-	22/03/2014	22:55	50.50369	-7.05120	-	-	-	-	111	Fones	Failure	
DGRAB	026		Day grab	-	-	-	-	22/03/2014	23:05	50.50370	-7.05122	-	-	-	-	111	Fones	Failure	
DGRAB	027	Benthic D2	Day grab	-	-	-	-	22/03/2014	23:19	50.50369	-7.05120	-	-	-	-	111	Fones	Sandy mud	
DGRAB	028	Benthic D3	Day grab	-	-	-	-	22/03/2014	23:57	50.49918	-7.05109	-	-	-	-	112	Fones	Sandy mud	
DGRAB	029	Benthic D4	Day grab	-	-	-	-	23/03/2014	00:37	50.49915	-7.05826	-	-	-	-	111	Fones	Sandy mud	
DGRAB	030		Day grab	-	-	-	-	23/03/2014	01:10	50.50011	-7.05994	-	-	-	-	112	Fones	Failure	
DGRAB	031		Day grab	-	-	-	-	23/03/2014	01:24	50.50000	-7.05488	-	-	-	-	110	Fones	Failure	
DGRAB	032	Benthic D5	Day grab	-	-	-	-	23/03/2014	01:36	50.50098	-7.05485	-	-	-	-	112	Fones	Sandy mud	
DGRAB	033	Benthic C1a	Day grab	-	-	-	-	23/03/2014	03:23	50.61072	-6.88333	-	-	-	-	105	Fones	Big rock	
DGRAB	034		Day grab	-	-	-	-	23/03/2014	03:36	50.61069	-6.88334	-	-	-	-	107	Fones	Failure	
DGRAB	035		Day grab	-	-	-	-	23/03/2014	04:18	50.61068	-6.87720	-	-	-	-	106	Fones	Failure	
DGRAB	036	Benthic C2	Day grab	-	-	-	-	23/03/2014	04:30	50.61070	-6.87723	-	-	-	-	106	Fones	Muddy gravelly sand (no subsample)	
UCCTD	037	Celtic Deep	Titanium	23/03/2014	08:45	51.12823	-6.56232	23/03/2104	08:51	51.12823	-6.56232	23/03/2014	08:56	51.12823	-6.56220	101	Statham	Suface bottle only	CTD005
MOOR	038	Celtic Deep	CEFAS smart buoy	23/03/2014	11:02	51.13756	-6.56711	-	-	-	-	23/03/2014	11:07	51.13757	-6.56712	101	Sivyer	Recovery deployment 7 (end = buoy on deck)	
MOOR	039	Celtic Deep	CEFAS smart buoy	23/03/2014	15:09	51.13637	-6.56358	-	-	-	-	23/03/2014	15:43	51.13732	-6.56748	99	Sivyer	Deployment (end = anchor in)	
UCCTD	040	Celtic Deep	Titanium	23/03/2014	16:17	51.13792	-6.56963	23/03/2014	16:22	51.13792	-6.56963	23/03/2014	16:28	51.13792	-6.56963	100	Statham/Sivyer	Calibration for smart buoy	CTD006
UCCTD	041		Titanium	23/03/2014	18:37	51.21350	-6.13707	23/03/2014	18:43	51.21350	-6.13703	23/03/2014	18:45	51.21350	-6.13707	109	Staham	Bulk water for incubations	CTD007
SEDCAM	042	Benthic B1	SPI camera	23/03/2014	23:40	51.09500	-6.70000	-	-	-	-	23/03/2014	23:50	51.09500	-6.66900	104	Silburn	3 replicate samples	
SEDCAM	043	Benthic B2	SPI camera	24/03/2014	00:33	51.09500	-6.69300	-	-	-	-	24/03/2014	00:40	51.09500	-6.69300	104	Silburn	3 replicate samples	
SEDCAM	044	Benthic B3	SPI camera	24/03/2014	01:07	51.09000	-6.69300	-	-	-	-	24/03/2014	01:14	51.09100	-6.69300	102	Silburn	3 replicate samples	
SEDCAM	045	Benthic B4	SPI camera	24/03/2014	01:48	51.09100	-6.70000	-	-	-	-	24/03/2014	02:01	51.09100	-6.70000	102	Silburn	3 replicate samples	
SEDCAM	046	Benthic B5	SPI camera	24/03/2014	02:32	51.09300	-6.69700	-	-	-	-	24/03/2014	02:40	51.09300	-6.69700	102	Silburn	3 replicate samples	
SEDCAM	047	Benthic B6	SPI camera	24/03/2014	03:14	51.08400	-6.69700	-	-	-	-	24/03/2014	03:20	51.08300	-6.69700	100	Silburn	3 replicate samples	
SEDCAM	048	Benthic B7	SPI camera	24/03/2014	03:47	51.07500	-6.69700	-	-	-	-	24/03/2014	03:54	51.07500	-6.69700	99	Silburn	3 replicate samples	
SEDCAM	049	Benthic F1	SPI camera	24/03/2014	04:55	51.07720	-6.65430	-	-	-	-	24/03/2014	05:01	51.07717	-6.65440	100	Silburn	3 replicate samples	
SEDCAM	050	Benthic F2	SPI camera	24/03/2014	05:28	51.07268	-6.65441	-	-	-	-	24/03/2014	05:32	51.07260	-6.65442	100	Silburn	3 replicate samples	

GEAR CODE	STN NBR	SITE	Description	STATION START				At BOTTOM				STATION END				SEA FLOOR DEPTH at bottom (not applicable to transects)	CONTACT for event	COMMENTS	NMF ID
				Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Uncorr. (m)			
SEDCAM	051	Benthic F3	SPI camera	24/03/2014	05:59	51.07259	-6.64727	-	-	-	-	24/03/2014	06:03	51.07251	-6.64278	101	Silburn	3 replicate samples	
SEDCAM	052	Benthic F4	SPI camera	24/03/2014	06:26	51.07696	-6.64726	-	-	-	-	24/03/2014	06:31	51.07690	-6.64727	100	Silburn	3 replicate samples	
SEDCAM	053	Benthic F5	SPI camera	24/03/2014	06:57	51.07468	-6.65082	-	-	-	-	24/03/2014	07:03	51.07462	-6.65079	101	Silburn	3 replicate samples	
UCCTD	054	Benthic D	Titanium	25/03/2014	07:15	50.50367	-7.05808	25/03/2014	07:23	50.50367	-7.05808	25/03/2014	07:34	50.50372	-7.05803	110	Statham	WP1/WP3	CTD008
UCCTD	055	Benthic A	Titanium	25/03/2014	13:26	51.20967	-6.13878	25/03/2014	13:31	51.20968	-6.13880	25/03/2014	13:45	51.20967	-6.13880	111	Statham	WP1/WP3	CTD009
SEDCAM	056	Benthic G1	SPI camera	25/03/2014	16:42	51.07400	-6.58400	-	-	-	-	25/03/2014	11:31	51.07400	-6.58400	102	Silburn	3 replicate samples. Video feed failed	
SEDCAM	057	Benthic G2	SPI camera	25/03/2014	18:38	51.07000	-6.58400	-	-	-	-	25/03/2014	18:43	51.07000	-6.58400	102	Silburn	3 replicate samples	
SEDCAM	058	Benthic G3	SPI camera	25/03/2014	19:09	51.07000	-6.57700	-	-	-	-	25/03/2014	19:15	51.07000	-6.57700	102	Silburn	3 replicate samples	
SEDCAM	059	Benthic G4	SPI camera	25/03/2014	19:36	51.07400	-6.57700	-	-	-	-	25/03/2014	19:41	51.07400	-6.57700	100	Silburn	3 replicate samples	
SEDCAM	060	Benthic G5	SPI camera	25/03/2014	19:58	51.07200	-6.58100	-	-	-	-	25/03/2014	20:05	51.07200	-6.58100	101	Silburn	3 replicate samples	
MOOR	061	Candyfloss	Guard buoy	26/03/2014	10:36	49.39469	-8.59910	-	-	-	-	26/03/2014	11:12	49.39730	-8.60010	151	Hopkins	WP1 deployment (end = anchor in)	
MOOR	062	Candyfloss	T-chain	26/03/2014	15:32	49.39325	-8.60085	-	-	-	-	26/03/2014	16:51	49.40013	-8.60256	150	Balfour/Hopkins	WP1 deployment (end = anchor in)	
BL	063	Candyfloss	Bedframe	26/03/2014	19:15	49.39941	-8.59816	26/03/2014	19:25	49.39939	-8.59819	-	-	-	-	148	Balfour/Hopkins	Deployment	
SEDCAM	064	Benthic CF1	SPI camera	26/03/2014	19:58	49.40300	-8.60700	-	-	-	-	26/03/2014	20:03	49.40300	-8.60700	150	Silburn	3 replicates (one attempt bounced)	
SEDCAM	065	Benthic CF2	SPI camera	26/03/2014	20:47	49.39400	-8.60700	-	-	-	-	26/03/2014	20:53	49.39400	-8.60700	150	Silburn	3 replicates	
