National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

National Oceanography Centre

Cruise Report No. 36

RRS *James Cook* Cruise 124-125-126

09 AUG-12 SEP 2015

CODEMAP2015
Habitat mapping and ROV vibrocorer trials around
Whittard Canyon and Haig Fras

Principal Scientist
V A I Huvenne

Co-Principal Scientist JC124
R B Wynn

Co-Principal Scientist JC126
J A Gales

2016

National Oceanography Centre, Southampton
University of Southampton Waterfront Campus
European Way
Southampton
Hants SO14 3ZH
UK

Tel: +44 (0)23 8059 6020
Email: vaih@noc.soton.ac.uk

DOCUMENT DATA SHEET

AUTHOR	*PUBLICATION DATE*
HUVENNE, V A I, WYNN, R B & GALES J A et al	2016

TITLE

RRS *James Cook* Cruise 124-125-126 09 Aug-12 Sep 2016. CODEMAP2015: Habitat mapping and ROV vibrocorer trials around Whittard Canyon and Haig Fras.

REFERENCE

Southampton, UK: National Oceanography Centre, Southampton, 223pp.
(National Oceanography Centre Cruise Report, No. 36)

ABSTRACT

The main aim of JC125 was to carry out habitat mapping work in the Whittard Canyon, NE Atlantic, in order to obtain a better insight in the biodiversity patterns, benthic habitat distributions and sediment transport processes of submarine canyons. At the same time, the objective was also to test a number of novel habitat mapping techniques, including sideways multibeam mapping of steep and overhanging cliffs using the Autosub6000 AUV (Autonomous Underwater Vehicle), which was specifically adapted for this task. The four-week expedition was the second cruise of the CODEMAP project (COmplex Deep-sea Ecosystems: Mapping habitat heterogeneity As Proxy for biodiversity), funded by the European Research Council (Grant No 258482).

Two short 'tag-on' cruises were added to this main expedition: JC124 covered four days of seabed monitoring in the Haig Fras and Canyons Marine Conservation Zones as part of the DEFRA-funded project "Novel AUV and Glider deployments to inform future MPA and MSFD monitoring strategy in UK shelf waters?". JC126 consisted of three days of ROV vibrocorer trials for the NERC-funded technology grant NERC Grant NE/0176581. Together, the five-week voyage was nick-named 'CODEMAP2015'.

To achieve its goals, CODEMAP2015 made extensive use of deep-water marine robotics: in a first for UK science, the Autosub6000 AUV, the Isis ROV (Remotely Operated Vehicle) and a Seaglider provided by the University of East Anglia were operating in the canyon, simultaneously, deployed from the RRS *James Cook*. They provided an unprecedented insight in the structure and processes of the submarine canyon. The nested survey design that was adopted throughout the cruise combined canyon-wide shipboard and glider surveys with AUV-based acoustics and ROV-based multibeam and HD video recordings. This enabled the integrated observation of different canyon processes at the scale they occur, ranging from 10s of km to a few mm.

KEYWORDS

Submarine canyon, cold-water corals, Marine Conservation Zone, Autonomous Underwater Vehicle, Remotely Operated Vehicle, Seaglider, habitat mapping

ISSUING ORGANISATION

National Oceanography Centre
University of Southampton Waterfront Campus
European Way
Southampton SO14 3ZH UK
Tel: +44(0)23 80596116 Email: nol@noc.soton.ac.uk

(Page intentionally left blank)

CONTENTS PAGE

SCIENTIFIC PERSONNEL

name	surname	institute	Role
Veerle	Huvenne	NOC	PSO
Russell	Wynn	NOC	Geologist/MMO/watch leader
Claudio	Lo Iacono	NOC	Geologist/watch leader
Jenny	Gales	NOC	Geologist/coring/geophysical processing
Leigh	Marsh	USoton	Biologist/co-watchleader
Katleen	Robert	NOC	Biologist/co-watchleader
Alex	Callaway	CEFAS	DEFRA/JNCC rep
Laura	Peteiro	Uni Aveiro	Biologist
Inge	Vanden Beld	IFREMER	Biologist/French observer
Raissa	Hogan	NUIG	Biologist/Irish observer
Noelie	Benoist	NOC	Biologist
Paul	Shawyer	USoton	Sedimentologist
Gareth	Carter	BGS	Geologist
Tahmeena	Aslam	Uni East Anglia	Oceanographer
Dave	Turner	MARS	ISIS
Andy	Webb	MARS	ISIS
Dave	Edge	MARS	ISIS
Russell	Locke	MARS	ISIS
Alan	Davies	MARS	ISIS
Antonio	Gamero-Campos	MARS	ISIS
Joshue	Viera-Rivero	MARS	ISIS
Will	Handley	Contractor	ISIS
James	Perret	MARS	Autosub
Ella	Richards	MARS	Autosub
Dan	Roper	MARS	Autosub
Billy	Platt	NMF	CTD
Alan	Sherring	NMF	Coring
Martin	Bridger	NMF	IT & Sea Systems

SHIPS OFFICERS AND CREW

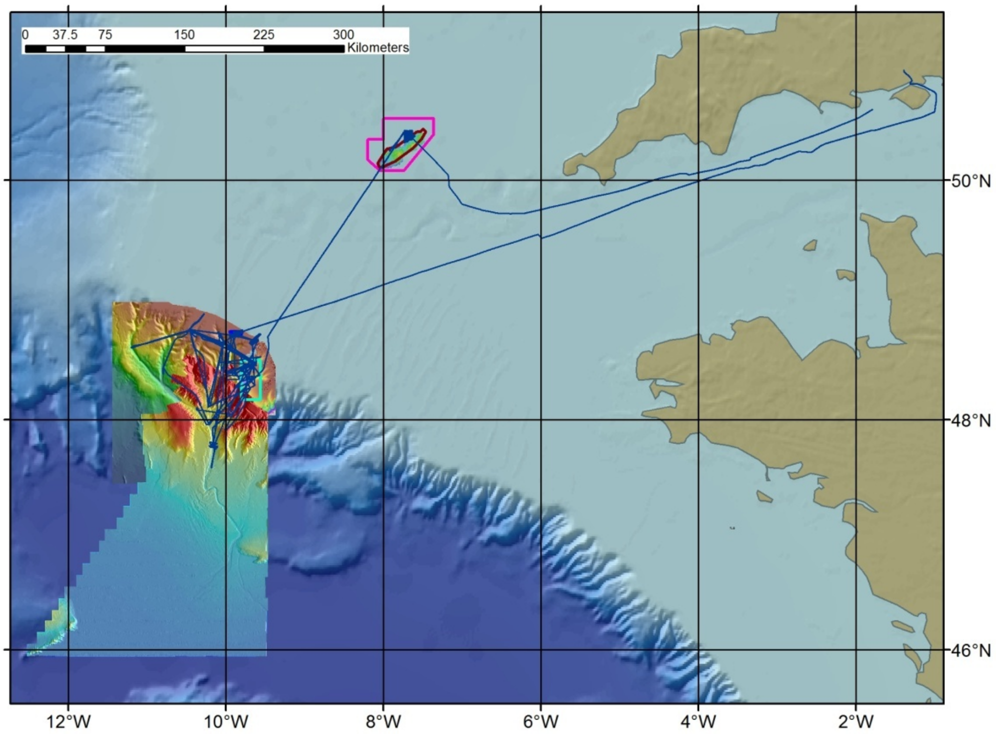
John	Leask	Master
Stewart	Mackay	Chief Officer
Nick	Norrish	2nd
Declan	Morrow	3rd Officer
Robert	Brett	Chief Engineer
Chris	Kemp	2nd Engineer
Michael	Murren	3rd Engineer
Noel	Doherty	3rd Engineer
Paul	Damerell	ETO
Graham	Bullimore	Purser
John	MacDonald	Chief Petty Officer - Scientific
Andy	MacLean	Chief Petty Officer - Deck
Steven	Duncan	Petty Officer - Deck
Neil	Machin	Engine Room Petty Officer
John	Hopley	Seaman Grade 1A
Samuel	Vargas	Seaman Grade 1A
Barry	Edwards	Seaman Grade 1A

Stephen	Day	Seaman Grade 1A
John	Haughton	Head Chef
Walter	Link	Chef
Peter	Robinson	Steward
Carl	Piper	Assistant Steward
Lee	Shotton	Cadet
Sam	Dawkins	Cadet

ITINERARY

Departure Southampton: 9 August 2015
Arrival Southampton: 12 September 2015

Cruise track chart:



BACKGROUND AND SCIENTIFIC RATIONALE

Expedition JC124-125-126, also named 'CODEMAP2015', combined three cruises with compatible aims and target destinations. The main part of the 5-week cruise ("JC125") was taken up by the CODEMAP expedition, part of the ERC Starting Grant CODEMAP ("COmplex Deep-sea Environments: Mapping habitat heterogeneity As Proxy for biodiversity", 2011-2017, grant no 258482), and was aimed at the habitat mapping and study of Whittard Canyon, a large submarine canyon system along the Celtic Margin, south-west of Ireland and the UK.

To this 4-week expedition, four extra days were added ("JC124") as support to the Department of Environment, Fisheries and Rural Affairs (DEFRA) for their continued assessment and monitoring of two Marine Conservation Zones. This work was part of the project entitled: "Novel AUV and Glider deployments to inform future MPA and MSFD monitoring strategy in UK shelf waters?" (PI: R.Wynn).

Three more days ("JC126") were added for the technical trials of a new vibrocoring system for the Isis ROV (NERC Grant NE/0176581, PI: P.Talling).

All three parts of the cruise were also linked to the NERC MAREMAP programme.

1. Whittard Canyon

Submarine Canyons are the main transport pathways between the shelf and the deep sea (Palanques et al., 2006; de Stigter et al., 2011; Puig et al., 2014), and are often considered biodiversity hotspots (Danovaro et al, 2009; Tyler et al., 2009). Their irregular topography can create specific oceanographic effects that result in enhanced primary productivity, which then gets transported to deeper waters through the canyon (Ryan et al., 2005; Allen & Hickey, 2010). At the same time, the steep canyon walls and enhanced sediment dynamics create a wide range of seabed substrates, providing different niches for a large variety in faunal communities. With human activities moving into deeper and deeper waters, some of these communities may now be under threat. For example, research by Spanish colleagues has shown that deep-sea bottom trawling on the upper flanks of a submarine canyon may have severe impacts, smoothing the topography, stirring up sediment and smothering benthic species (Puig et al., 2012; Pusceddu et al., 2014). There is a strong need for effective marine spatial planning in submarine canyons, and the availability of accurate habitat maps is generally the first prerequisite for this planning process. A thorough understanding of canyon processes, in terms of spatial distribution of faunal communities, species connectivity, oceanography, current patterns and sediment dynamics is further needed to support the decision process.

Whittard Canyon is one of the largest submarine canyons along the Celtic Margin, NE Atlantic (Fig. 1). The deeply incised dendritic system has 4 main branches, reaching from the shelf at ~200m water depth to their junction point at ca. 3600m depth. From there, Whittard Channel leads to the final sediment depocentre of the Celtic Fan (Zaragosi et al., 2000; Bourillet et al., 2006). The canyon hosts rich faunal communities, which vary greatly in terms of abundance, species richness and diversity throughout the canyon branches and depths. Although a more coordinated and comprehensive sampling of fauna & environmental conditions is necessary to really reveal the processes behind the patterns, it is clear that this variability is most probably related to the high environmental heterogeneity, caused by a combination of organic matter trapping, current regimes (due to focussed internal tides) and differing substrates (Amaro et al., subm.). Unique foraminifera, meiofauna and macrofauna communities have been reported (e.g. Duros et al., 2011; Ingels et al., 2011; Gunton et al., 2015). In terms of megafauna, cold-water corals frequently act as habitat engineers (e.g. Morris et al., 2013; Robert et al., 2014), but also dense aggregations of holothurians have been reported (Amaro et al., 2015). The most spectacular megafauna communities have been found on vertical and overhanging substrates (Huvenne et al., 2011; Johnson et al., 2013). Those locations formed a prime target during CODEMAP2015.