SEDCAM	066	Benthic CF3	SPI camera	26/03/2014	21:47	49.39400	-8.59400	-	-	-	-	26/03/2014	21:57	49.39400	-8.59300	150	Silburn	3 replicates (two attemps may have failed)	
SEDCAM	067	Benthic CF4	SPI camera	26/03/2014	22:37	49.40400	-8.59300	-	-	-	-	26/03/2014	22:47	49.40400	-8.59300	150	Silburn	3 replicates	
DGRAB	068		Day grab	-	-	-	-	26/03/2014	23:10	49.40394	-8.59294	-	-	-	-	151	Fones	Failure	
DGRAB	069		Day grab	-	-	-	-	26/03/2014	23:25	49.40394	-8.59294	-	-	-	-	150	Fones		
MOOR	070	Candyfloss	ADCP mooring	27/03/2014	10:09	49.40045	-8.60369	-	-	-	-	27/03/2014	10:35	49.40184	-8.59980	150	Rippeth	WP1 deployment (end = anchor in)	
MOOR	071	Candyfloss	ODAS buoy	27/03/2014	15:26	49.39944	-8.59857	-	-	-	-	27/03/2014	16:03	49.40209	-8.59514	151	Fenna	WP1 deployment (end = anchor in)	
MOOR	072	Candyfloss	CEFAS smart buoy	27/03/2014	18:19	49.39960	-8.60604	-	-	-	-	27/03/2014	19:08	49.40192	-8.60372	149	Sivyer	WP1 deployment (end = anchor in)	
UCCTD	073	Candyfloss	Titanium	27/03/2014	19:32	49.40252	-8.60320	27/03/2014	19:38	49.40252	-8.60320	27/03/2014	19:56	49.40252	-8.60320	148	Statham	WP1/WP3	CTD010
AUV	074	Shelf break area	Slocum glider	28/03/2014	06:25	48.56792	-9.51527	-	-	-	-	-	-	-	-	225	White	Deployment (Stella 43b). WP1/WP3	
AUV	075	Near Shelf break	Slocum glider	28/03/2014	09:25	48.56786	-9.51407	-	-	-	-	-	-	-	-	224	White	Deployment (Raleigh 399). WP1/WP3	
AUV	076	Shelf break area	Seaglider	28/03/2014	14:26	48.56836	-9.51436	-	-	-	-	-	-	-	-	225	White	Deployment (Fomalhault SG525)	
AUV	077	Shelf break area	Seaglider	28/03/2014	16:41	48.57133	-9.51317	-	-	-	-	-	-	-	-	201	White	Deployment (Eltanin SG550)	
UCCTD	078	Shelf break area	Titanium	28/03/2014	15:41	48.57112	-9.51267	28/03/2014	15:49	48.57113	-9.51270	28/03/2014	16:09	48.57113	-9.51272	204	Staham	WP1/WP3/Calibration for gliders (no. out of	CTD011
BL	079	Benthic G	NOCL benthic lander	31/03/2014	12:46	51.07492	-6.58476	31/03/2014	12:54	51.07492	-6.58477	07/04/2014	09:09	51.07725	-6.58765	100	Balfour/de Souza	Deployment/recovery (end = recovery)	
DGRAB	080	Benthic G1	Day grab	-	-	-	-	31/03/2014	13:40	51.07260	-6.58110	-	-	-	-	100	Thompson	Muddy sand	
DGRAB	081	Benthic G1	Day grab	-	-	-	-	31/03/2014	14:15	51.07260	-6.58110	-	-	-	-	100	Thompson	Muddy sand	
DGRAB	082	Benthic G1	Day grab	-	-	-	-	31/03/2014	?	51.07260	-6.58110	-	-	-	-	103	Thompson	Meteorite like rock	
UCCTD	083	Benthic A	Titanium	31/03/2014	18:55	51.21372	-6.13722	31/03/2014	19:00	51.21372	-6.13727	31/03/2014	19:17	51.21372	-6.13723	111	Statham	Bulk water for incubations	CTD012
MULCORE	084	Benthic A	Multicorer	-	-	-	-	31/03/2014	19:14	51.21360	-6.13730	-	-	-	-	110	Stahl		
MULCORE	085	Benthic A	Multicorer	-	-	-	-	31/03/2014	20:52	51.21350	-6.13730	-	-	-	-	110	Lichtschlag		
BOXCORE	086	Benthic A	NIOZ corer	-	-	-	-	31/03/2014	22:09	51.21350	-6.13730	-	-	-	-	107	Wood/Hale	Practice core	
BOXCORE	087	Benthic A	NIOZ corer	-	-	-	-	31/03/2014	22:33	51.21330	-6.13740	-	-	-	-	109	Main/Kitidis	Pulse-chase, pigments, microbial abundance	
BOXCORE	088	Benthic A	NIOZ corer	-	-	-	-	31/03/2014	22:49	51.21330	-6.13740	-	-	-	-	106	Silburn	Porewater	
BOXCORE	089	Benthic A	NIOZ corer	-	-	-	-	31/03/2014	23:09	51.21350	-6.13740	-	-	-	-	107		Misfire	
BOXCORE	090	Benthic A	NIOZ corer	-	-	-	-	31/03/2014	23:20	51.21340	-6.13730	-	-	-	-	106	Main/Kitidis	Pulse-chase, pigments, microbial abundance	
BOXCORE	091	Benthic A	NIOZ corer	-	-	-	-	31/03/2014	23:39	51.21340	-6.13740	-	-	-	-	106	Main/Kitidis	Pulse-chase, pigments	
BOXCORE	092	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	00:00	51.21340	-6.13730	-	-	-	-	106	Silburn	Porewater	
BOXCORE	093	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	00:18	51.21340	-6.13730	-	-	-	-	106	Main/Kitidis	Pulse-chase, microbial abundance	
BOXCORE	094	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	00:36	51.21340	-6.13730	-	-	-	-	106	Main/Kitidis	Pulse-chase, pigments	
BOXCORE	095	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	00:53	51.21340	-6.13730	-	-	-	-	106	Silburn	Discarded (possible hole)	
BOXCORE	096	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	01:10	51.21338	-6.13729	-	-	-	-	107	Silburn	Porewater	
BOXCORE	097	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	01:28	51.21340	-6.13730	-	-	-	-	106	Main/Kitidis	Pulse-chase, molecular biomass	
BOXCORE	098	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	01:46	51.21340	-6.13730	-	-	-	-	106	Silburn	PSA, O2, porosity, RFA	
BOXCORE	099	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	02:05	51.21330	-6.13730	-	-	-	-	107		Discarded	
BOXCORE	100	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	02:23	51.21333	-6.13728	-	-	-	-	106	Wood/Hale	Core 1	
BOXCORE	101	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	02:40	51.21333	-6.13730	-	-	-	-	109	Wood/Hale	Core 2	

GEAR CODE	STN NBR	SITE	Description	STATION START				At BOTTOM				STATION END				SEA FLOOR DEPTH at bottom (not applicable to transects)	CONTACT for event	COMMENTS	NMF ID
				Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Uncorr. (m)			
BOXCORE	102	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	02:57	51.21332	-6.13710	-	-	-	-	108	Wood/Hale	Core 3	
BOXCORE	103	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	03:12	51.21333	-6.13731	-	-	-	-	108	Wood/Hale	Core 4	
BOXCORE	104	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	03:24	51.21339	-6.13730	-	-	-	-	109	Wood/Hale	Core 5	
BOXCORE	105	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	03:46	51.21332	-6.13730	-	-	-	-	109	Stahl/Kitidis	Incubation 1	
BOXCORE	106	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	04:08	51.21328	-6.13731	-	-	-	-	109	Stahl/Kitidis	Incubation 2	
BOXCORE	107	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	04:27	51.21330	-6.13729	-	-	-	-	109	Stahl/Kitidis	Incubation 3	
BOXCORE	108	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	04:47	51.21327	-6.13731	-	-	-	-	111	Stahl/Kitidis	Incubation 4	
BOXCORE	109	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	05:06	51.21329	-6.13730	-	-	-	-	110	Stahl/Kitidis	Incubation 5	
BOXCORE	110	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	05:25	51.21325	-6.13728	-	-	-	-	110	Stahl/Kitidis	Incubation 6	
BOXCORE	111	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	-	-	-	-	-	-	-	-	-	Wire slipped (re-termination)	
BOXCORE	112	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	20:03	51.21319	-6.13748	-	-	-	-	111	Silburn/Fones/Bone		
BOXCORE	113	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	20:18	51.21318	-6.13747	-	-	-	-	110	Silburn/Fones/Bone/Kitidis	Molecular biomass	
BOXCORE	114	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	20:33	51.21318	-6.13746	-	-	-	-	110	Misfire		
BOXCORE	115	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	20:45	51.21319	-6.13747	-	-	-	-	110	Silburn/Fones		
BOXCORE	116	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	21:04	51.21314	-6.13748	-	-	-	-	110	Silburn/Fones		
BOXCORE	117	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	21:17	51.21314	-6.13748	-	-	-	-	110	Silburn/Fones		
BOXCORE	118	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	21:34	51.21315	-6.13747	-	-	-	-	109	Fones/Thompson	Whole core 1	
BOXCORE	119	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	21:48	51.21314	-6.13748	-	-	-	-	110	Fones/Thompson	Whole core 2	
BOXCORE	120	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	22:09	51.21309	-6.13749	-	-	-	-	108	Fones/Thompson	Whole core 3	
BOXCORE	121	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	22:30	51.21309	-6.13748	-	-	-	-	107	Fones/Thompson	Whole core 4	
BOXCORE	122	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	22:49	51.21309	-6.13748	-	-	-	-	108	Fones/Thompson	Whole core 5	
BOXCORE	123	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	23:05	51.21309	-6.13749	-	-	-	-	107	Fones/Thompson	Whole core 6	
BOXCORE	124	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	23:21	51.21304	-6.13747	-	-	-	-	107	Widdicombe		
BOXCORE	125	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	23:35	51.21304	-6.13749	-	-	-	-	106		Failure	
BOXCORE	126	Benthic A	NIOZ corer	-	-	-	-	01/04/2014	?	51.21305	-6.13748	-	-	-	-	106	Wood/Hale	Core 6	
BOXCORE	127	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	00:09	51.21304	-6.13747	-	-	-	-	106	Widdicombe		
BOXCORE	128	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	00:26	51.21300	-6.13748	-	-	-	-	106	Wood/Hale	Core 7	
BOXCORE	129	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	00:42	51.21300	-6.13746	-	-	-	-	106	Wood/Hale	Core 8	
BOXCORE	130	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	00:57	51.21300	-6.13748	-	-	-	-	106	Widdicombe		
BOXCORE	131	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	01:10	51.21300	-6.13748	-	-	-	-	107		Failure	
BOXCORE	132	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	01:28	51.21296	-6.13747	-	-	-	-	106	Wood/Hale	Core 9	
BOXCORE	133	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	01:40	51.21295	-6.13748	-	-	-	-	106	Widdicombe		
BOXCORE	134	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	01:55	51.21295	-6.13748	-	-	-	-	106	Wood/Hale	Core 10	
BOXCORE	135	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	02:08	51.21296	-6.13747	-	-	-	-	106	Wood/Hale	Core 11	
BOXCORE	136	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	02:21	51.21296	-6.13746	-	-	-	-	107	Wood/Hale	Core 12	
BOXCORE	137	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	02:32	51.21296	-6.13747	-	-	-	-	107	Widdicombe		
BOXCORE	138	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	02:43	51.21292	-6.13748	-	-	-	-	108	Wood/Hale	Core 14	
BOXCORE	139	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	02:57	51.21292	-6.13748	-	-	-	-	108	Wood/Hale	Core 13	
BOXCORE	140	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	03:10	51.21291	-6.13747	-	-	-	-	108	Wood/Hale/Fones		
BOXCORE	141	Benthic A	NIOZ corer	-	-	-	-	02/04/2014	03:25	51.21292	-6.13747	-	-	-	-	101	Bone		
BOXCORE	142	Benthic A	SMBA corer	-	-	-	-	02/04/2014	04:37	51.21289	-6.13724	-	-	-	-	109	Widdicombe		
BOXCORE	143	Benthic A	SMBA corer	-	-	-	-	02/04/2014	05:22	51.21292	-6.13745	-	-	-	-	110	Widdicombe		
BOXCORE	144	Benthic A	SMBA corer	-	-	-	-	02/04/2014	06:08	51.21288	-6.13746	-	-	-	-	112	Widdicombe		
BOXCORE	145	Benthic A	SMBA corer	-	-	-	-	02/04/2014	06:48	51.21288	-6.13745	-	-	-	-	112	Widdicombe		
BOXCORE	146	Benthic A	SMBA corer	-	-	-	-	02/04/2014	07:20	51.21280	-6.13765	-	-	-	-	111	Widdicombe		
SEDCAM	147	Benthic A1	SPI camera	02/04/2014	10:44	51.21358	-6.13748	-	-	-	-	02/04/2014	10:56	51.21350	-6.13751	110	Silburn	3 replicates	
SEDCAM	148	Benthic A2	SPI camera	02/04/2014	11:31	51.20885	-6.13750	-	-	-	-	02/04/2014	11:37	51.20574	-6.13749	107	Silburn	3 replicates	
SEDCAM	149	Benthic A3	SPI camera	02/04/2014	12:07	51.20887	-6.13037	-	-	-	-	02/04/2014	12:15	51.20880	-6.13038	107	Silburn	3 replicates	
UCCTD	150	Benthic G	Titanium	02/04/2014	17:34	51.07287	-6.58117	02/04/2014	17:42	51.07287	-6.58117	02/04/2014	17:52	51.07287	-6.58117	104	Statham	Bulk water for incubations	CTD013
BOXCORE	151	Benthic G	SMBA corer	-	-	-	-	02/04/2014	18:55	51.07502	-6.57747	-	-	-	-	105		Stone - bent box	
BOXCORE	152	Benthic G	SMBA corer	-	-	-	-	02/04/2014	19:32	51.07496	-6.57750	-	-	-	-	106	Widdicombe		

GEAR CODE	STN NBR	SITE	Description	STATION START				At BOTTOM				STATION END				SEA FLOOR DEPTH at bottom (not applicable to transects)	CONTACT for event	COMMENTS	NMF ID
				Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Uncorr. (m)			
BOXCORE	153	Benthic G	NIOZ corer	-	-	-	-	02/04/2014	21:04	51.07496	-6.57756	-	-	-	-	104	Wood/Hale/Kitidis	Microbial abundance, pigments, core 1	
BOXCORE	154	Benthic G	NIOZ corer	-	-	-	-	02/04/2014	21:21	51.07496	-6.57755	-	-	-	-	103	Wood/Hale/Kitidis	Microbial abundance, pigments, core 2	