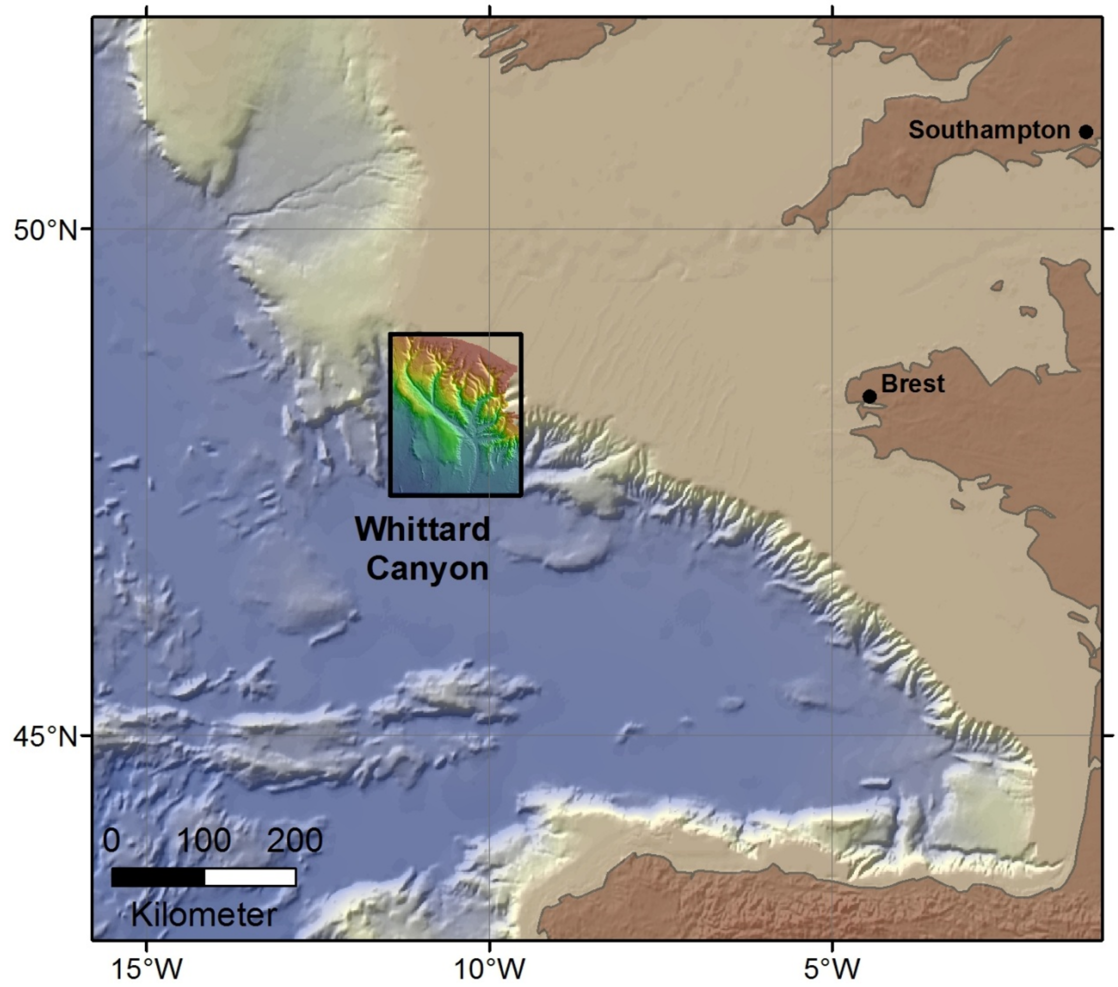


Fig. 1 Location map of Whittard Canyon

1.1. Habitat mapping

Biodiversity has been identified as a major indicator of ecosystem status and functioning (Danovaro et al., 2008), and therefore is often the driver behind effective marine spatial management and conservation. However, measuring biodiversity in the deep ocean is challenging, especially in complex environments such as submarine canyons. Traditional, over-the-side sampling methodologies (such as coring or towed video sleds) are time-consuming and cover very limited ground. In addition, they are often not very effective in steep terrains. Increasingly, the scientific community is looking at other ways to quantify biodiversity in the deep sea, making use of, among others, acoustic mapping data that are easier to obtain. The approach proposed in the CODEMAP project is based on the ecological 'Niche' Theory, which states that biodiversity is driven by spatial variability in environmental conditions, also known as habitat heterogeneity (Chase & Leibold, 2003). The aim of the CODEMAP project, therefore, is to develop an integrated, robust, and fully 3-dimensional methodology to map complex deep-sea habitats, to quantify their habitat heterogeneity and to test if these heterogeneity measures derived at different scales reflect epibenthic megafauna biodiversity.

The example complex environments studied within CODEMAP are submarine canyons and cold-water coral reefs, although other types of terrain can also be investigated in the same way (e.g. seamounts, hydrothermal vent fields etc.). The project tackles the challenge in 4 ways: (1) top-down: statistically robust and objective seafloor classification, followed by quantification of heterogeneity (Ismail et al., 2015), (2) bottom-up: extrapolation of known, local biodiversity information to entire study areas through predictive habitat modelling (Robert et al., 2014, 2015); (3) connecting information across spatial scales using a nested survey & analysis approach (Robert, 2014), and (4) developing mapping methodologies in full 3D, including vertical and overhanging substrates (Huvenne et al., 2011; 2015).

Whittard Canyon functioned as one of the main study sites for the CODEMAP project. The canyon was mapped at a regional scale in 2009 (JC035, Huvenne et al., 2009), using TOBI 30kHz sidescan sonar and ship-board EM120 multibeam systems. In addition, selected sites were surveyed with the Isis ROV during cruise JC036 (Masson et al., 2009), providing video data, samples, and high-resolution ROV-based bathymetry. During the first phases of the project, these datasets were used to create an over-arching marine landscape map for the canyon (Ismail, 2015), and a number of habitat suitability predictions (Robert et al., 2015). However, the validity of those models needed testing, and locations with high model uncertainty (or disagreement) needed further observation.

In addition, during JC036, we developed the unique ROV-based 'sideways mapping' methodology, to map the morphology of vertical and overhanging seabed substrates (Huvenne et al., 2011; 2015). One of the aims of the CODEMAP project was to expand this methodology to AUVs, to allow for more extensive and time-efficient surveying. Following the development phase, the vertical mapping methodology now had to be tested (see section 3.1.).

1.2. Internal tides

Along the Celtic Sea shelf edge, internal waves and tides are generated at the shelf break by across-slope tidal flow (Pingree and Mardell, 1985; Holt and Thorpe, 1997) and have been observed as a coherent signal up to 170 km onto the Celtic Sea shelf (Inall et al., 2011). Submarine canyons along the shelf break have the potential to modify remotely generated internal waves and to cause generation themselves (Hickey, 1995), thus complicating the internal tide wavefield at the shelf break. Reflection of the internal tide can result in trapping and focusing of remotely generated internal tide energy (Gordon and Marshall, 1976; Hotchkiss and Wunsch, 1982) and also non-linear behaviour such as wave breaking and turbulent mixing (e.g. Nash et al., 2004).

Preliminary numerical model simulations of the M2 tide in the Whittard Canyon region show that depth-integrated internal tide energy flux is enhanced within the canyon and the spatial pattern of intensity varies across different branches of the canyon (Amaro et al., subm.). There appears to be a significant flux from the easternmost canyon limb onto the shelf. Near-bottom tidal currents within the canyon are also enhanced, with modeled velocities ranging from >0.4 m s^{-1} in the upper reaches to 0.1 m s^{-1} in the lower reaches of the canyon. Such enhanced bottom currents within the canyon could have many implications for sediment and organic matter transport and resuspension, the generation of nepheloid layers and will contribute to habitat heterogeneity. So far these oceanographic parameters have not yet been included in the CODEMAP habitat maps and predictions, as the model results still need in-situ validation, but it is clear that such type of information would increase the reliability of the Whittard Canyon habitat maps. Hence, to strengthen the numerical model and evaluate the modeling results, repeated measurements of the water column structure and variability were needed, mapping the *in-situ* internal tide field for a length of time.

1.3. Species connectivity (Acesta)

The deep-sea file clam *Acesta excavata* is commonly associated with cold-water corals in the NE Atlantic and their highly vulnerable habitat (López Correa et al., 2005). It is especially abundant in submarine canyons, where it can adhere to vertical walls in high abundances (e.g. Johnson et al., 2013). Like cold-water corals, Acesta is considered an "engineering species", creating three-dimensional complex habitats for other species and supporting an increased biodiversity. Those qualities convert Acesta in a potential target species for conservation. The development of effective conservation measures, like the designation of Marine Protected Areas, requires more knowledge about connectivity patterns between subpopulations. This requires (i) an understanding of the spatial and temporal scales of connectivity and the processes that underlie genetic structure of this species, (ii) an understanding of population persistence in these systems and (iii) capacity building (knowledge and expertise) in understanding connectivity in the deep sea to inform policy makers engaged in marine spatial planning.

To achieve this, the project ConDeep ("Population Connectivity of the deep-sea file clam (*Acesta excavata*) associated to cold-water coral habitats in the NE Atlantic: genetics, life history and oceanography") was submitted to the Norwegian Research Council by Dr. J. Jarnegren (NTNU), in collaboration with the University of Aveiro (Dr. Ana Hilario), NOC (Dr. Veerle Huvenne), Florida State University (Dr. Sandra Brooke), NUI Galway (Dr. Louise Allcock), NIVA (Dr. Eva Ramirez-Llodra) and SINTEF (Dr. Øyvind Knutsen). The project will integrate different techniques: (1) evolutionary and ecological genetic parameters, (2) elemental fingerprinting of larval-shells and (3) bio-physical models, at different spatial scales (medium scale: between branches of the Whittard Canyon; and large scale: between Whittard Canyon and other canyons along the NE Atlantic Margin, e.g. offshore Portugal and Norway). The use of different spatial scales will allow to explore potential connectivity across a range of distances, from a few to thousands of kilometers, and constrain scales and patterns of genetic variation to infer historical processes (e.g. past range expansions and contractions) and mechanisms, such as phylogeographic breaks and rates of gene flow, underlying contemporary distributions.

Especially approach (1) and (2) require in-situ work: precise sample collection and the installation of larval traps, for which access to specialised ROV capabilities is needed.

1.4. Sediment dynamics

Extensive studies of cores from the Celtic Fan (e.g. Zaragosi et al., 2000; Toucanne et al., 2008, 2012) have shown that the canyons on the Celtic Margin (including Whittard Canyon) experienced a high sediment through-put during sealevel lowstands, particularly during deglaciation phases. Zaragosi et al. (2006) even suggested that the area was affected by annual sediment gravity flows, resulting in varved turbidite deposits. During glacial times and subsequent transgressions the the meltwater discharges from the Fleuve Manche (the main river system that developed in the current area of the English Channel, collecting the outflow of all major N European rivers) and the British-Irish Ice Sheet were delivered more or less directly into the canyon heads. However, with increasing sealevel rise at the start of the Holocene, this delivery mechanism disappeared, and the present-day activity in Whittard Canyon is much reduced. However, recent studies based on cores, sediment traps and turbidity measurements collected from whithin the canyon itself (rather than the Celtic Fan) do indicate that the canyon is far from 'inactive' in terms of sediment dynamics and transport (Amaro et al., subm.). Although the frequency of large sediment flows has clearly reduced, a number of flows do still occur. Scouring patterns, nepheloid layers within the canyon and turbidite deposits in levee cores do indicate continued sediment transport, albeit not always in the down-canyon direction. Exactly how frequently flows of different sizes do occur, how they are formed (simultaneous events that trigger failures and flows in several branches, or just one branch at a time?) and the mechanics of the actual flow process (size of the sediment cloud? Scour formation, bypassing, differential deposition on opposite canyon flanks/terraces/levees, deposition on the inner or outer bend?) are still open questions. Particularly enigmatic is a field of sandwaves at the head of the eastern Whittard Canyon branch with a morphology that suggests the action of a current spilling out of the canyon rather than being directed down-canyon (Cunningham et al., 2005). Detailed mapping together with oceanographic observations were necessary to identify the exact processes behind the sandwave formation.

2. Marine Conservation Zones

The UK Government and the Devolved Administrations are committed to establishing an ecologically coherent network of Marine Protected Areas (MPAs) in UK seas to meet international commitments and European obligations. The Marine and Coastal Access Act (2009) requires the UK Governments to create a network of MPAs that will comprise existing sites (European Marine Sites, SSSIs and Ramsar sites) together with new national designations. The Marine and Coastal Access Act makes provision for the designation of Marine Conservation Zones (MCZs) in the UK Marine Area (JNCC, 2013).

2.1. Haig Fras MCZ

Within UK, European, and global waters, various networks of Marine Protected Areas (MPAs) are currently being identified, assessed, and designated. A key question arising from this process is how to optimally monitor these sites in the future, in order to identify any changes in condition resulting from management measures. In partnership with Defra, NOC has been leading a project looking at the use of marine autonomous vehicles for repeat mapping and monitoring of MPAs, primarily in UK waters.

In July 2012, the NERC *Autosub600*0 AUV was deployed from RRS Discovery to collect high-resolution multibeam bathymetry (MBES), sidescan sonar (SSS) and seafloor photography data from the Greater Haig Fras recommended Marine Conservation Zone (rMCZ), in an area previously covered by Cefas vessel-based mapping (Fig. 2). This allowed an initial comparison of vessel and AUV-based mapping data, and the results were published in a report to Defra (Wynn et al., 2012) and in the scientific literature (Wynn et al., 2014). A follow-up survey, three years after the initial AUV data acquisition, was now needed in order to further assess the monitoring capabilities of the autonomous technology. Using Autosub6000 once again to carry out the same survey as in 2012 would enable us to (1) test the feasibility of shallow-water high-resolution repeat mapping, and (2) evaluate the amount of 'natural' change shown by the studied seabed habitats and fauna over the three-year period.

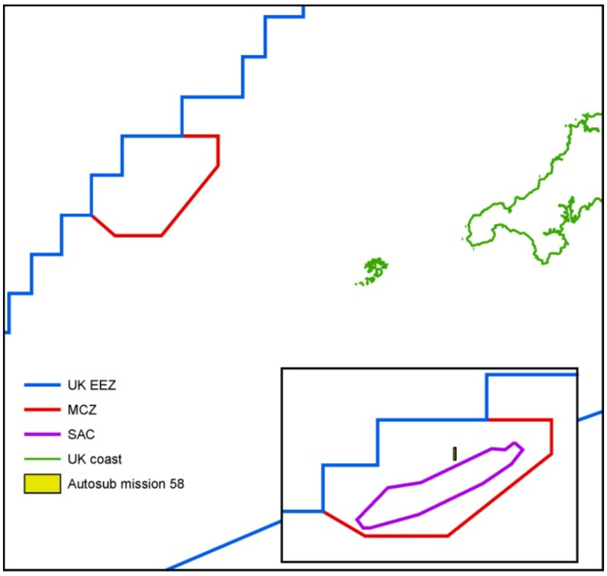


Fig. 2 Location map showing the outline of the Greater Haig Fras rMCZ west of Cornwall, including the associated SAC and the position of the repeat Autosub6000 survey.

In addition, while the AUV was 'on mission', the availability of the ROV Isis provided an opportunity to survey steep walls around the nearby Haig Fras SAC (Special Area of Conservation) to support existing vessel-based data. Finally, a vessel-based MBES survey was also undertaken overnight when the AUV was out and the ROV was not in operation.

Haig Fras is designated as a site of community interest (SCI) under the EC Habitats Directive as it represents Annex 1 Reef and is also encompassed by the Greater Haig Fras recommended Marine Conservation Zone. The reef is an isolated granite outcrop which rises from approximately 100 m depth to 40 m at the shallowest point. Haig Fras represents the only substantial area of bedrock reef in the Celtic Sea and is 45 km long and 14 km at its widest, covering an area of 481 km^2.