BOXCORE	155	Benthic G	NIOZ corer	-	-	-	-	02/04/2014	21:45	51.07497	-6.57759	-	-	-	-	102	Wood/Hale/Kitidis	Microbial abundance, pigments, core 3	
BOXCORE	156	Benthic G	NIOZ corer	-	-	-	-	02/04/2014	22:01	51.07495	-6.57760	-	-	-	-	102		Misfire - core bit	
BOXCORE	157	Benthic G	NIOZ corer	-	-	-	-	02/04/2014	22:16	51.07494	-6.57763	-	-	-	-	102	Lichtschlag		
BOXCORE	158	Benthic G	NIOZ corer	-	-	-	-	02/04/2014	22:36	51.07490	-6.57759	-	-	-	-	101	Lichts./Kitidis/Wood/Hale	Pigments, core 5	
BOXCORE	159	Benthic G	NIOZ corer	-	-	-	-	02/04/2014	22:52	51.07489	-6.57760	-	-	-	-	102	Wood/Hale	Core 4	
BOXCORE	160	Benthic G	NIOZ corer	-	-	-	-	02/04/2014	23:06	51.07484	-6.57763	-	-	-	-	101	Wood/Hale	Core 6	
BOXCORE	161	Benthic G	NIOZ corer	-	-	-	-	02/04/2014	23:21	51.07491	-6.57749	-	-	-	-	102		Failure - not enough sediment	
BOXCORE	162	Benthic G	NIOZ corer	-	-	-	-	02/04/2014	23:39	51.07485	-6.57760	-	-	-	-	102	Silburn		
BOXCORE	163	Benthic G	NIOZ corer	-	-	-	-	02/04/2014	23:53	51.07485	-6.57763	-	-	-	-	100		Failure - not enough sediment	
BOXCORE	164	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	00:09	51.07485	-6.57762	-	-	-	-	101		Failure - not enough sediment	
BOXCORE	165	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	00:27	51.07486	-6.57764	-	-	-	-	101		Failure - not enough sediment	
BOXCORE	166	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	00:49	51.07419	-6.57764	-	-	-	-	100	Kitidis	Microbial abundance, pigments, molecular	
BOXCORE	167	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	01:07	51.07420	-6.57765	-	-	-	-	101		Failure - not enough sediment	
BOXCORE	168	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	01:31	51.07510	-6.57763	-	-	-	-	100	Widdicombe		
BOXCORE	169	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	01:44	51.07595	-6.57760	-	-	-	-	99	Wood/Hale	Core 7	
BOXCORE	170	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	01:59	51.07510	-6.57761	-	-	-	-	101	Wood/Hale	Core 8	
BOXCORE	171	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	02:14	51.07509	-6.57761	-	-	-	-	100	Widdicombe		
BOXCORE	172	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	02:24	51.07509	-6.57762	-	-	-	-	100	Widdicombe		
BOXCORE	173	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	02:37	51.07521	-6.57762	-	-	-	-	100	Wood/Hale	Core 9	
BOXCORE	174	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	02:50	51.07509	-6.57761	-	-	-	-	100	Wood/Hale/Silburn	Core 10	
BOXCORE	175	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	03:03	51.07514	-6.57762	-	-	-	-	101	Widdicombe		
BOXCORE	176	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	03:17	51.07514	-6.57760	-	-	-	-	100	Wood/Hale	Core 11	
BOXCORE	177	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	03:30	51.07515	-6.57762	-	-	-	-	101	Wood/Hale	Core 12	
BOXCORE	178	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	03:44	51.07514	-6.57761	-	-	-	-	101	Wood/Hale		
BOXCORE	179	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	03:56	51.07516	-6.57763	-	-	-	-	102	Wood/Hale/Silburn		
BOXCORE	180	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	04:10	51.07520	-6.57762	-	-	-	-	102	Widdicombe		
BOXCORE	181	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	04:25	51.07522	-6.57754	-	-	-	-	102		Failure	
BOXCORE	182	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	04:39	51.07521	-6.57757	-	-	-	-	103		Failure - not enough sediment	
BOXCORE	183	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	04:51	51.07527	-6.57756	-	-	-	-	102		Failure	
BOXCORE	184	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	05:04	51.07525	-6.57756	-	-	-	-	103		Failure	
BOXCORE	185	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	05:19	51.07503	-6.57755	-	-	-	-	104	Silburn		
BOXCORE	186	Benthic G	NIOZ corer	-	-	-	-	03/04/2014	05:30	51.07504	-6.57776	-	-	-	-	103	Wood/Hale		
BOXCORE	187	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	05:11	51.07497	-6.57753	-	-	-	-	103	Stahl/Kitidis		
BOXCORE	188	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	05:26	51.07497	-6.57753	-	-	-	-	103	Stahl/Kitidis		
BOXCORE	189	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	05:40	51.07499	-6.57753	-	-	-	-	103	Stahl/Kitidis		
BOXCORE	190	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	05:51	51.07498	-6.57752	-	-	-	-	103	Kitidis		
BOXCORE	191	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	06:02	51.07497	-6.57754	-	-	-	-	104	Stahl/Kitidis		
BOXCORE	192	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	06:14	51.07499	-6.57753	-	-	-	-	104	Stalh/Kitidis		
BOXCORE	193	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	06:25	51.07502	-6.57752	-	-	-	-	104	Stahl		
BOXCORE	194	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	06:36	51.07503	-6.57753	-	-	-	-	104	Main		
BOXCORE	195	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	06:48	51.07503	-6.57753	-	-	-	-	104	Main		
BOXCORE	196	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	06:59	51.07503	-6.57753	-	-	-	-	104	Main		
BOXCORE	197	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	07:10	51.07489	-6.57753	-	-	-	-	104	Main		
BOXCORE	198	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	07:22	51.07489	-6.57753	-	-	-	-	104	Main	Cores possibly suspect	
BOXCORE	199	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	07:33	51.07489	-6.57752	-	-	-	-	105	Main		
BOXCORE	200	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	07:44	51.07489	-6.57753	-	-	-	-	104		Misfire	
AUV	201	Benthic G	Autosub6000	04/04/2014	09:30	51.10332	-6.58320	-	-	-	-	04/04/2014	20:35	51.10332	-6.57230	107	Ruhl/Furlong	Test dip and mission 69 - swath only	
UCCTD	202	Benthic G	Titanium	04/04/2014	11:42	51.07260	-6.58027	04/04/2014	11:47	51.07260	-6.58027	04/04/2014	11:59	51.07260	-6.58028	104	Statham	WP1/WP3	CTD014
BENFLUME	203	Benthic G	In-situ bed flume	?	?	?	?	04/04/2014	14:39	51.07248	-6.58024	04/04/2014	18:00	51.07249	-6.58025	94	Thompson	Depth from skipper log. Failed	

GEAR CODE	STN NBR	SITE	Description	STATION START				At BOTTOM				STATION END				SEA FLOOR DEPTH at bottom (not applicable to transects)	CONTACT for event	COMMENTS	NMF ID
				Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Uncorr. (m)			
SAPS	204	Benthic G	SAPS	-	-	-	-	04/04/2014	18:21	51.07247	-6.58027	-	-	-	-	95	Statham	2 SAPS. Depth from skipper log	
BOXCORE	205	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	21:24	51.07628	-6.57914	-	-	-	-	104			
BOXCORE	206	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	21:35	51.07629	-6.57914	-	-	-	-	104	Fones/Silburn/Main		
BOXCORE	207	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	21:48	51.07629	-6.57915	-	-	-	-	103		Failure	
BOXCORE	208	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	22:01	51.07629	-6.57914	-	-	-	-	104	Silburn/Main/Thompson	Syringe core	
BOXCORE	209	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	22:15	51.07631	-6.57900	-	-	-	-	103	Fones/Silburn	Syringe core	
BOXCORE	210	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	22:29	51.07626	-6.57916	-	-	-	-	103	Fones/Silburn	Muddy sand, syringe core	
BOXCORE	211	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	22:44	51.07627	-6.57915	-	-	-	-	103		Failure	
BOXCORE	212	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	22:56	51.07626	-6.57915	-	-	-	-	103	Thompson/Main		
BOXCORE	213	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	23:09	51.07626	-6.57916	-	-	-	-	102	Main		
BOXCORE	214	Benthic G	NIOZ corer	-	-	-	-	04/04/2014	23:22	51.07026	-6.57916	-	-	-	-	103	Bone	Syringe core	
BOXCORE	215	Benthic G	SMBA corer	-	-	-	-	05/04/2014	00:24	51.07626	-6.57915	-	-	-	-	102	Widdicombe		
BOXCORE	216	Benthic G	SMBA corer	-	-	-	-	05/04/2014	00:31	51.07627	-6.57910	-	-	-	-	101	Widdicombe		
BOXCORE	217	Benthic G	SMBA corer	-	-	-	-	05/04/2014	00:48	51.07621	-6.37919	-	-	-	-	101	Widdicombe		
BOXCORE	218	Benthic G	SMBA corer	-	-	-	-	05/04/2014	01:00	51.07620	-6.57917	-	-	-	-	101	Widdicombe		
BOXCORE	219	Benthic G	SMBA corer	-	-	-	-	05/04/2014	01:15	51.07621	-6.57929	-	-	-	-	101	Widdicombe		
BENFLUME	220	Benthic G	In-situ bed flume	05/04/2014	13:05	51.07313	-6.58024	05/04/2014	13:10	51.07312	-6.58024	05/04/2014	16:05	51.07313	-6.58025	103	Thompson		
SEDCAM	221	Benthic A4	SPI camera	05/04/2014	19:07	51.21361	-6.13018	-	-	-	-	05/04/2014	19:12	51.21352	-6.13019	110	Silburn	3 replicates	
SEDCAM	222	Benthic A5	SPI camera	05/04/2014	19:41	51.21106	-6.13398	-	-	-	-	05/04/2014	19:46	51.21100	-6.13396	110	Silburn	3 replicates	
SAPS	223	Benthic A	SAPS	-	-	-	-	05/04/2014	20:38	51.21908	-6.13397	-	-	-	-	110	Statham	2 SAPS	
BENFLUME	224	Benthic A	In-situ bed flume	05/04/2014	22:34	51.21098	-6.13398	05/04/2014	22:47	51.21099	-6.13395	05/04/2014	01:27	?	?	110	Thompson		
DGRAB	225	Benthic H	Day grab	-	-	-	-	06/04/2014	09:57	50.52002	-7.03261	-	-	-	-	104	Failure		
MULCORE	226	Benthic H	Multicorer	-	-	-	-	06/04/2014	10:17	50.52000	-7.03263	-	-	-	-	111	Stahl/Lichtschlag		
BOXCORE	227	Benthic H	NIOZ corer	-	-	-	-	06/04/2014	11:23	50.52003	-7.03259	-	-	-	-	108	Fones	Winch failure during deployment. Mud retrieved	
AUV	228	Benthic A	Autosub6000	06/04/2014	18:35	51.23188	-6.13872	-	-	-	-	06/04/2014	05:10	51.18901	-6.13185	105	Ruhl/Furlong	Mission 70 - swath only	
SEDCAM	229	Benthic G6	SPI camera	07/04/2014	10:37	51.07490	-6.58450	-	-	-	-	07/04/2014	10:57	51.07479	-6.58434	100	Silburn	5 replicates	
SEDCAM	230	Benthic G7	SPI camera	07/04/2014	11:22	51.07419	-6.58330	-	-	-	-	07/04/2014	11:41	51.07405	-6.58316	101	Silburn	5 replicates	
SEDCAM	231	Benthic G8	SPI camera	07/04/2014	12:04	51.07341	-6.58214	-	-	-	-	07/04/2014	12:18	51.07329	-6.58194	101	Silburn	5 replicates	
SEDCAM	232	Benthic G9	SPI camera	07/04/2014	12:43	51.07265	-6.58092	-	-	-	-	07/04/2014	12:58	51.07254	-6.58073	100	Silburn	5 replicates	
SEDCAM	233	Benthic G10	SPI camera	07/04/2014	13:21	51.07189	-6.57970	-	-	-	-	07/04/2014	13:34	51.07178	-6.57950	100	Silburn	5 replicates	
SEDCAM	234	Benthic G11	SPI camera	07/04/2014	13:59	51.07115	-6.57850	-	-	-	-	07/04/2014	14:11	51.07102	-6.57828	98	Silburn	5 replicates	
SEDCAM	235	Benthic G12	SPI camera	07/04/2014	14:35	51.07038	-6.57730	-	-	-	-	07/04/2014	14:53	51.07020	-6.57705	97	Silburn	6 replicates (1 possible misfire)	
SEDCAM	236	Benthic G13	SPI camera	07/04/2014	15:46	51.07489	-6.57740	-	-	-	-	07/04/2014	16:04	51.07479	-6.57757	98	Silburn	5 replicates	
SEDCAM	237	Benthic G14	SPI camera	07/04/2014	16:22	51.07415	-6.57859	-	-	-	-	07/04/2014	16:30	51.07401	-6.57877	98	Silburn	5 replicates	
SEDCAM	238	Benthic G15	SPI camera	07/04/2014	16:47	51.07339	-6.57982	-	-	-	-	07/04/2014	16:57	51.07325	-6.57999	98	Silburn	5 replicates	
SEDCAM	239	Benthic G16	SPI camera	07/04/2014	18:11	51.07258	-6.58100	-	-	-	-	07/04/2014	18:20	51.07246	-6.58118	100	Silburn	5 replicates	
SEDCAM	240	Benthic G17	SPI camera	07/04/2014	18:37	51.07183	-6.58221	-	-	-	-	07/04/2014	18:46	51.07170	-6.58241	100	Silburn	5 replicates	
SEDCAM	241	Benthic G18	SPI camera	07/04/2014	19:06	51.07105	-6.58343	-	-	-	-	07/04/2014	19:15	51.07094	-6.58362	100	Silburn	5 replicates	
SEDCAM	242	Benthic G19	SPI camera	07/04/2014	19:31	51.07028	-6.58465	-	-	-	-	07/04/2014	19:40	51.07018	-6.58485	100	Silburn	5 replicates	
AUV	243	Benthic A	Autosub6000	08/04/2014	06:04	51.18912	-6.13497	-	-	-	-	08/04/2014	11:38	51.23102	-6.13623	104	Ruhl/Furlong	Mission 71 (photos only)	
AUV	244	Benthic G	Autosub6000	08/04/2014	14:48	51.09318	-6.58324	-	-	-	-	08/04/2014	15:47	51.09158	-6.58603	98	Ruhl/Furlong	Mission 72 (photos only). Recovered early	
AUV	245	Benthic G	Autosub6000	08/04/2014	16:56	51.09263	-6.58392	-	-	-	-	08/04/2014	21:56	51.05083	-6.58655	96	Ruhl/Furlong	Mission 72 (photos only).	