During a baseline monitoring survey carried out by Cefas in partnership with JNCC on RV *Cefas Endeavour* (survey CEND 09/15), 91 video stations were targeted across the reef using Cefas' drop-down video camera system. The nature of this equipment does not allow near-vertical surfaces to be readily surveyed, and the opportunity to deploy ROV *Isis* would therefore potentially provide information on these areas of the reef.

2.2. Canyons MCZ

The Canyons MCZ was recommended by the Finding Sanctuary Regional MCZ Project, and was one of 31 sites proposed for MCZ designation in 2013. Following public consultation, Defra confirmed its intention to progress the site and The Canyons MCZ was designated in November 2013 (JNCC, 2013). The Canyons MCZ represents the only deep-water site within the MCZ network, and is the only deep-water MPA within the English region of the UK Exclusive Economic Zone. It comprises the upper reaches of two canyon limbs (Dangeard and Explorer Canyon) that feed into the Whittard Canyon system (Stewart et al., 2014). The site was designated for two features, 'Deep-seabed' and 'Cold-water coral reefs', based upon data from a Mapping European Seabed Habitats (MESH) project survey carried out in 2007 and UKSeaMap 2010 (McBreen, 2010; Davies et al., 2014). Both features were given a 'recover' conservation objective (JNCC, 2013).

Upon review, data underpinning designation of the site were considered to provide limited evidence of the features. Therefore, further survey was needed and in partnership with Defra, NOC allocated vessel time for data collection within the MCZ as part of the JC124-6 surveys targeting the Whittard Canyon system. All data acquired within the allotted days at The Canyons MCZ would be used to improve the evidence base for designated features and consequently inform decisions made regarding management of the site. These data will also contribute to the network-wide evidence base of the MCZ programme.

3. Technological developments for deep-sea research

3.1. Autosub adaptation

The morphology of complex deep-sea terrains causes areas such as steep cliffs and overhangs to be 'overlooked' on traditional maps. However, they often host rich ecosystems of filter-feeders, including cold-water corals and clams (e.g. Van Rooij et al., 2010; Johnson et al., 2013). One possible solution is to map those areas with the acoustic equipment (multibeam echosounder or sidescan sonar) mounted on the side or front of an underwater vehicle. This was successfully tested in the Whittard Canyon in 2009, using the ROV Isis (Fig. 3, Huvenne et al., 2011) and has since also been applied to the headwall scarp of a submarine landslide in the Rockall Trough, using the Irish ROV Holland I (Huvenne et al., 2015). However, although data of very high resolution can be obtained in this way, a more time-efficient approach was sought within the CODEMAP project: the NOC AUV

Autosub6000 was adapted in order to be able to map vertical and overhanging substrates in 'sideways-mapping' mode. This new development now needed testing in an environment where such vertical maps were known to bring new scientific insights.

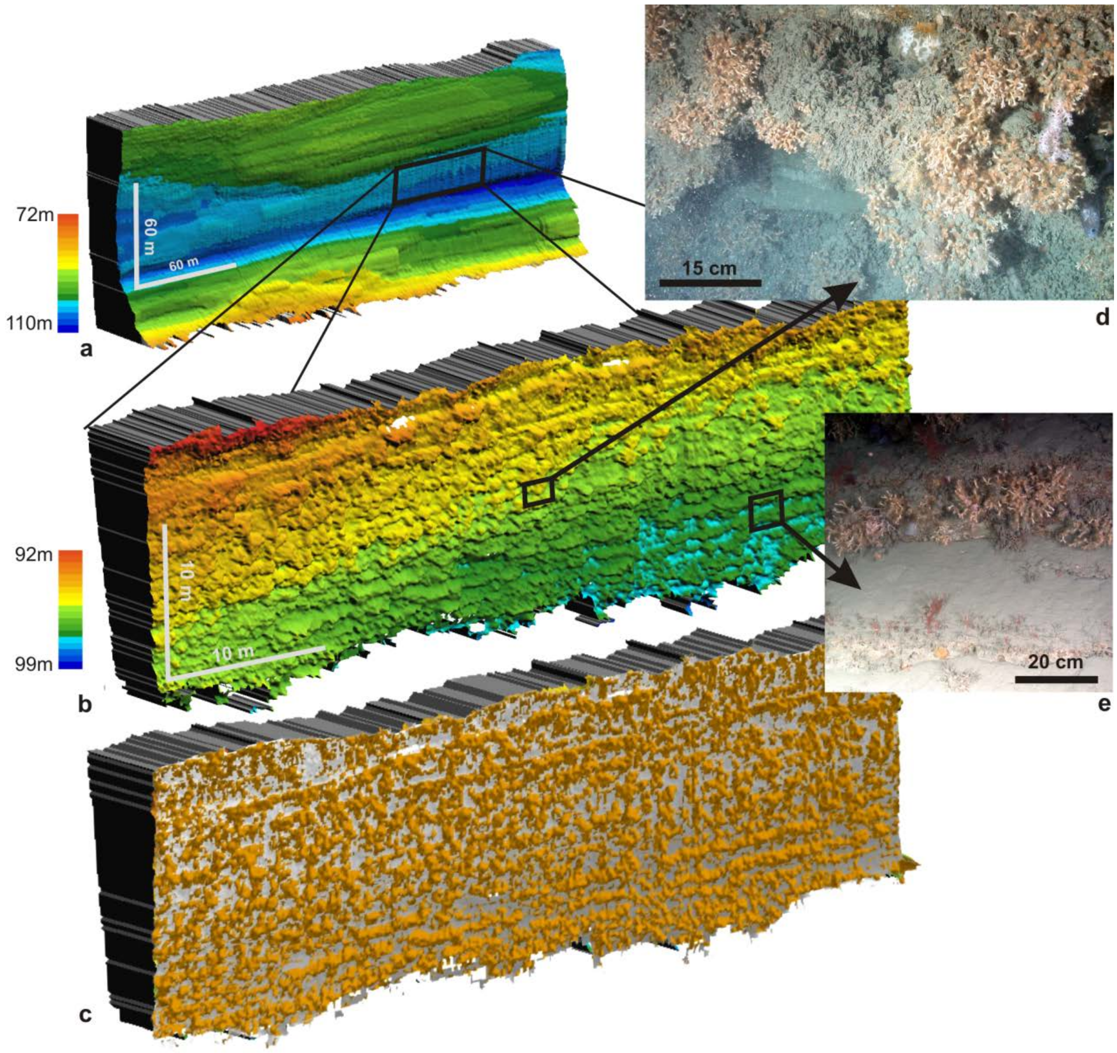


Fig. 3 Vertical mapping results obtained with the ROV Isis in Whittard Canyon. (a) cliff morphology mapped from 30m distance providing an overview over the 120m-high cliff; (b) cliff morphology mapped at 7 m distance, showing individual coral colonies and protruding rock strata; (c) top-hat transformation result of the previous map, indicating coral coverage of ~70% shaded in orange; (d) representative photograph showing large Lophelia colonies attached to the wall; (e) illustration of coral preference for specific strata. From Huvenne et al. (2011)

3.2. ROV vibrocorer

During CODEMAP2015 a new ROV-based vibrocorer was tested as part of the NERC technology-led project "Building and testing a new ROV-based vibrocorer for precisely located coring of sandy substrate in water depths up to 6000m" (NE/0176581) aiming to build the first ROV-mounted vibrocorer able to be deployed at full ocean depth. The vibrocorer would allow for precisely located coring, especially in sandy substrate which has previously proved difficult for traditional coring methods such as piston and gravity corers. Additional benefits of the ROV-mounted vibrocorer is the ability of the surrounding seafloor to be mapped by high-definition video cameras, providing additional context for the targeted coring sites.

The design of the instrument was based upon similar vibrocoring systems developed at the Monterrey Bay Aquarium Research Institute (MBARI), and was previously tested offshore Montserrat (JC083). However, since then, the system had undergone significant improvements, and was not yet tested in its new configuration, nor in deep water (>200m).

OBJECTIVES

Following the background and rationales laid out above, the CODEMAP2015 expedition had an extensive range of objectives. The core aims of the cruise were:

1. To carry out **further habitat mapping** at different resolutions in Whittard Canyon, to increase our understanding of the system in a nested approach
2. To test and improve the habitat models built within CODEMAP using the 2009 data by collecting **additional ground-truthing** data (video & samples)
3. To apply further **sideways multibeam mapping** (+video ground-truthing), in order to develop a true 3D habitat model of the canyon – especially **testing the Autosub6000** adaptation for this purpose
4. To **measure the water column structure** in the Eastern Branch of Whittard Canyon, to allow the inclusion of oceanographic parameters in the predictive habitat models.
5. To **repeat the 2012 Autosub6000 survey over Haig Fras twice**, in order to assess the feasibility of shallow-water high-resolution repeat mapping by AUV and to establish the amount of natural change in the seabed habitats and fauna over a three-year period.
6. To improve understanding of **feature location and condition in the Canyons MCZ**, for example, improving confidence in the presence, extent and condition of *Lophelia pertusa* and other scleractinian corals
7. ROV **vibrocorer tests**

In addition, we also aimed to achieve the following:

- ROV Isis surveys within the Haig Fras MCZ to acquire video and photography data from near-vertical wall and overhanging reef substrates
- Acquiring shipboard multibeam data from the Greater Haig Fras area, to add to existing CEFAS data.
- Sampling of *Acesta excavata* and placement of larval traps in two canyon branches for connectivity studies, plus characterisation of the *Acesta* environment (CTD & SAPS)
- Additional piston coring to reveal sediment dynamic characteristics of Whittard Canyon
- Collection of voucher specimens for our cruise partners from IFREMER and NUI Galway
- Storage of spare megacores and additional CTD/SAPS deployments for the study of organic matter distribution in relation to faunal spatial patterns (collaboration with Dr. K.Kiriakoulakis, John Moore University, Liverpool)
- Shipboard multibeam data acquisition on all transits
- Cetacean & bird observations

With regard to the work for DEFRA, objectives 6 was broken down into the following specific tasks:

1) Deploy ROV *Isis* on an area of cold-water coral reef, first observed on the MESH Canyons survey in 2007 (Fig. 1).
2) Acquire ship-mounted multibeam echosounder (MBES) data for remaining areas of Dangeard and Explorer Canyons (Fig. 1).
3) Complete ROV *Isis* transect from the middle of Explorer Canyon up the northern flank of Explorer Canyon (Fig. 1).
4) Complete further ROV *Isis* transects of Dangeard and Explorer canyon flanks (Figure 1).
5) Acquire ship-mounted MBES data for the remaining area in the south of The Canyons MCZ, with priority to the deeper waters (>1000m) (Fig. 1).
6) Undertake AUV *Autosub6000* mission on southern flank of Dangeard Canyon, completing a block of high-resolution side-scan sonar from the mini-mounds on the interfluve area extending NW into deeper water. Then undertake an AUV photo mission criss-crossing the area covered by side-scan sonar (Fig. 1).
7) Undertake a second AUV mission on the floor of Dangeard or Explorer Canyons (Fig. 1).

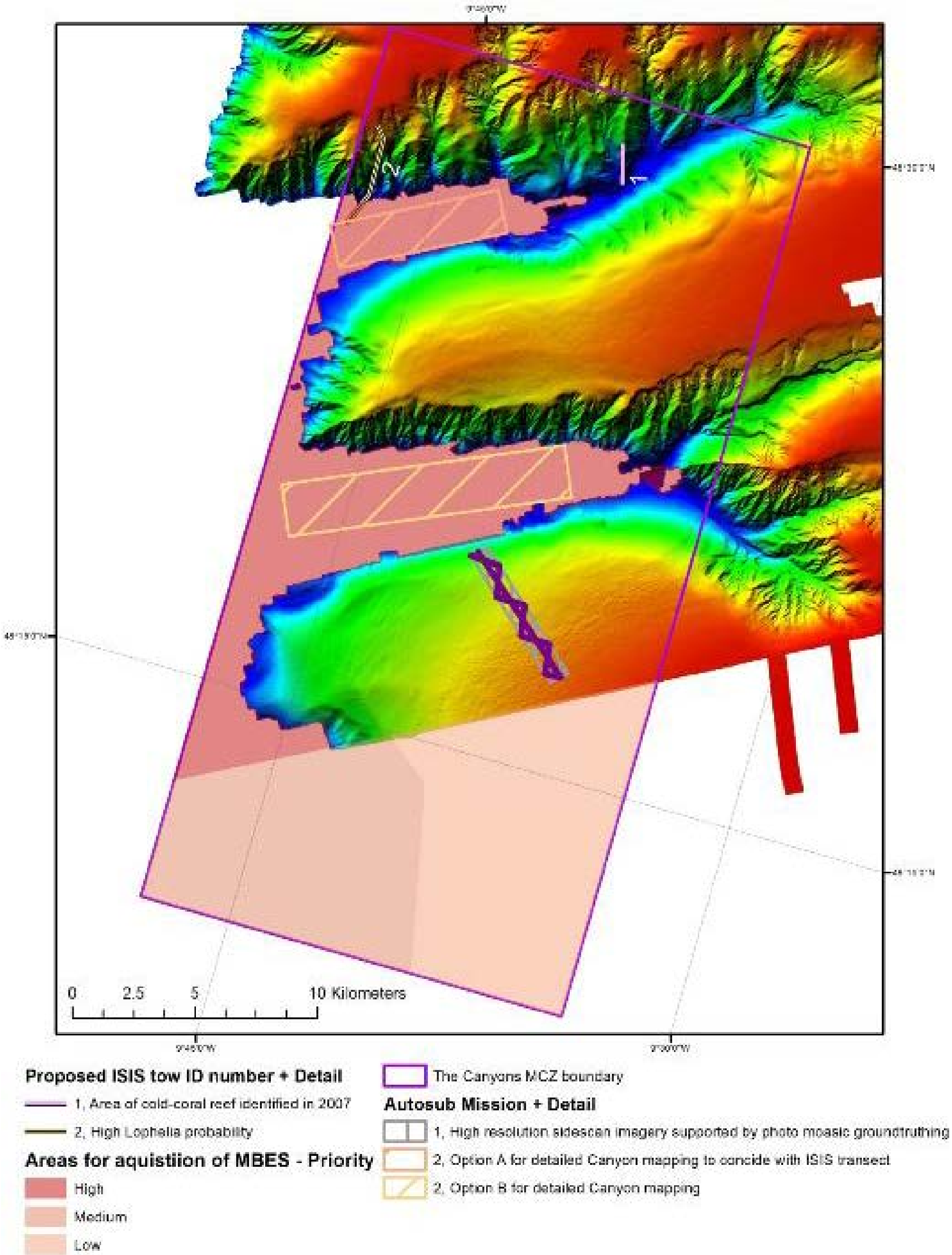


Fig. 1 Map provided by JNCC showing priority areas for data collection in The Canyons MCZ.

NARRATIVE

Saturday 8 August 2015 (JD221)

The last piece of equipment (the UEA Seaglider) was loaded on board in the morning. The scientific party arrived on board, and gathered for a science meeting at 3pm. All was set and ready to go by the evening

Sunday 9 August 2015 (JD221)

The RRS *James Cook* set sail at 0650BST from Empress Dock (outside NOC). Weather was fair, with a calm sea and light breeze. The science team attended a safety briefing at 0900BST, and joined a safety drill at 1615BST. Induction into the ROV logging protocols and work in the van was attended by all. The first seabird observations were recorded by Russell Wynn. Passage continued smoothly for the whole day.

Monday 10 August 2015 (JD222)

Clocks changed to GMT at 0200 overnight. Passage continued until we reached the first working area at 1030. The 75kHz ADCP was set up as a test and it started recording at 1037. The CTD (JC125-001/CTD01) was deployed at 1058, and also carried the Sound Velocity Probe (SVP) and 2 USBL beacons for testing (one for the ROV and one for the AUV). As the AUV beacon was not responsive, the beacon was swapped for a recently purchased one upon recovery of the CTD, and the instrument was sent down again, but without the SVP (JC125-002/CTD02). This time all worked well. In the meantime, the sound velocity profile was uploaded in the Simrad multibeam software, but it appeared to cause typical 'smilies', i.e. the sound velocity recorded appeared too high. After some detective work, it was established that the wrong profile was uploaded. Once this was corrected we were ready to start the EM710 swath survey (JC125-003/MBES01). This survey was planned to cover the Autosub survey site to check if the area was OK. We also recorded SBP120 and EM120. As we were approaching the end of this survey, it transpired that Autosub had problems with its GPS antenna. Hence the EM710 survey was extended towards the south.

While carrying out the multibeam survey, the bridge communicated with a fishing vessel in the neighbourhood that had gear in the vicinity. It was established that the Autosub survey area should be free of fishing gear, but further communications are planned for the coming days to secure the safe operation of our vehicles. Noteworthy was the fact that the fishing vessel had its gear to the south of the Autosub area, i.e. in the Haig Fras cSAC.

At 1450 the EM710 survey was paused to lift Autosub outboard to test if the communication problem was solved. This was not the case, hence the AUV was brought back inboard and at 1620 the EM710 survey was continued. By 1800 the AUV was ready for deployment, so station JC125-003/MBES01 was finished and Autosub was deployed at 1837 (JC125-004/M86). We stayed at the deployment site to contact the vehicle at the seabed, and by 2000 the USBL signal was registered. At 2010 Autosub started its mission, and the scientific party went back to EM710 surveying (JC125-005/MBES02) at 2058.

Tuesday 11 August 2015 (JD223)

The multibeam survey was temporally paused at 0124 for a rendez-vous with Autosub at 0146. The AUV came to the surface, and communication was established. Some vital statistics were downloaded, which showed that Autosub seemed to perform well. Hence the vehicle dived again at 0253 to continue its mission. The EM710 mission was continued at 0303.

Multibeam surveying continued until 0717, when the ship moved to the first ROV dive site (JC125-006/ISIS242). The vehicle had some trouble latching into the LARS head, but was finally deployed at 0856. It reached the bottom at 0923, but initially a number of issues with navigation and camera settings had to be sorted out. The Doppler navigation did not seem to function very well, probably as a result of the large boulders and irregularity of the terrain. This left rather little time for the actual dive, as the ROV had to be back on deck by 1130 to make sure we would be in time for the Autosub pick-up. ISIS left the seabed at 1109, and was on deck at 1131. We steamed directly to the AUV recovery site, and by 1248 the vehicle was on deck.

From there we went back to the same location for a second ROV dive, but again problems were encountered with the LARS latching system. The cause was quickly established, but it took several hours to repair, so the decision was taken to add another line to our multibeam survey (JC125-007/MBES03). By 1830 the ship was back at the ROV site, and the vehicle went into the water at 1903 (JC125-008/ISIS243). Once at the seabed (1920), it became clear that the USBL position was not correct, and differed from the USBL position that was registered through the Sonardyne software from the ship. By 2204 the fault was rectified by re-importing the acoustic beacons into the software and letting the software determine the characteristics automatically, and the actual video transect could be started (some sampling had taken place in the meantime). It is possible that the same fault may have affected the USBL data from Dive 242.

The dive was finished by 2335 and the ROV was brought on deck at 2347. The Autosub engineers were still working through problems with the camera, hence the decision was taken to carry out EM710 surveying overnight and to deploy Autosub in the morning. However, this would have to be with a reduced mission plan: by taking out the repeat of the multibeam survey, the mission could be shortened to 9 hours instead of 15, which would allow recovery before dark and before a patch of worse weather that was predicted.

Wednesday 12 August 2015 (JD224)

The EM710 survey was started at 0030 (JC125-009/MBES04), and continued until 0733. The data throughout the last few days have been OK, a little noisy in the bathymetry part but with excellent results in the backscatter. At 0821 we were ready to deploy Autosub (JC125-010/M87), and the vehicle was in the water by 0845. The ship went straightaway onto transit to the next ROV Dive site (JC125-011/ISIS244). ISIS was deployed at 1146 to carry out a survey over several bedforms and over a different rocky outcrop part of the Haig Fras reef. The dive was successful, although on the reef currents were so strong that the vehicle could not keep position and sample at the same time. Hence only video surveying was carried out.

By 1604 ISIS was back on deck and the ship went back to the Autosub recovery site, where it arrived at 1800. The AUV had not yet surfaced, so we set up the vessel at the northern end of the survey area, where the mission was supposed to end. No USBL contact could be made for 2 hours, hence by 2020 the *James Cook* started travelling southwards in an attempt to pick up a USBL signal. This was received shortly after, indicating that the sub was still on track, but simply had completed the survey slower than expected, probably as a result of the very strong tidal currents this afternoon. By 2045 the AUV was at the surface, and by 2152 it was on deck. This was the sign to start the transit to Whittard Canyon. EM120 data was collected underway (JC125-012/MBES05). However, at the start of the survey the Simrad acquisition software SIS could not recognise the 1PPS pulse from the GPS, and the clock synchronisation had to be switched off. The data were of reasonable quality, though, and given that this was a transit, it was decided to continue with those settings.

Thursday 13 August 2015 (JD225)

Despite a worsening weather (reaching up to a sea state 6), the vessel made good speed on its transit to Whittard Canyon, hence the first working site there, at the confluence of all branches, was reached at 1524. The first planned operation was a CTD, but just before the instrument was deployed, it was noticed that the winch cable was incorrectly spooled through the parallellogram. While this was rectified, the ROV team started streaming the ROV cable. With the weight, they also deployed 2 USBL beacons for testing. All went well. In the meantime, the CTD wire problem was solved, the system was re-terminated and a load test was carried out. Hence at 2129 the CTD was in the water and by 2258 it reached the seabed (JC125-013/CTD03). As the system was brought up, at 3667m depth the communications failed.

Friday 14 August 2015 (JC226)

The day started with reasonable weather conditions, but a large swell started to come up later on that limited operations to CTD, coring and MBES (the latter with poor results for all lines in a NW direction).

The CTD was brought on deck by 0021, but the diagnostics were only carried out later on in the day. From there the ship moved to our first piston coring location, collecting EM120 data underway (JC125-014/MBES06). The core was deployed at 0624 (JC125-015/PC01), and reached the seabed at 0738. However, when we started to pull it out, the tension kept increasing, up to the safe working load of the system, and it became apparent that the core was stuck in the seabed. What followed was an operation to try to free the core, by sailing in different directions and applying tension, but the core did not come loose. Eventually the wire tension was gradually and carefully increased, but at 1121, at 12t the weight came off which meant that the cable had broken. The cable was carefully winched up, and at 1344 the left-overs were brought on board. The trigger core and lever arm were saved, but the penant wire was sheared and the piston core was lost.

Following this unlucky event, we sailed NE along the canyon branch, back up towards shallow waters, in order to carry out a CTD + SAPS. However, as a result of the failure the day before, the CTD had to be re-terminated, and the CTD unit had to be replaced by a spare. This procedure also involved a load test. This would take >6hours, hence a multibeam survey was carried out (JC125-016/MBES07), part as transit to the CTD site, and part as survey of the canyon branch with the Acesta wall. The EM120, however, had to be restarted mid-way, which resulted in an hour delay. By 1030 the CTD was ready, and the SAPS filters were prepared. However, although tested before the load test, and found to be working well on the deck lead, the CTD did not respond once it was lifted off the deck for deployment. Hence the only option we had as science team was to sail on and go on transit to the next Autosub deployment site (which meant a continuation of JC125-016/MBES07).

Saturday 15 August (JD227)

The day started with a large swell, but the wind had completely died down. By 0800 conditions were smooth, with broad and gentle swell.

We arrived at the sediment wave field at the canyon head of the eastern branch by 0205, to start a specific EM710 survey (JC125-017/MBES08). Together with the EM710 (with its dropkeel down), we also again collected EM120 and SBP120 data. However, by 0607 the EM120 stopped recording, and with it the SBP120. The IT tech worked on both systems and by 0646 the SBP was back in action. Shortly after also the EM120 was operational again, but it was decided not to use the system any further for this survey as it seemed to interfere with the SBP, which, by then, was showing very good data.

The multibeam survey continued until 0942, when we came on station for the next Autosub deployment (JC125-018/M88). The EM710 dropkeel was brought up, and the sub was deployed very smoothly. It was in the water by 1021. Comms were checked and the vehicle started to dive at 1042. Once on the bottom a navigation correction procedure was carried out, and by 1122 Autosub was on its way for Mission 88. This freed up the vessel to steam to the position (but running the EM120 underway, JC125-019/MBES09) where we planned to deploy the glider (JC125-020/Glider01). The glider was in the water by 1411. Communication tests were carried out and by 1437 it submerged for a short test dive. Back at the surface at 1507, the tests were confirmed successful by the glider piloting team of UEA, and the vehicle was set off on its mission for the next 3 weeks by 1532.

The glider deployment was followed by a CTD (JC125-021/CTD04, in water: 1553, on bottom: 1654, on deck: 1753), and more EM120 multibeam (JC125-022/MBES10), this time carried out at 4kn to ensure a high data density, as this was the multibeam survey for JNCC/DEFRA in the Canyons MCZ.

Sunday 16 August (JD228)

Calm weather, sea state 1-2, some rain in the morning, clearing in the late afternoon.

The MBES survey was carried out successfully, and finished by 0440. At 0445 the ship set course to the Autosub mission site for pick-up, continuing with EM120 data collection on the way (JC125-023/MBES11). However, at 0731 the system crashed once again. As this was only a transit, the ship was not stopped, and the EM120 was tended to during later operations during the day.

We arrived on site for the Autosub pick up at ~0800, but Autosub was still on its mission. After a little wait, the ship went on a NE course in an attempt to locate the vehicle. Soon after, a USBL signal was picked up, showing that Autosub was carrying out its last photo transect. We waited until that was finished, and Autosub was easily recovered, with the vehicle on deck by 1035. A large amount of sidescan sonar data was collected, but unfortunately the camera did not collect any photographs as a result of human error. Once the data were downloaded and analysis started, we realised that the vehicle had struggled a lot against a strong tide. Some of the mission lines were not completed, and the heading upon which that happened changed every 6 hours.

The ship was repositioned, and at 1200 the ROV was in the water for JC125-024/ISIS245, a dive on the coral wall in the eastern branch of Whittard Canyon. The descent went smoothly, with spectacular views of a school of fish, but upon reaching the seabed at 1309, visibility had decreased so much that the seabed could hardly be seen. The dive transect was started, though, in the hope that the waters would clear as the tide would turn and as the vehicle would travel to shallower water. Unfortunately, by 1415 the ROV developed a fault in the control computing system ('topside'). Although the system was restarted and appeared (partly) operational again, it was decided to abort the dive, given the very low visibility and the risk of diving at the overhanging coral wall. At 1627 the vehicle was back on deck.

As an alternative programme, it was then decided to carry out a planned CTD cast including a SAPS deployment (JC125-025/CTD05) next to the coral wall, to support the study of lipids and pigments (food quality) carried out at the Liverpool John Moore University. Although the original plan was to let the SAPS pump water for 2 hours next to the coral wall, the amount of turbidity observed made us change the plans to a 30min filtering session. The filter indeed had a large amount of material on it upon recovery, but there may be a chance it was torn and the sampling was not quantitative.

By the time the CTD was back on deck (1901), there was still no diagnosis on the ROV, hence we decided on a coring programme through the night. A coring site was chosen in the confluence of the two eastern canyon branches (3700m), and the ship set off on a 3.5 hour transit (JC125-026/MBES12). We reached the coring station at 2237 and the piston core was deployed at 2323 (JC125-027/PC02).

Monday 17 August (JD229)

Calm weather, sea state 1.