BOXCORE	246	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	02:52	50.51999	-7.03249	-	-	-	-	101	Widdicombe		
BOXCORE	247	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	03:07	50.51998	-7.03249	-	-	-	-	101	Wood/Hale		
BOXCORE	248	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	03:24	50.51998	-7.03250	-	-	-	-	101	Main/Bone		
BOXCORE	249	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	03:36	50.19978	-7.03250	-	-	-	-	101	Widdicombe		
BOXCORE	250	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	03:50	50.51997	-7.03250	-	-	-	-	101	Wood/Hale		
BOXCORE	251	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	04:03	50.51998	-7.03247	-	-	-	-	101	Main		
BOXCORE	252	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	04:16	50.51997	-7.03249	-	-	-	-	101	Widdicombe		
BOXCORE	253	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	04:30	50.52002	-7.03249	-	-	-	-	101	Wood/Hale		
BOXCORE	254	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	04:42	50.52003	-7.03251	-	-	-	-	101	Main		

GEAR CODE	STN NBR	SITE	Description	STATION START				At BOTTOM				STATION END				SEA FLOOR DEPTH at bottom (not applicable to transects)	CONTACT for event	COMMENTS	NMF ID
				Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Uncorr. (m)			
BOXCORE	255	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	04:54	50.52003	-7.03251	-	-	-	-	101	Wood/Hale		
BOXCORE	256	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	05:07	50.52002	-7.03246	-	-	-	-	101	Widdicombe		
BOXCORE	257	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	05:21	50.52007	-7.03250	-	-	-	-	101	Wood/Hale/Kitidis		
BOXCORE	258	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	05:32	50.52007	-7.03250	-	-	-	-	101	Main/Kitidis		
BOXCORE	259	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	05:44	50.52007	-7.03249	-	-	-	-	101	Wood/Hale/Kitidis		
BOXCORE	260	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	05:57	50.52011	-7.03251	-	-	-	-	101	Widdicombe		
BOXCORE	261	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	06:09	50.52011	-7.03247	-	-	-	-	101	Wood/Hale		
BOXCORE	262	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	06:21	50.52011	-7.03250	-	-	-	-	101	Wood/Hale/Kitidis		
BOXCORE	263	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	06:33	50.52011	-7.03246	-	-	-	-	101	Wood/Hale		
BOXCORE	264	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	06:45	50.52011	-7.03247	-	-	-	-	101	Wood/Hale		
BOXCORE	265	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	06:57	50.52016	-7.03249	-	-	-	-	101	Wood/Hale		
BOXCORE	266	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	07:09	50.52002	-7.03248	-	-	-	-	101	Wood/Hale		
BOXCORE	267	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	07:24	50.52016	-7.03248	-	-	-	-	101		Failed	
BOXCORE	268	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	07:38	50.52020	-7.03248	-	-	-	-	101	Wood/Hale		
BOXCORE	269	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	07:50	50.52020	-7.03248	-	-	-	-	101	Wood/Hale		
BOXCORE	270	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	08:02	50.52019	-7.03250	-	-	-	-	101	Wood/Hale		
BOXCORE	271	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	08:16	50.52020	-7.03247	-	-	-	-	101	Bone		
BOXCORE	272	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	08:28	50.52020	-7.03248	-	-	-	-	101	Silburn		
BOXCORE	273	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	08:40	50.52019	-7.03250	-	-	-	-	107	Stahl/Kitidis		
BOXCORE	274	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	08:53	50.52020	-7.03248	-	-	-	-	107	Stahl/Kitidis		
BOXCORE	275	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	09:08	50.52027	-7.03250	-	-	-	-	106	Stahl/Kitidis		
BOXCORE	276	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	09:24	50.52026	-7.03251	-	-	-	-	106	Silburn		
BOXCORE	277	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	09:35	50.52027	-7.03250	-	-	-	-	105	Kitidis/Fones		
BOXCORE	278	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	09:47	50.52028	-7.03250	-	-	-	-	107		Misfire	
BOXCORE	279	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	09:59	50.52028	-7.03249	-	-	-	-	107	Silburn		
BOXCORE	280	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	10:14	50.52032	-7.03250	-	-	-	-	107	Kitidis/Fones		
BOXCORE	281	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	10:26	50.52032	-7.03251	-	-	-	-	106		Failure	
BOXCORE	282	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	10:38	50.52030	-7.03249	-	-	-	-	108	Silburn/Fones		
BOXCORE	283	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	10:50	50.52033	-7.03249	-	-	-	-	107		Failure	
BOXCORE	284	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	11:03	50.52032	-7.03251	-	-	-	-	108	Silburn/Fones		
BOXCORE	285	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	11:15	50.52037	-7.03250	-	-	-	-	108	Silburn/Fones		
BOXCORE	286	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	11:27	50.52036	-7.03249	-	-	-	-	108	Silburn		
BOXCORE	287	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	11:39	50.52036	-7.03250	-	-	-	-	108	Silburn		
BOXCORE	288	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	11:52	50.52035	-7.03249	-	-	-	-	108	Silburn		
BOXCORE	289	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	12:05	50.52035	-7.03249	-	-	-	-	108	Thompson		
BOXCORE	290	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	12:20	50.52040	-7.03250	-	-	-	-	107	Thompson		
BOXCORE	291	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	12:33	50.52039	-7.03251	-	-	-	-	108	Thompson		
BOXCORE	292	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	12:45	50.52039	-7.03250	-	-	-	-	108	Thompson	Mat loose	