The piston core reached the seabed at 0054, and was pulled out by 0056 with 6.8t tension. It was on deck by 0250, but proved difficult to extract from the barrel (problems detaching the core catcher). In the end recovery was 1.78m in total. The piston core was followed by a mega core (JC125-028/MC01), which was in the water by 0329 and back on deck at 0723. Pull-out was 4.61t, and we recovered 7 out of 8 cores, although one was disturbed. Two cores were frozen at -20° for biogeochemistry (lipids & pigments), two were subcored for geology.

The next operation was the deployment of Autosub, a 2-hour transit away from the coring site (JC125-029/MBES13). We arrived at 1011, and after a few more checks the vehicle was lifted off the deck at 1054. However, the motor and propeller seemed to have problems, and the vehicle was brought back inboard at 1147. As the cause of the problem was not immediately obvious, we decided to continue with the next step of the programme, an ISIS dive for JNCC in the Explorer Canyon, at the location of a *Lophelia* reef. The fault in the ROV had been found and rectified overnight, and the vehicle was ready for a dive. It only took a one-hour transit (JC125-030/MBES14) to reach the site, and the vehicle was in the water by 1333 (JC125-031/ISIS246). It reached the bottom at 1429, and carried out transect that brought us spectacular views of cold-water coral habitats, with a broad range of fish species in high abundance. The ROV also encountered evidence of trawling/fishing and had to avoid fishing gear several times.

Tuesday 18 August (JD230)

Calm weather, sea state 1-2

Dive246 finished at 0337 (off bottom), and the ROV was on deck at 0434. In the meantime, the Autosub problem had been solved the day before, so after the short transit back (JC125-032/MBES15), we deployed Autosub for the JNCC mission (JC125-033/M89). The start position determined through the Linquest USBL could not be communicated to the vehicle, so the Mission may be several hundred metres off to the north of the originally planned WP. However, there were no risks in that direction, so no further action was taken. By 0748 the vehicle started its science mission, and by 0827 the ship was on transit (JC125-034/MBES16) to the next ISIS dive (JC125-035/ISIS247). Dive 247 targeted a second priority transect proposed by JNCC, with the aim to check the predictive model for *Lophelia* habitat produced by Kerry Howell (University of Plymouth). ISIS was in the water at 1001 and reached the seabed at 1102. The dive started in the thalweg with spectacular evidence of violent flows and scour marks, but the amount of cold-water coral, although present in small patches, was nowhere near what was observed the night before. Unfortunately, several fishing lines were seen across our path again, which resulted in severe alteration of the planned track.

Wednesday 19 August (JD231)

ISIS was brought back on deck by 0233, and the ship set off on transit (JC125-036/MBES17) back to the Autosub deployment site to pick up the AUV. The vehicle surfaced at 0410, and was recovered by 0448. With the AUV secured, another transit was carried out (JC125-037/MBES18) to our next ROV dive site in the deep Whittard Channel (4200m, JC125-038/ISIS248). We arrived on site at 0831, but just before deployment it became clear that the ROV deployment waypoint was within 1 nautical mile from a (disused) deep-sea cable. The dive plan was altered, and ISIS was in the water at 0959. She reached the seabed at 1225 and set off on her transect across the channel floor. With about half the dive under her belt, she lost power at 1748. The fault was identified (blown fuse) and rectified by 1754, but nearly immediately after the controls on some aspects of the vehicle were lost. Only the HD cameras kept working, indicating that one of the fibres in the cable had given up. When trying to restart the system, connection was completely lost, and the vehicle had to be brought up as a dead vehicle. It was safely on deck by 2150, and the engineers started immediately with diagnostics and re-termination of the cable. It meant, however, that ISIS was out of action for about 24hours.

As an alternative plan, and with a prospect of worsening weather coming up towards the weekend, it was then decided to go back to the coral wall to deploy Autosub in the morning. The ship was on transit (JC125-039/MBES19) by 2205.

Thursday 20 August (JD232)

Calm to moderate weather, sea state 5.

We arrived at the coral wall by 0307, and set up for a CTD & SAPS (JC125-040/CTD06). This was a repeat of CTD05, as the SAPS filter seemed torn at that occasion. The CTD was in the water at 0354, and reached 1350m depth at 0433. Pumping started at 0456, and lasted for 30min. By 0607 the CTD was back on deck. The next operation was the deployment of Autosub. However, the last pre-dive checks on deck revealed a groundfault on the ADCP. Given that this is an essential instrument for position keeping in the canyon, it was decided to abort the operation and go for an alternative plan. With also the ROV still out of action, the best option appeared to carry out another CTD & SAPS, this time next to the Acesta wall. Hence the ship went on transit (JC125-041/MBES20) once again at 0754, and by 0959 arrived on station. The CTD & SAPS (JC125-042/CTD07) were in the water by 1030, and reached 700m depth by 1052. The SAPS was set to pump for 90mins, starting at 1100. The system was back on deck by 1255.

By that time ISIS was back in shape, but the weather had deteriorated to marginal conditions for vehicle deployment. Therefore we decided to once again move on to the piston coring site in the lower canyon and carry out a coring programme before the next attempt of vehicle deployment the next morning. The ship was on its way (JC125-043/MBES21) by 1411, and arrived on site at 1828. The piston core (JC125-044/PC03) was in the water at 1857, reached the seabed at 2022 and was back on deck at 2218. Recovery was 8.95m, with a pull-out of 6.2t. This operation was followed by a megacore (JC125-045/MC02) which was in the water at 2332.

Friday 21 August (JD233)

The megacore was back on deck by 0315. Two cores failed, while two had limited recovery, but 4 good cores could be extracted. From there the ship set off on its transit (JC125-046/MBES22) back to the coral wall area for ISIS Dive249 (JC125-047/ISIS249), a second attempt at putting the Acesta traps out and collecting video data from this environment. We arrived at 0714, and by 0755 the vehicle was in the water. It reached the seabed at 0857, but conditions were more or less equally as bad as during Dive245 in terms of visibility. However, with all systems working well (especially the forward looking sonar), it was decided to continue the dive. As the vehicle was coming up the coral wall, visibility improved, and the larval traps could be deployed around a depth of 1310m. Samples of Acesta and associated fauna were taken, and some video work was carried out. By 1918 the ROV was back on deck, and the ship repositioned (JC125-048/MBES23) for the deployment of Autosub (JC125-049/M90). The AUV was deployed at 2017. Once the vehicle was sent off on its science mission, the ship was repositioned again (no multibeam data collected) to a shallower site in the canyon branch for a short ROV dive (JC125-050/ISIS250). ISIS was in the water by 2353.

Saturday 22 August (JD234)

Calm weather, sea state 2-3, large period swell.

ISIS continued its survey of the shallow eastern branch of Whittard Canyon until 0549, and was back on deck by 0634. The ship immediately repositioned to pick up Autosub, and by 0808 the vehicle was caught. It was safely on deck by 0818.The ship then went on transit (JC125-051/MBES24) to the site of the Acesta wall. EM120 and SBP120 data were collected as usual, but the systems failed at 1002, and the transit was continued without further recording.

At 1108, ISIS was ready to dive (JC125-052/ISIS251). The vehicle reached the seabed at ca.750m depth by 1157. Currents were fierce and conditions difficult to work in, but the dive progressed towards the Acesta wall in good order. However, by 1400 the bridge informed us of a conversation with a close-by fishing vessel which had warned them that they had longlines out exactly at the location of the Acesta wall, the main target of the dive. The dive plan was then altered, and ISIS was sent to the opposite wall of the canyon, where steep topography was also expected. A spectacular cliff covered with *Acesta*, *Neopycnodonte*, *Lophelia*, *Madrepora*, *Desmophyllum* and all their associated species appeared, and was video-surveyed in detail. We also placed 3 more Acesta larval traps for the University of Aveiro, although it proved difficult to find suitable locations as the wall was fully overhanging. To date, this certainly is the most spectacular find of this cruise.

ISIS was back on deck by 2206, and the vessel was repositioned (no multibeam) for the deployment of Autosub at the same location (JC125-053/M91), to carry out a reconnaissance multibeam survey. The vehicle was in the water by 2309, and started its dive at 2317.

Sunday 23 August (JD235)

Calm start with sea state 1-2, freshening after lunch to sea state 5-6.

With Autosub in the water, we were free again to carry out another short ROV video dive (JC125-054/ISIS252). The ship was repositioned and at 0125 the vehicle was in the water. With a water depth of 850m, ISIS was on the seabed at 0216, and was brought back on board 4 hours later at 0653. We repositioned back to the Autosub site, and met the vehicle at 0730 at the surface. It was on deck by 0753.

With a prospect of worsening weather, it was decided to resort to coring operations rather than putting the vehicles out again. Our first coring target was a repeat of PC02, given that the recovery there was rather limited. Travelling the 40 miles transit (JC125-055/MBES25) to the coring site, the ship had to divert to avoid fishing vessels. At one point in time, 26 different fishing vessels could be identified in the vicinity on the ship's radar. We arrived at the coring site (JC125-056/PC04) by 1219, and were set up on station at 1235. The core was in the water at 1239, and reached the seabed at 1427. It was back on deck at 1607, with approx. 7m of sediment. Pull-out was 6.3t.

With this successful sample on board, the ship was repositioned to the next coring site. On the way we carried out a short transect with the subbottom profiler, to identify the correct coring target: a small terrace 20m above the canyon thalweg. The core (JC125-057/PC05) was deployed at 1816, reached the seabed at 1942 and was pulled out with 5.4t. When it arrived on deck by 2209, the core barrel was jammed in the head. However, a good core of 1.5m length was recovered.

While the piston core was being retrieved from the barrel, the megacore (JC125-058/MC03) was prepared and launched. It was in the water at 2201.

Monday 24 August (JD236)

Sea state starting moderate, with wind speeds up to 30kn, but calming down later through the day.

The megacore hit the bottom just after midnight (0009) and was back on deck by 0205. Two cores failed, but there was enough material to for the requested 2 cores for geology and 2 cores for biology.

In the meantime the weather conditions were still not ideal for vehicle work, but it was estimated that they would be in the morning. Hence the ship made its way towards the next ROV dive site, taking a detour to fill in some gaps in the multibeam coverage (JC125-059/MBES26). We arrived at the ROV site by 0643, and the vehicle could be deployed at 0742 (JC125-060/ISIS253). This was a deep dive on a set of gullies and ridges, hence it took until 0956 to reach the seabed. Original recovery time was planned to be 2000, but with potential bad weather coming in, the dive was cut short and the ROV was on deck by 1926.

The ship then moved (JC125-061/MBES27) to the next coring station, at the confluence of all canyon branches. We arrived there at 2115, and put the piston core (JC125-062/PC06) in the water at 2318. At 2320 the core was pulled out with 5.7t tension.

Tuesday 25 August (JD237)

Roughening weather, up to 8 or 9 Bft in the evening

The piston core was back on deck at 0114, and recovered 3m of sediment. It was followed by a megacore at the same location (JC125-063/MC04, in water 0141, on seabed 0319, on deck 0456). One core failed, the other 7 were good, and 4 were kept (2x geo, 2x bio).

With the weather predicted to be worsening overnight, we were restricted in equipment use. Given that the coring technician had been up all night, we resorted to CTD operations. A CTD transect was chosen in the Explorer Canyon, at the site of the cold-water coral reef, to characterise the water column properties across the canyon with the aim to identify potential differences between the two canyon flanks. The ship set off on transit (JC125-064/MBES28) at 0624, and reached the CTD site at 1013. The CTD (JC125-065/CTD08) was in the water for the first dip at 1028, and was recovered at 1135. A problem occurred with the winch (problem with the belly-box, resulting in the cable jumping off one sheave), which resulted in a delay in the next CTD. The ship was repositioned and the next CTD cast (JC125-066/CTD09) was taken (in water at 1213 and on deck at 1314). Another CTD followed (JC125-067/CTD10), in water at 1355 and on deck at 1528). By that time the sea started to build, and the captain preferred to be cautious, so further operations were cancelled until the morning.

Wednesday 26 August (JD238)

Still rough sea state, up to 6 overnight, calming down to 4 in the morning, but then picking up again to 5 later on (mainly due to a large swell coming from the west).

By 0930 in the morning, the sea state had calmed down enough to allow CTD work, so we set out to repeat & complete the programme from the previous day. In an attempt to catch the same state of the tide, we decided to first deploy the CTD & SAPS next to the coral reef, and do the CTD transect after that. By 1001 the CTD was in the water (JC125-068/CTD11), and it reached the bottom at 1036. It was brought up to 850m depth and started pumping for 90mins starting at 1055. The instrument was back on board at 1300. We repositioned to the SE end of the CTD transect and started the first cast (JC125-069/CTD12) at 1332. With the sea state still pretty rough and a large swell causing roll on the ship, the CTD had to be lowered carefully to avoid negative tension on the wire. This meant that the transect would take longer than planned and would probably not match up with the tidal state of the day before. The CTD was on board by 1434, and we transferred to the next station (JC125-070/CTD13). The system was in the water at 1502 and back on deck by 1615. By that time the captain was too concerned again about the sea state, and operations were halted for several hours until the swell died down to a workable level. By 1830 an all clear was given again, and the next CTD (JC125-071/CTD14) was in the water by 1836, back on deck at 1936. From now on, conditions improved, and the CTD could be deployed more easily. The deepest CTD of the transect (JC125-072/CTD15) was deployed at 2003 and recovered at 2120. Two more CTDs followed (JC125-073/CTD16, in water at 2154, on deck at 2259; and JC125-074/CTD17, in the water at 2331).

Thursday 27 August (JD239)

Moderate seas calming down to sea state 2.

The last CTD was brought on board at 0038. The next operation on the programme was ROV work, but at ~2000 the evening before, the captain and lead ROV technician had worries about the sea state calming down enough to deploy ISIS at night, and the programme had been altered to deploy the ROV at first daylight. Hence to kill the time, the ship set off on a multibeam survey (JC125-075/MBES29) at 0044, but as it had to sail into the swell at first, the data were of very bad quality. The erratic seabed returns caused the multibeam software to crash several times, and it took until 0251, when the course was altered, before a reasonable data quality was achieved.

We arrived on station for the ROV by 0449 (JC125-076/ISIS254), and deployed the vehicle at 0539. It reached the seabed at 0630, for a dive on the opposite wall compared to the coral reef (ISIS246) in Explorer Canyon. However, before exploring the southern flank, some time was spent to obtain really good video footage and imagery for display and presentation purposes, and to learn more about the fauna associated with the coral framework. At about 0730, both the Scorpio and Science cameras lost connection, and we feared there might be a problem with the fibre again. However, by carefully managing the cable attitude (wraps, distance from the ship, tension), the connection was improved and the images came back. It was decided to continue the dive, and to investigate the cable afterwards, when the ROV would come on deck.

The ROV was back on deck at 1727, and the cable was checked. No immediate fault could be found, so the programme continued as planned, and the ship set off on transit (JC125-077/MBES30) at 1816, back to the Acesta wall for another ROV dive. Again the course was mainly heading into the seas, which seemed to be too much for the EM120, and by 2036 the signal was lost and the SIS software crashed. A number of attempts to revive it failed, and the ship continued the transit without EM120 and SBP120 acquisition, arriving on station at 2210. ISIS was deployed (JC125-078/ISIS255) for its next dive at 2258, and reached the seabed at 2342.

Friday 28 August (JD240)

Calm, sunny weather, moderate to calm sea state. Wind 5Bft, reducing.

The dive continued without problems until 0743. The ROV was brought on deck and the ship was re-positioned for the deployment of Autosub's first mission with the side-ways mounted EM2040 swath system (JC125-079/M92). The AUV was in the water by 0849 and we followed it on the USBL to make sure the control systems were working correctly. There seemed to be a lot of drift, and the ADCP on the vehicle lost contact with the seabed several times, as the mission was planned to be carried out at constant depth. In the end the system was instructed to come to the surface because the USBL indicated some erratic behaviour. The plan was to give the AUV new instructions and let it dive again, but it did not manage to establish a good GPS fix, which made it necessary to recover. By 1450 Autosub was back on deck, and it was decided to first analyse the data before attempting a new mission.

This provided us with ample time to carry out another ROV dive (JC125-080/ISIS256) on the opposite side of the Acesta wall. ISIS was in the water at 15:47.

Saturday 29 August (JD241)

Calm weather, sea state 2

The ISIS dive continued well until 0653, when the vehicle was brought on deck. The ship was repositioned, back to the AUV starting point (JC125-081/M93), and Autosub was in the water by 0946. A few issues with USBL tracking and connections with the ADCP had delayed the deployment, but by 0955 the vehicle started to dive, and by 1105 it could start its science mission. The aim this time was to repeat the same mission as the day before, but trying to get closer to the walls of the canyon. The collision avoidance worked well, but when we brought the vehicle to the surface to give it new instructions (flying even closer to the wall), it was noticed that the EM2040 data logger stopped recording, so the vehicle was brought on deck at 1633.

As the weather was very nice, we decided to continue working with the vehicles as much as we could. Hence the ship set off on transit (JC125-082/MBES31) to the western branch of Whittard Canyon for an ISIS dive at 2700m depth (JC125-083/ISIS257). The vehicle was deployed at 1914.

Sunday 30 August (JD242)

Calm seas, wind picking up to force 4-5.

After another successful dive where we encountered our first piece of deep-sea archeology (a vase), ISIS was brought on deck by 0753. We immediately set off on transit (JC125-084/MBES32) back to the Acesta wall for a last trial with Autosub6000 (JC125-085/M94). The AUV was deployed at 1125, and was followed throughout its track, as it was working at 75 and 60m off the canyon wall. It surfaced at 1402 for new instructions, and was finally brought on deck by 1804.

With the good weather persisting, we kept our main focus on the robotic vehicles. Hence we set off on transit (JC125-086/MBES33) at 1818 to the next ROV (JC125-087/ISIS258) site, aiming to explore the opposite canyon flank to the 'coral wall'. We arrived at 2003, and were ready to deploy soon after. However, the deployment procedure was halted because the area was affected by a very strong surface current. To give the ROV the 'still water' conditions necessary for deployment, the ship had to carry out a 1kn movement towards the stern (south). The situation was evaluated, and eventually the ROV was deployed with caution at 2202. The descent went reasonably well, but as the vehicle came within 180m off the seabed, a very strong current was experienced again. The ROV needed all its power to stay in the correct location, which meant no sampling or course deviations were possible. On top of that the visibility was very limited as well. It was then decided to adapt the dive plan, and to only carry out the section of the dive that was shallower than 1250m, in an attempt to avoid the worst of the current.

Monday 31 August (JD243)

Calm weather, sea state 2

Still, to reach that part of the canyon, the vehicle took a long time, and when it reached the seabed there, again a strong current prevented any reasonable work. By 0139 it was decided to give up on the dive, and by 0258 the vehicle was recovered. To fill the time until the next operation (AUV mission), EM120 data was collected (JC125-088/MBES34). We arrived on station at 0715, a second attempt at collecting a multibeam bathymetry grid around the coral wall (JC125-089/M95). Complicated mission planning delayed the deployment a bit, but by 0936 the vehicle was in the water. Following the descent and some tests, it started its mission at 1123, and we followed it from the ship with the USBL for a while. Unfortunately a fault occurred at 1159 (rudder got stuck), and the vehicle had to come back to the surface. It was on board at 1311.

As substantial repairs were needed, we moved on to the next operation on the programme (transit, JC125-090/MBES35), another ROV dive (JC125-091/ISIS259), deeper in the eastern branch, in the hope that the strength of the tide there was a bit less. The ROV was deployed at 1510, and carried out a successful dive over spectacular terrain from 3000 till 2200m depth.

Tuesday 1 September (JD244)

Calm weather, sea state 2

Unfortunately, by 0120 the ROV lost its telemetry, and had to be recovered once again as a dead vehicle. It was brought on deck by 0318, and needed a re-termination. To make up the time until the next scheduled operation, a multibeam survey was started (JC125-092/MBES36). We arrived at the next station at 0718, and set up for a CTD & SAPS (JC125-093/CTD18). The instrument was in the water at 0836, reached depth at 0912 and pumped for 90 mins. It was back on deck at 1115.

Next on the schedule was another AUV mission (JC125-094/M96), mapping the seabed around the coral site of the Explorer Canyon with the EM2040. The vehicle was deployed at 1230 and was followed to the seabed. Once it had started its mission successfully, we transited back (JC125-095/MBES37) to the previous ROV site for an ROV multibeam dive (JC125-096/ISIS260). By that time the termination of the ROV was carried out, and ISIS was deployed at 1723, and reached the seabed at 2001. Once the multibeam system had been set up correctly, we started the survey on the steep terrain.

Wednesday 2 September (JD245)

Calm weather, sea state 2-3

The ROV multibeam survey progressed well until the early hours of the morning, but then the vehicle began to struggle against the tide. Further data collection was difficult and the data quality may be compromised. By 0815, just as we decided to bring the ROV off the bottom for recovery (there was an AUV to be picked up), ISIS was held back by a lost wire strung across a gully. Swift reaction from the ROV pilots avoided any danger, and the ROV was freed from the wire without damage. However, as the vehicle came up, the fibre-optic connection faltered again. There was no time to carry out any tests as we had to pick Autosub, so the ROV was brought on board at 1040 and we set sail for the Explorer Canyon (JC125-097/MBES38).

We arrived just in time at the rendez-vous location for Autosub, as the vehicle was just approaching the WP. It was picked up and secured on deck by 1255. With the recurring problems with the ROV fibre-optic cable, it was decided to carry out a number of tests before putting the vehicle back in the water. These were conclusive: there was a problem with the cable, not so much in terms of kinks, rather than in terms of sensitivity to bending & twisting. Although it was positive that the origin of the problem was established, it meant another re-termination before the vehicle could be deployed again.

This meant we had to come up with an alternative plan overnight, which consisted of a set of coring operations. The first piston core (JC125-098/PC07), targeting the flank of a gully, was successful, and brought back a 4.5m core from a 6m barrel. It was in the water at 1748, and back on deck at 1854. A second core (JC125-099/PC08, in water at 2001, on deck at 2131, 12m barrel) apparently did not trigger. A small amount of sediment was found in the barrel and in the trigger core, but the trigger mechanism had not worked. The hydrostatic release was changed over to the spare, and another deployment was attempted (JC125-100/PC09, in water 2233, on deck 2350). Unfortunately, it had the same result. As the coring technician and CPO were out of hours for the day, it was decided to change over to megacoring.

Thursday 3 September (JD246)

Calm weather, sea state 2-3

The first megacore (JC125-101/MC05, in water 0040, on deck 0142), at the location of PC07, was successful with 7 out of 8 tubes full. It was then decided to move to the canyon thalweg rather than to continue the coring of the gully environment. After a short transit (JC125-102/MBES39), the megacore (JC125-103/MC06) was deployed at 0429, but came back on deck empty at 0557. By that time it was necessary to transit back (JC125-104/MBES40) to the coral area in Explorer Canyon for an ROV multibeam dive (JC125-105/ISIS261). We deployed the ROV at 0733 and reached the seabed at 0836. At first the survey went very well, but as the ROV approached the thalweg a strong tidal current swept it off track. The survey layout was adapted to avoid the area/depth of the strongest tidal flow, and a good dataset was collected. By 2028 ISIS was back on deck.

Next followed a transit (JC125-106/MBES41) back to the coral wall area in the eastern branch for the deployment of Autosub (JC125-107/M97). This was a repeat of M95, the mission that had to be aborted because of the rudder problems. Autosub was deployed at 2248, and was followed to the seabed for its navigation tie-in.

Friday 4 September (JD247)

Calm weather, sea state 2

We checked Autosub started its survey correctly, and then set off on transit (JC125-108/MBES42) at 0139 to the next ROV dive site in the shallowest parts of the eastern branch (JC125-109/ISIS262). ISIS was in the water at 0307, and reached the seabed at 0403. The very successful dive lasted until recovery at 1141, when we had to transit back (JC125-110/MBES43) to pick up Autosub. We arrived at the final AUV waypoint as Autosub was arriving as well, and the AUV was given the command to leave the seabed at 1337. It was on deck at 1415 with a very successful dataset. The ship re-positioned and ISIS was deployed (JC125-111/ISIS263) at 1525 on more or less the same location for a repeat of Dive 258, which was washed out by the tidal current. The current situation this time was much better, although the visibility was still limited.

Saturday 5 September (JD248)

Calm weather, sea state 2-3, wind up to 4Bft

The dive continued until 0439, when the vehicle was on deck. The ship set up on transit back to Explorer Canyon, but communication confusion caused the MBES data not to be recorded. Autosub was deployed (JC125-112/M98) at 0728 for a repeat of M96, as the previous mission had not obtained full coverage of the area. We left on transit (JC125-113/MBES44) to the Acesta wall site at 1040, and set up there for the next ROV dive (JC125-114/ISIS264) by 1355. This dive was aimed at vertical mapping of the Acesta wall with the ROV multibeam. The vehicle was in the water at 1427, and carried out a very successful dive until 2336. We then carried out a short transit (JC125-115/MBES45) back to the coral wall for another CTD & SAPS (JC125-116/CTD19).

Sunday 6 September (JD249)

Calm to moderate sea, 3-4.

The CTD was in the water by 0227, and the SAPS started pumping at 0311 for 30mins. The instrument was recovered and well back on deck at 0420. Time to move on with a transit (JC125-117/MBES46) to the Autosub recovery site, where we arrived at 0633. However, Autosub had already surfaced at 0424 (it finished its survey early), and because it could not get a good GPS fix, it was drifting on the current. Using the Iridium messages, we started hunting for the system, but in the meantime we also received news that the glider had shown some irregular behaviour: it had gone into recovery mode for a while, before starting to dive normally again. It was decided it was time to pick it up as well (that was planned for the afternoon anyway, but the pick-up was moved forward on the schedule). Autosub was eventually spotted around 0820, and was safely brought back on deck at 0856.

We left straightaway on transit (JC125-118/MBES47) to pick up the glider, and arrived at the pick-up site by 1102. The glider also sent regular position updates, and by that time had been instructed to do short dives to increase the number of GPS fixes. Luckily it was spotted nearly immediately, and it was skilfully recovered by 1154. To calibrate the glider, a CTD was then taken (JC125-119/CTD20) at the recovery location. The instrument was in the water at 1235 and back on deck at 1400. This then left us with the afternoon to complete the programme that was originally foreseen for the morning. We went on transit back to Explorer Canyon (JC125-120/MBES48), and carried out a dedicated SBP survey (JC125-121/MBES49) over the coral mounds and upcoming piston coring site (1600-1739). A coring site was chosen (JC125-122/PC10), and the core was in the water at 1824. It came back on deck at 1947, empty apart from a short section of mud below the piston. Again it had not triggered. It now was very clear that there was a problem with the trigger mechanism (hydrostatic release). To make sure the site was accessible for coring, we first tried a megacore (JC125-123/MC07), which was deployed at 2002 and back on deck at 2121. It had 8 good cores, so we were sure it was not the site that was the problem. So the piston core (JC125-124/PC11) was set up without hydrostatic release on the trigger arm, and was deployed again at 2227. When it came on deck at 2353, it was a sounding success: 4.5m recovery.

Monday 7 September (JD250)

Moderate to calm seas, force 3-4

Following the coring success we set off on transit (JC125-125/MBES50) to the sandwave area to the north of the eastern Whittard Branch. This was our chosen area to test the ROV vibrocorer, the main aim of expedition JC126. We arrived at 0129, and started the work with an EM710 survey (JC125-126/MBES51) with the dropkeel down. At 0609 we set up on station to deploy Autosub on the second part of the sandwave area (JC125-127/M99). The vehicle was deployed by 0632, and we transited (JC125-128/MBES52) to the part of the sandwave area that was mapped with Autosub during M88. ISIS was deployed (JC125-129/ISIS265) for its first dive of the day at 0915. The ROV took 2 vibrocore barrels to the seabed, and although the first core was not really successful (problems with the cutter being in the way), the second one certainly was. The ROV was back on deck at 1151, eager for a second try. Following a short SBP survey (JC125-130/MBES53), ISIS was deployed on the sandwaves again at 1339 (JC125-131/ISIS266), again with success. The vehicle came back on board at 1617. The sequence was repeated once again, including a transit (JC125-132/MBES54) and a third ROV vibrocore dive (JC125-133/ISIS267). The ROV was deployed at 1742 and came back on deck at 2007 with two more cores. Time to go and pick up Autosub. However the USBL pole was stuck, and it took half an hour before the ship could set off on transit (JC125-134/MBES55).