BOXCORE	293	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	13:01	50.52038	-7.03248	-	-	-	-	107	Thompson		
BOXCORE	294	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	13:19	50.52040	-7.03248	-	-	-	-	107		Failure - not enough sediment	
BOXCORE	295	Benthic H	NIOZ corer	-	-	-	-	09/04/2014	13:39	50.52029	-7.03249	-	-	-	-	107	Thompson		
BOXCORE	296	Benthic H	SMBA corer	-	-	-	-	09/04/2014	14:08	50.52028	-7.03251	-	-	-	-	107	Widdicombe		
BOXCORE	297	Benthic H	SMBA corer	-	-	-	-	09/04/2014	14:24	50.52028	-7.03248	-	-	-	-	107		Misfire	
BOXCORE	298	Benthic H	SMBA corer	-	-	-	-	09/04/2014	14:33	50.52027	-7.03251	-	-	-	-	108	Widdicombe		
BOXCORE	299	Benthic H	SMBA corer	-	-	-	-	09/04/2014	14:48	50.52017	-7.03248	-	-	-	-	108	Widdicombe	Broken shoe	
BOXCORE	300	Benthic H	SMBA corer	-	-	-	-	09/04/2014	15:31	50.52009	-7.03251	-	-	-	-	106	Widdicombe		
BOXCORE	301	Benthic H	SMBA corer	-	-	-	-	09/04/2014	15:45	50.52010	-7.03248	-	-	-	-	106	Widdicombe		
SAPS	302	Benthic H	SAPS	-	-	-	-	09/04/2014	17:03	50.52008	-7.03955	-	-	-	-	99	Statham	2 SAPS	
BENFLUME	303	Benthic H	In-situ bed flume	?	?	?	?	09/04/2014	19:37	50.52007	-7.03954	?	?	?	?	105	Thompson		
SEDCAM	304	Benthic H1	SPI camera	09/04/2014	23:07	50.51994	-7.03953	-	-	-	-	09/04/2014	23:17	50.52003	-7.03955	104	Silburn	3 replicates (pictures too dark)	
SEDCAM	305	Benthic H2	SPI camera	09/04/2014	23:48	50.52461	-7.03953	-	-	-	-	09/04/2014	23:56	50.52453	-7.03942	107	Silburn	3 replicates (pictures too dark)	

GEAR CODE	STN NBR	SITE	Description	STATION START				At BOTTOM				STATION END				SEA FLOOR DEPTH at bottom (not applicable to transects)	CONTACT for event	COMMENTS	NMF ID
				Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Uncorr. (m)			
SEDCAM	306	Benthic H3	SPI camera	10/04/2014	00:41	50.52226	-7.03564	-	-	-	-	10/04/2014	00:49	50.52231	-7.03556	108	Silburn	3 replicates (pictures too dark)	
SEDCAM	307	Benthic H4	SPI camera	10/04/2014	01:20	50.52452	-7.03200	-	-	-	-	10/04/2014	01:27	50.52442	-7.03101	108	Silburn	3 replicates (pictures too dark)	
SEDCAM	308	Benthic H5	SPI camera	10/04/2014	01:55	50.51998	-7.03201	-	-	-	-	10/04/2014	02:03	50.52004	-7.03211	107	Silburn	3 replicates (pictures too dark)	
DGRAB	309	Benthic I1	Day grab	-	-	-	-	10/04/2014	02:58	50.51999	-7.08150	-	-	-	-	109	Widdicombe	WP1 line 1	
DGRAB	310	Benthic I2	Day grab	-	-	-	-	10/04/2014	03:26	50.51998	-7.08864	-	-	-	-	108	Widdicombe	WP2 line 1	
DGRAB	311	Benthic I3	Day grab	-	-	-	-	10/04/2014	03:49	50.51997	-7.09581	-	-	-	-	109	Widdicombe	WP3 line 1	
DGRAB	312	Benthic I4	Day grab	-	-	-	-	10/04/2014	04:11	50.51997	-7.10297	-	-	-	-	109	Widdicombe	WP4 line 1	
DGRAB	313	Benthic I5	Day grab	-	-	-	-	10/04/2014	04:31	50.51997	-7.11015	-	-	-	-	111	Widdicombe	WP5 line 1	
DGRAB	314	Benthic I6	Day grab	-	-	-	-	10/04/2014	04:47	50.52447	-7.09575	-	-	-	-	106	Widdicombe	500 m north WP3 line 1	
AUV	315	Benthic H	Autosub6000	10/04/2014	06:20	50.52051	-7.01688	-	-	-	-	10/04/2014	16:58	50.52277	-7.01618	111	Ruhl/Furlong	Mission 73 (bathymetry and photos)	
DGRAB	316	Benthic I7	Day grab	-	-	-	-	10/04/2014	10:14	50.62505	-6.93297	-	-	-	-	105	Stahl	muddy sand	
DGRAB	317	Benthic I8	Day grab	-	-	-	-	10/04/2014	10:36	50.62489	-6.92655	-	-	-	-	106	Stahl	muddy sand	
DGRAB	318	Benthic I9	Day grab	-	-	-	-	10/04/2014	11:00	50.62475	-6.91871	-	-	-	-	106	Stahl	muddy sand	
DGRAB	319	Benthic I10	Day grab	-	-	-	-	10/04/2014	11:25	50.62476	-6.91170	-	-	-	-	106	Stahl	muddy sand	
DGRAB	320	Benthic I11	Day grab	-	-	-	-	10/04/2014	11:51	50.62484	-6.90450	-	-	-	-	107	Stahl	muddy sand	
DGRAB	321	Benthic I12	Day grab	-	-	-	-	10/04/2014	12:37	50.61580	-6.90461	-	-	-	-	106	Stahl	muddy sand	
DGRAB	322	Benthic I13	Day grab	-	-	-	-	10/04/2014	14:20	50.47380	-7.05076	-	-	-	-	109	Stahl	muddy sand	
DGRAB	323	Benthic I14	Day grab	-	-	-	-	10/04/2014	14:44	50.47380	-7.04369	-	-	-	-	110	Stahl	muddy sand	
DGRAB	324	Benthic I15	Day grab	-	-	-	-	10/04/2014	15:15	50.46927	-7.04351	-	-	-	-	111	Stahl	muddy sand	
DGRAB	325	Benthic I16	Day grab	-	-	-	-	10/04/2014	18:06	50.57366	-7.08058	-	-	-	-	111	Stahl		
DGRAB	326	Benthic I17	Day grab	-	-	-	-	10/04/2014	18:29	50.57365	-7.08764	-	-	-	-	111	Stahl		
DGRAB	327	Benthic I18	Day grab	-	-	-	-	10/04/2014	18:57	50.57366	-7.10677	-	-	-	-	111	Stahl	sandy mud	
DGRAB	328	Benthic I19	Day grab	-	-	-	-	10/04/2014	19:17	50.57365	-7.10884	-	-	-	-	111	Stahl	sandy mud	
DGRAB	329	Benthic I20	Day grab	-	-	-	-	10/04/2014	19:49	50.57815	-7.10883	-	-	-	-	106	Stahl		
DGRAB	330	Benthic I21	Day grab	-	-	-	-	10/04/2014	20:14	50.57815	-7.10177	-	-	-	-	107	Stahl		
DGRAB	331	Benthic I22	Day grab	-	-	-	-	10/04/2014	20:38	50.57594	-7.10519	-	-	-	-	107	Stahl		
MULCORE	332	Benthic I	Multicorer	-	-	-	-	10/04/2014	20:53	50.57593	-7.10520	-	-	-	-	107	Stahl/Lichtschlag		
BOXCORE	333	Benthic I	SMBA corer	-	-	-	-	10/04/2014	21:21	50.57590	-7.10519	-	-	-	-	107	Widdicombe		
BOXCORE	334	Benthic I	SMBA corer	-	-	-	-	10/04/2014	21:35	50.57594	-7.10520	-	-	-	-	108	Widdicombe		
BOXCORE	335	Benthic I	SMBA corer	-	-	-	-	10/04/2014	21:46	50.57590	-7.10520	-	-	-	-	107	Widdicombe		
BOXCORE	336	Benthic I	SMBA corer	-	-	-	-	10/04/2014	22:02	50.57598	-7.10522	-	-	-	-	107	Widdicombe		
BOXCORE	337	Benthic I	SMBA corer	-	-	-	-	10/04/2014	22:15	50.57598	-7.10522	-	-	-	-	108	Widdicombe		
BOXCORE	338	Benthic I	NIOZ corer	-	-	-	-	10/04/2014	22:35	50.57597	-7.10522	-	-	-	-	107	Widdicombe		
BOXCORE	339	Benthic I	NIOZ corer	-	-	-	-	10/04/2014	22:51	50.57595	-7.10523	-	-	-	-	108	Wood/Hale/Kitidis	Microbial abundance, pigments	
BOXCORE	340	Benthic I	NIOZ corer	-	-	-	-	10/04/2014	23:05	50.57594	-7.10523	-	-	-	-	108	Wood/Hale/Kitidis	Microbial abundance, pigments	
BOXCORE	341	Benthic I	NIOZ corer	-	-	-	-	10/04/2014	23:18	50.57595	-7.10528	-	-	-	-	108	Widdicombe		
BOXCORE	342	Benthic I	NIOZ corer	-	-	-	-	10/04/2014	23:34	50.57598	-7.10526	-	-	-	-	108	Wood/Hale/Kitidis	Microbial abundance, pigments	
BOXCORE	343	Benthic I	NIOZ corer	-	-	-	-	10/04/2014	23:47	50.57599	-7.10526	-	-	-	-	108	Wood/Hale/Kitidis	Molecular biomass	
BOXCORE	344	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	00:03	50.57597	-7.10526	-	-	-	-	110	Widdicombe		
BOXCORE	345	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	00:22	50.57604	-7.10529	-	-	-	-	110	Wood/Hale		
BOXCORE	346	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	00:37	50.57603	-7.10328	-	-	-	-	110		Misfire - cable caught	
BOXCORE	347	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	00:53	50.57602	-7.10529	-	-	-	-	110	Widdicombe		
BOXCORE	348	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	01:08	50.57603	-7.10529	-	-	-	-	110	Wood/Hale		
BOXCORE	349	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	01:22	50.57608	-7.10527	-	-	-	-	109	Wood/Hale		
BOXCORE	350	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	01:38	50.57608	-7.10528	-	-	-	-	109	Widdicombe		
BOXCORE	351	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	01:52	50.57608	-7.10528	-	-	-	-	109	Wood/Hale		
BOXCORE	352	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	02:05	50.57607	-7.10527	-	-	-	-	110	Wood/Hale		
BOXCORE	353	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	02:19	50.57612	-7.10528	-	-	-	-	110	Wood/Hale		
BOXCORE	354	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	02:32	50.57612	-7.10526	-	-	-	-	110	Wood/Hale		
BOXCORE	355	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	?	50.57613	-7.10528	-	-	-	-	110	Wood/Hale		
BOXCORE	356	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	02:56	50.57612	-7.10527	-	-	-	-	109		Misfire	

GEAR CODE	STN NBR	SITE	Description	STATION START				At BOTTOM				STATION END				SEA FLOOR DEPTH at bottom (not applicable to transects)	CONTACT for event	COMMENTS	NMF ID
				Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Date (UTC)	Time (UTC)	Latitude	Longitude	Uncorr. (m)			
BOXCORE	357	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	03:07	50.57612	-7.10528	-	-	-	-	109	Wood/Hale		
BOXCORE	358	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	03:19	50.57611	-7.10527	-	-	-	-	109	Wood/Hale		
BOXCORE	359	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	03:30	50.57612	-7.10528	-	-	-	-	109	Wood/Hale		
BOXCORE	360	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	03:47	50.57617	-7.10529	-	-	-	-	109	Silburn		
BOXCORE	361	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	04:01	50.57616	-7.10530	-	-	-	-	109		Misfire	
BOXCORE	362	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	04:14	50.57616	-7.10529	-	-	-	-	109	Stahl/Kitidis		
BOXCORE	363	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	04:31	50.57617	-7.10526	-	-	-	-	109	Silburn		
BOXCORE	364	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	04:48	50.57622	-7.10525	-	-	-	-	109	Stahl/Kitidis		
BOXCORE	365	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	05:09	50.57622	-7.10525	-	-	-	-	109	Silburn		
BOXCORE	366	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	05:26	50.57622	-7.10524	-	-	-	-	108	Stahl/Kitidis		
BOXCORE	367	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	05:43	50.57622	-7.10525	-	-	-	-	108	Stahl/Silburn/Bone		
AUV	368	Benthic I	Autosub6000	11/04/2014	06:20	50.60430	-7.10898	-	-	-	-	11/04/2014	17:29	50.55581	-7.10588	106	Ruhl/Furlong	Mission 74 (bathymetry, side scan, photos)	
SEDCAM	369	Benthic H1	SPI camera	11/04/2014	07:32	50.52442	-7.03932	-	-	-	-	11/04/2014	07:37	50.524298	-7.039316	101	Silburn	3 replicates	
SEDCAM	370	Benthic H2	SPI camera	11/04/2014	08:01	50.51988	-7.03929	-	-	-	-	11/04/2014	08:09	50.51979	-7.03929	105	Silburn	3 replicates	
SEDCAM	371	Benthic H3	SPI camera	11/04/2014	08:45	50.51989	-7.03216	-	-	-	-	11/04/2014	08:54	50.5198	-7.032167	105	Silburn	3 replicates	
SEDCAM	372	Benthic H4	SPI camera	11/04/2014	09:23	50.52436	-7.03199	-	-	-	-	11/04/2014	09:32	50.52428	-7.03197	105	Silburn	3 replicates	
SEDCAM	373	Benthic H5	SPI camera	11/04/2014	10:05	50.52236	-7.03550	-	-	-	-	11/04/2014	10:13	50.52287	-7.0355	104	Silburn	3 replicates	
SEDCAM	374	Benthic I1	SPI camera	11/04/2014	11:17	50.57805	-7.10897	-	-	-	-	11/04/2014	11:25	50.57797	-7.108974	107	Silburn	3 replicates	
SEDCAM	375	Benthic I2	SPI camera	11/04/2014	11:57	50.57360	-7.01896	-	-	-	-	11/04/2014	12:06	50.573511	-7.108977	101	Silburn	3 replicates	
SEDCAM	376	Benthic I3	SPI camera	11/04/2014	12:44	50.57356	-7.10193	-	-	-	-	11/04/2014	12:52	50.57346	-7.10194	109	Silburn	3 replicates	
SEDCAM	377	Benthic I4	SPI camera	11/04/2014	13:19	50.57800	-7.71019	-	-	-	-	11/04/2014	13:31	50.57796	-7.10188	109	Silburn	3 replicates	
SEDCAM	378	Benthic I5	SPI camera	11/04/2014	14:03	50.57585	-7.10457	-	-	-	-	11/04/2014	14:11	50.575762	-7.104588	110	Silburn	3 replicates	
BOXCORE	379	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	14:43	50.57575	-7.10454	-	-	-	-	109	Fones		
BOXCORE	380	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	14:57	50.57576	-7.10454	-	-	-	-	110	Thompson		
BOXCORE	381	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	15:10	50.57577	-7.10454	-	-	-	-	111	Fones	Crack in core	
BOXCORE	382	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	15:23	50.57577	-7.10452	-	-	-	-	110	Thompson		
BOXCORE	383	Benthic I	NIOZ corer	-	-	-	-	11/04/2014	15:37	50.57577	-7.10452	-	-	-	-	111	Thompson		
SAPS	384	Benthic I	SAPS	-	-	-	-	11/04/2014	18:36	50.57613	-7.10665	-	-	-	-	101	Statham	2 SAPS	
BENFLUME	385	Benthic I	In-situ bed flume	11/04/2014	20:48	50.57613	-7.10667	11/04/2014	20:57	50.57614	-7.10668	11/04/2014	23:50	50.57613	-7.10666	108	Thompson		