Autosub was smoothly recovered at 2236, which gave us a bit more time to expand the EM710 survey (JC125-135/MBES56).

Tuesday 8 September (JD251)

Increasing wind speeds to 25 knots, sea state 5-6

By 0100 we had to set off on transit (JC125-136/MBES57) for the deep-water vibrocorer test. The conditions were marginal, but it was decided to still carry out the ROV dive (JC125-137/ISIS268), as worsening weather was predicted. The vehicle was deployed at 0908 and back on deck by 1553. Unfortunately the test was not successful, as the electronics bottle of the hydraulic power pack of the vibrocorer imploded. No indications could be found in the specs and equipment documentation about the depth rating of the system, but clearly the 4180m test was too much. At first sight the ROV did not incur any damage, but thorough inspection would be necessary to ascertain this. Hence it was decided that no further dives for ISIS should be planned during the cruise.

We then left on transit (JC125-138/MBES58) to carry out a programme of coring. By 2024 the piston core was deployed (JC125-139/PC12).

Wednesday 9 September (JD252)

Decreasing wind speed, increasing long swell

The core was on deck at 00:03 and was successful, with 1.3m recovery. The next operation on the schedule was the deployment of Autosub in the Whittard Channel for its 100th mission, but the weather conditions had not improved, on the contrary, and it was deemed too dangerous to deploy the vehicle, especially in the dark. The AUV deployment was delayed till first daylight. To cover the time gap in the schedule (due to unavailability of technicians with sufficient hours of rest), we carried out a short SBP survey (JC125-140/MBES59) until 0252, when we came on station for a megacore (JC125-141/MC08). The core was deployed at 0323, and back on deck at 0719, with 6 out of 8 cores successful.

By that time the sea had calmed down into a long, regular swell, which was more predictable for an Autosub deployment (JC125-142/M100). The vehicle was in the water at 0832, but took a long time to reach the seabed. It could start its science mission at 1217.

While waiting for Autosub to finish its mapping work, we set off to do more coring. First a megacore was taken (JC125-143/MC09, in water 1318, on deck 1649), then a piston core was deployed (JC125-144/PC13, in water 1629, on deck 2215). Although it only carried a 6m barrel, the core was bent when it came back on deck. A sample could still be retrieved, but was considered too disturbed to be kept.

Thursday 10 September (JD253)

Soon after, Autosub finished its mapping work at the seabed, and started its ascent. It was recovered by 0245 in difficult conditions as by that time the swell had increased to >3m. Luckily no damage was incurred and nobody was hurt, but to add to the sad situation, neither the multibeam nor the sidescan sonar had recorded any data. There was not much that could be done this late in the cruise, and we set off on transit (JC125-145/MBES58) back to the sandwave field for a last few cores before going home.

We arrived on site at 0852 and had the piston core (JC125-146/PC14) deployed by 0908 at the same site of one of the vibrocores. The core was back on deck by 1009 with ca. 1.5m of loose sands, probably flown in rather than properly cored. This was followed by two boxcores (JC125-147/BC01, in water 1124, on deck 1149; and JC125-148/BC02, in water 1230, on deck 1255). This concluded our science operations around Whittard Canyon. As soon as the core was secured on deck, the ship set off on transit back home (JC125-149/MBES59).

Friday 11 September (JD254)

The transit home continued smoothly. The ship stopped shortly at 0900 to allow the ROV to be craned onto the centre of the deck.

Saturday 12 September (JD255)

Clocks were brought back to BST overnight. We finished the transit back to Southampton, and docked in Empress Dock at 0830BST.

EQUIPMENT and SAMPLING REPORTS

1. **Autosub6000** (James Perrett, Ella Richards, Daniel Roper)

1.1. Introduction

The Autosub6000 AUV was used on the CODEMAP2015 campaign for multi-beam, side-scan and photographic surveys. This campaign was the first time that the new horizontal collision avoidance system had been used to allow the multibeam mapping of canyon walls at a constant distance. This system worked well. At the end of the campaign the AUV had collected 40000 useful images, surveyed over 384km of EM2040 multi-beam data & had collected side scan data on 195km of track.

1.2. Vehicle Build

For JC125 Autosub6000 was configured as follows:

Sensors used	*Sub configuration*
1) RDI workhorse ADCP 300kHz downwards. 2) Kongsberg EM2040 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) Seabird 911 CTD with 2 x SBE3plus, 2 x SBE4C, 1 x SBE43	1) Rear winglets set at 6º pitched downwards (5º for first missions). 2) Autosub 6k recovery line retention system with nylon springer lines 3) 14.2kg positive buoyancy at surface. 4) 6 x new battery packs. 5) Lawson Engineering Autosub6000 launch and recovery system (LARS)

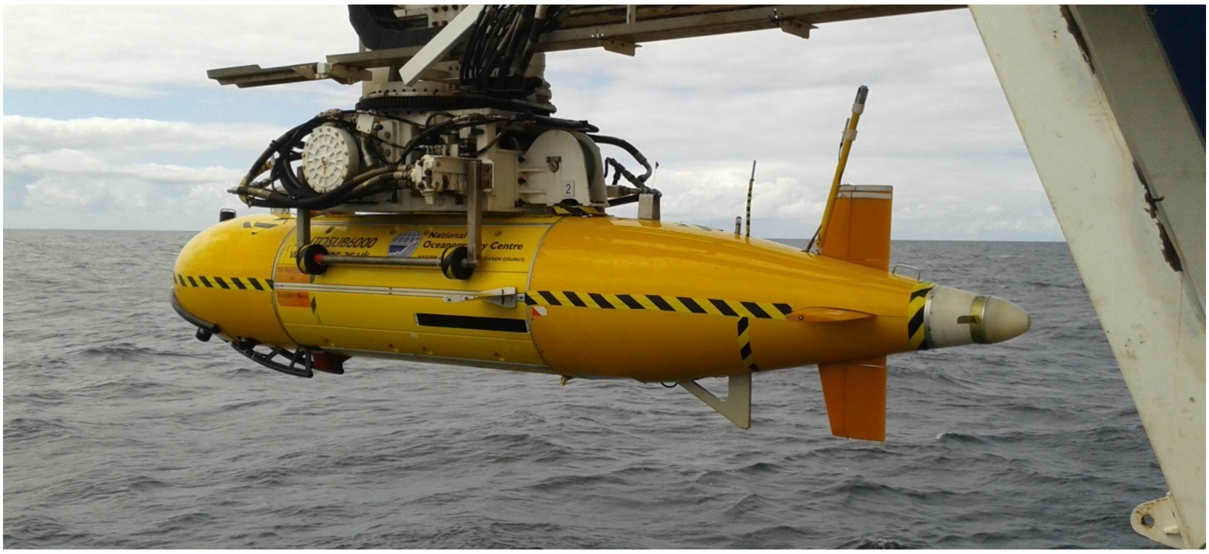


Fig. 1.1 Picture showing vehicle on gantry before launch.

1.3. Mission summaries

The missions conducted during JC120 are summarised in Table 1.1.

Table 1.1 Data by Mission

Mission	Date	Distance	Notes on the data
86	10/8/15	76.5 km	24km Multibeam, 19.6km HF sidescan recorded. Only a few useful images due to camera logger problem.
87	12/8/15	48.2 km	40000 images at seabed with 19.5km of HF sidescan.
88	15/8/15	84.2 km	54km of HF sidescan but camera didn't start.
89	18/8/15	92.1 km	66km of HF sidescan data recorded but no camera due to disk problem.
90	21/8/15	49.2 km	First canyon survey with 42.6km multibeam recorded.
91	22/8/15	36.2 km	Second canyon survey with 31.1km multibeam recorded.
92	28/8/15	18.9 km	First test of horizontal collision avoidance – 12km multibeam recorded although avoidance wasn't properly activated.
93	29/8/15	25.9 km	Approx 8km of angled EM2040 data – Horizontal Collision Avoidance worked well but multibeam data logger problem prevented full recording of data and mission aborted during attempts to fix this problem.
94	30/8/15	26.7 km	15.7km of angled EM2040 data, the closest at only 60m from canyon walls.
95	31/8/15	12.4 km	Rudder failed after only 0.4km of multibeam survey during a holding pattern.
96	1/9/15	102 km	86.3km of angled EM2040 data surveying the walls of the Explorer canyon at 400kHz.
97	3/9/15	65.9km	51.8km of angled EM2040 data surveying the Coral Wall canyon.
98	5/9/15	101.6km	84.7km of angled EM2040 data surveying the walls of the Explorer canyon at 200kHz
99	7/9/15	63.8km	21.6km of angled EM2040 data surveying sand waves followed by 35km of HF sidescan and sub-bottom at the same site.
100	9/9/15	73.6km	Only ADCP and CTD data recorded.

In total the AUV ran:

- 18.5 km of camera survey capturing 40000 images at the seabed.
- 384 km of multi-beam surveys
- 195 km of side scan surveys

1.4. EM2040 multibeam system

The vehicle is fitted with a Kongsberg EM2040 multibeam sonar system system offering (under the most favourable conditions) up to 400 beams with an angular range of +/-70 degrees across track and a 0.4 degree beamwidth along track. On JC125 it was used at both 200kHz (which gives an 0.7 degree along track beamwidth) and 400kHz (which gives an 0.4

degree along track beamwidth). It was also used in both 256 and 400 beam mode as the facility was added during the cruise to switch this mode. For settings used in the different missions, see Table 1.2.

This was the first cruise where the horizontal collision avoidance system developed by the MARS group at NOC was used. This is intended to keep the vehicle away from canyon walls and takes advantage of the wide +/- 140 degree coverage of the EM2040 transmit head in conjunction with the receive head angled at -20 degrees to give horizontal coverage in the starboard direction.

The diagram below (Fig. 1.2) shows the concept of the collision avoidance system. First the system selects all the beams that lie within a set range of angles – shown by the dashed black and red lines. It then calculates the horizontal range to the canyon wall for each of those beams and finds the minimum of those horizontal ranges. If that range is lower than a preset minimum distance it then calculates a heading offset demand to send to the position control system.

Once the system was configured correctly, it appeared to work well and allowed us to travel as close as 60m from the canyon wall.

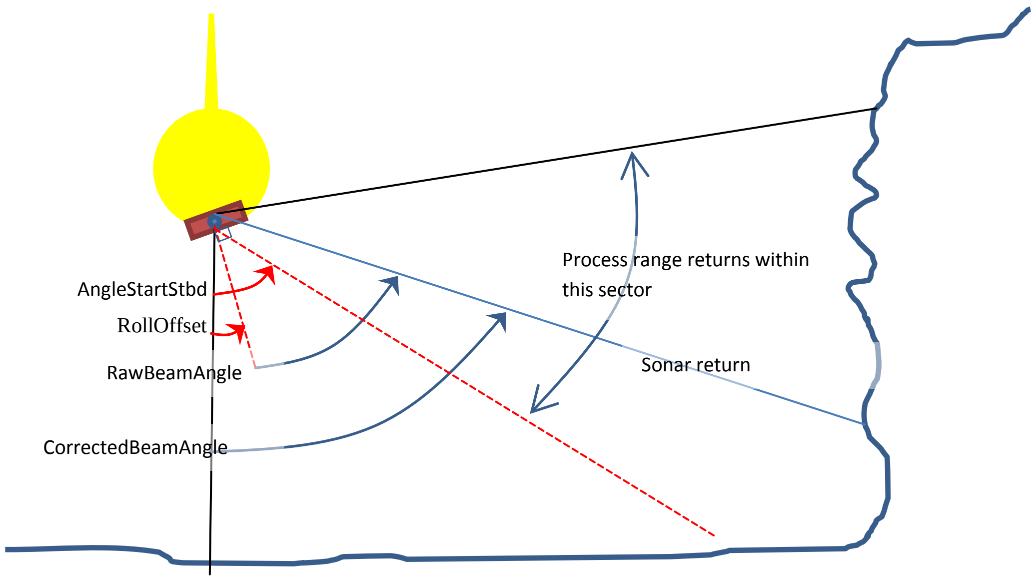


Fig. 1.2 View looking into the propeller of the AUV showing offset receive head.

Table 1.2 Main EM2040 configuration changes between missions.

Mission Number	Head Roll Rotation (degrees)	Frequency (kHz)	Beam Count	Angular Coverage	RX Head Heading Offset	Range Filtering (1)	Horizontal Avoidance Range.
86	0	200	256	Auto	0	Default	12 (3)
90	0	200	256	Auto	180	Default	12 (3)
91	0	200	256	Auto	180	Default	12 (3)
92	-20	200	256	Auto	0	Default	120 (but inactive)
93	-20	200/400	400	Auto	0	Default	120
94	-20	400	400	Auto	0	Default?	75
95	-20	400	400	Auto	0	Relaxed	120
96	-20	400	400	Auto	0	Relaxed	120
97	-20	200	400	Manual (2)	0	Relaxed	120
98	-20	200	400	Manual (2)	0	Relaxed	120
99	-20	200	400	Manual (2)	0	Relaxed	20 (3)

(1) Relaxed filtering settings were: Max Range = 250m, weak spike filter strength and large range gate size. Default settings are: Max Range = 150m, medium spike filter strength and medium range gate size.
(2) Manual angular coverage was +/- 70 degrees.
(3) A low value effectively disables the horizontal collision avoidance.

1.5. Edgetech sidescan/sub-bottom configuration

Autosub is fitted with an Edgetech 2200-M multi-frequency sidescan sonar and sub-bottom profiler.

All sidescan missions used the high frequency system with a 410 kHz, 50kHz bandwidth, 2.4ms wideband pulse together with a 2-13kHz 16ms sub-bottom chirp pulse running at 6Hz repetition rate.

1.6. Significant faults/Issues

There were a small number of issues and faults associated with this campaign. The major faults and issues are listed below:

- CTD Sensors – the temperature sensors had been damaged, probably after improper cleaning previously, the conductivity sensors were out of calibration and the oxygen sensor did not appear to be working correctly. From mission 91 onwards the primary C and T sensors were replaced with spares from the ship's CTD system.
- The new camera logger boards run hotter than the original version which appeared to cause issues when the vehicle was left powered up in the sun for any length of time.
- There is a DC offset between the ADCP ground and its case which affects the vehicle ground fault detection but doesn't seem to have any other effect on vehicle operation.

1.7. Autosub Data Outputs

Table 1.3 Output from Main processing stored in mission directory.

concatenatedLogFile\Mxxx.log	The log files for the mission concatenated into one file.
ProcessedLogData\Mxxx.mat	The variable data extracted from the log file and stored as Matlab workspace variables.
CTDdata\MxxxCTD.log	The raw CTD data taken from the logger data.
CTDdata\MxxxCTD.cnv	The CTD data converted into engineering units.
ProcessedLogData\Mxxx_CTD.mat	The converted CTD data stored as Matlab workspace variables.
ProcessedLogData\Mxxx_ProTritech.mat	The sonar messages stored as Matlab workspace variables.
ProcessedLogData\Mxxx_ADCPdown.mat	The ADCP data stored as Matlab workspace variables.
ProcessedLogData\MxxxLS2.mat	Contains interpolated variable data from different nodes of Autosub logger, data is reduced to a common time base set to an interval of 2 seconds currently. Saved as Matlab workspace variables.
ProcessedLogData\MxxxBNV.mat	Contains all variables interpolated to a common time base and interpolated to a best navigation* position.

*Autosub navigation is collected through an inertial navigation system (dead-reckoning). The AUV picks up a GPS fix before diving, and can use the inertial nav as soon as it is close enough to the seabed (~160 m altitude). There can be lateral drift during the descent, hence the vehicle was monitored during each descent and given an updated position either based on USBL information or on the more precise 'range only navigation' procedure (Huvenne et al., 2009) once it was at the bottom. Also dead-reckoning can result in a certain amount of navigational drift, especially when the vehicle loses bottom lock. Hence the end position of the AUV (either end of survey at the seabed, measured by USBL if the ship is in the vicinity, or surface location, measured by GPS) is used by the AUV team to calculate an estimated 'Best Navigation', where all the accumulated drift is proportionally spread over the entire length of the survey track. Given that Autosub was working in a canyon environment, bottom lock was occasionally lost, and that most 'end' locations corresponded to the surface GPS fix (hence prone to drift during ascent), caution is recommended with the use of the 'Best Navigation' as automatically calculated by the MatLab scripts. In most cases, the navigation of Autosub6000 was re-calculated during the geophysical processing, using rubber-sheeting procedures within the CARAIBES software while matching individual survey swaths.

Table 1.4 Output from SensorProcess.m (mainly science data)

ProcessedLogData\Mxxx_EdgeTechNav.txt	Text file with the post processed AUV navigation (as above), time corrected to align with the Edgetech data.
ProcessedLogData\Mxxx_PHSensorData.csv	All sensor (except Edgetech or Camera) on a common time base with the AUV post processed navigation data. Comma separated values, with time in excel format.
ProcessedLogData\Mxxx_ScienceData.csv	Contains the position along with the date and time for every recording of a variable.
ProcessedLogData\Mxxx_Sensors.mat	
ProcessedLogData\Mxxxcam.txt	Contains the date, time, size and filename of every frame taken.
ProcessedLogData\Mxxxcam.txt_imageData.csv	Contains the position, depth and altitude of every frame taken.
ProcessedLogData\MxxxNavPerformance.txt	A measure of how far the dead reckoned navigation had drifted during the submerged portion of the mission. This is for information only , the applicable correction has already been applied to the post processed navigation data.
ProcessedLogData\MxxxScienceLS2.mat	
Figures\Mxxx_DOxygen.fig	Plot of position vs Dissolved Oxygen
Figures\Mxxx_DOxygen.pdf	
Figures\Mxxx_LSS.fig	Plot of position vs Light Scatter
Figures\Mxxx_LSS.pdf	
Figures\Mxxx_Salinity.fig	Plot of position vs Salinity
Figures\Mxxx_Salinity.pdf	
Figures\MxxxAltitude.fig	Plot of position vs Altitude
Figures\MxxxAltitude.pdf	
Figures\MxxxHPWaterDepth.fig	Plot of position vs Water depth after a high pass filter has been applied
Figures\MxxxHPWaterDepth.pdf	
Figures\MxxxWaterDepth.fig	Plot of position vs Water depth
Figures\MxxxWaterDepth.pdf	
Figures\Mxxx_Sensortimeseries.jpg	
Figures\Mxxx_Mission Info.txt	Some basic Mission Information. Start and end times, survey duration and most common values of water depth, AUV depth and AUV altitude.

2. **Isis ROV** (Dave Turner, Andy Webb, Dave Edge, Russell Locke, Alan Davies, Antonio Gamero-Campos, Josue Viera-Rivero, Will Handley)

2.1. Introduction

The ROV operations during the CODEMAP2015 expedition were carried out by NERC's Isis ROV, a work-class system that can dive down to 6500 m water depth. The ROV is tethered to the ship through a high-voltage fibre-optic cable, and has its own Launch & Recovery System (LARS), cable & winch. It was mobilised on board specifically for this three-in-one cruise. The ROV control room consists of two joined 20-foot containers, and gives plenty of space for (3) engineers and (3) scientists, plus all necessary computing equipment to steer and record the dives.

A summary of the Isis operations for CODEMAP2015 is presented in Table 2.1. Individual summaries of bottom time for each dive are given in Section 4. A full discussion on the Isis operations is given in the Isis Technical Report, which is attached in Appendix D.

Table 2.1 Overview of Isis performance during CODEMAP2015

Total number of dives	27 (Isis Dive242 to Dive268)
Total run time for thrusters	247.26 hrs
Total time at seabed or survey depth	181.36 hrs
Maximum working depth	4184 m
Shallowest working depth	100 m
Maximum dive duration	14.45 hrs at depth, 16.62 hrs in water

2.2. Configuration

Navigation

When at the seabed, Isis has two different navigation systems: the Sonardyne Ultra-Short Base Line system (USBL), which provides an absolute position versus the ship (turned into an absolute position on the globe using the GPS position of the ship), and the Doppler dead-reckoning, calculated through the Doppler Velocity Log associated with the RDI Doppler bottom tracking sonar, which provides a better relative positioning, but drifts over the long time and hence has to be reset to the USBL position regularly.

During dives, Isis is navigated by the engineers, who interpret the information of both datastreams to decide the best path to the required locations or waypoints (WPs). The ROV can be driven manually, but also has a very precise closed-loop control auto-navigation function. The latter is based on the Doppler navigation, and hence does require the Doppler to have a good 'bottom lock'.

ROV operations were followed and annotated by the science team in real time, using the OFOP software. OFOP also records the ship’s and ROV navigation (both USBL and Doppler records). Full navigation data recording was also carried out independently through the ship’s and Isis’ TECHSAS systems (see below).

During Dive243 problems with the USBL beacon were identified, which were corrected mid-dive (see Section 2.4).

Equipment

Isis is equipped with two manipulator arms (one 'Kraft Predator', which has force feedback, and one 'Schilling T4'), that are used to carry out all sampling operations. In addition, the vehicle can be equipped with the following sampling gear:
- pushcores for sediment sampling
- carrousel of 5 Niskin bottles for water sampling
- Bioboxes (with lid): 2 small bioboxes on swing arms (one port, one starboard side) and one large biobox on the front toolsled
- Rock boxes (open)
- Scoop
- Suction sampler with 5 chambers to separate samples - those can be fitted with fine or coarse meshes depending on the type of sample expected and the type of sediment from which the sample needs to be picked up. The suction sampler also has a 'gate' which creates the possibility to pick up samples and deposit them elsewhere (e.g. in a biobox)
- NEW: For the CODEMAP2015 expedition, the ROV team also created a new type of sample storage system, consisting of a set of 6 tubes with lids kept in place magnetically (Fig. 2.1). Those were used for small samples that needed to stay separate (e.g. for genetic studies).

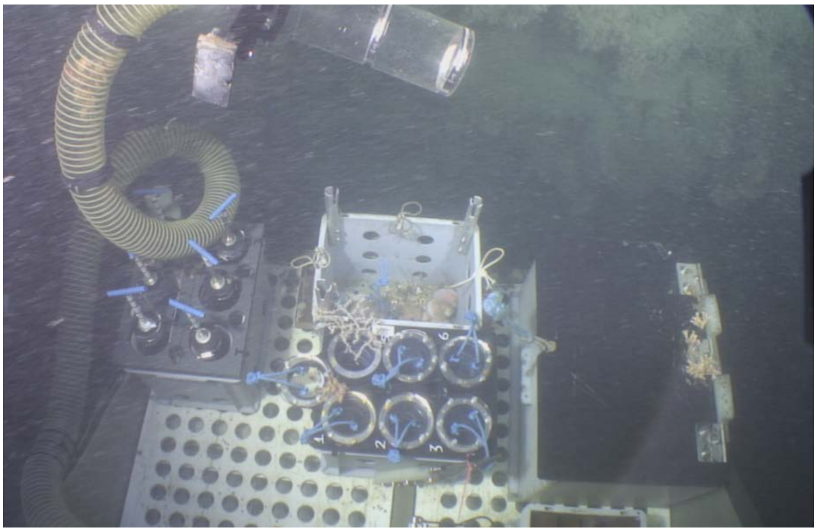


Fig. 2.1 Image of the ISIS tool tray illustrating different sampling equipment: suction sampler (top), rack of pushcores (left), biobox (right), rock box (centre, top), and rack of tubes with magnetic lids (centre, below)

Furthermore, Isis is equipped with a wide range of digital measurement equipment:
- Seabird SBE49 CTD and WetLabs ECO-NTU-RTD turbidity sensor
- (HD) video cameras and stills camera (see section 4)

- Reson Seabat 7125 multibeam system, which can be mounted in a downward or forward-looking mode (see sections 3.10 and 3.11)
- Forward scanning sonar (Tritech)

Before each dive, a dive plan was created by the Principal Scientist, and discussed with the ROV team, including a detailed list of sampling equipment and their settings as required for each dive. A scan of the dive plans can be found with the cruise backup.

2.3. Data recording

For every dive, a wealth of digital data is recorded, mostly within the Isis TECHSAS logging system. This is a combination of control information and scientific digital data from the equipment listed above. The TECHSAS database uses NetCDF format, but at the end of each dive, a series of ASCII text files is also created (Table 2.2).

During the cruise, a new database system was also trialled, that would give the scientists more options to extract customised datasets and tables. This database was built by Antonio, and was the only location where the camera pan & tilt angles were recorded (as this was a new parameter that previously was never recorded). The aim is for the database to stay accessible via the internet, also after the cruise. For the time being, the camera pan & tilt information was extraced into .csv files and stored on the QNAP drive.

Table 2.2 ASCII outputs from the Isis TECHSAS system

Name	Description
CSVGA	Doppler navigation
Depth	Parascientific depth sensor information
GPS01	Ship GPS information
IGGA1	USBL navigation & depth
IOCT2	Now obsolete: used to contain Octans information
IOCTS	Octans attitude information (heading, pitch, roll, yaw)
ISCSV	Compilation of all ISIS sensors (navigation, depth and attitude,...)
ISXBW	Obsolete
MS2000	Now obsolete: used to contain SM2000 multibeam info
SOCTS	Ship Octans info (pitch and roll
SPHDG	Ship Heading info
WINCH	Winch information (cable out, tension)

The scientifc data come in a range of formats, listed in Table 2.3. The HD video data were recorded on two large RAID-enabled Lacie disks, of which one was handed over to the Principal Scientist (ser# MRVL0001B6E8219A7891) and the other is stored with the Isis team for the duration of one year, before being recycled for a following cruise (see Section 4). The other datasets were copied from the Isis server and backed up on a QNAP Raid system by the science team after every dive.

Table 2.3 Isis digital datasets

Description	Format	Total disk space
TECHSAS data	NetCDF and ASCII (.csv)	4.94 Gb
DVLNAV (Doppler raw data)	.DAT, .M, .ENR, .CSV	24.45 Gb
Sonardyne raw data	.mdf, .ldf	5.28 Gb
Tritech scanning sonar	.V4LOG	4.44 Gb
Seabird SBE49 CTD	.hex	326.9 Mb
WetLabs Turbidity sensor	.eng, .raw	57 Mb
HD video data	.mov	38.33 Tb
Scorpio Digital stills	.jpg	85.98 Gb
Reson 7125 multibeam	PDS2000 LogData package	183.97 Gb
OFOP Event Logger	.txt (ASCII)	870.4 Mb
Camera pan & tilt info	.csv (ASCII)	88.5 Mb

2.4. Significant faults and their solutions

Overall, the ROV operations went very well, and some very signifcant results were obtained. Unfortunately, a few problems emerged, but they could always be resolved. Full details of the errors and solutions are given in the ROV Technical report in Appendix D. The main problems were:

Dive 242 - first half of Dive 243

Although the tracking of the USBL beacon used for the ROV did not give any errors in the Sonardyne system, the position recorded for it was faulty because the software did not recognise its settings correctly. This was detected and rectified halfway Dive 243, so navigation for the first 2 dives has to be considered as less reliable.

Dive 248

Dive 248 had to be aborted because the vehicle experienced a black-out as a result of a fuse that blew in the jetway. Although the fuse got replaced and ROV came back online shortly, another black-out followed immediately and the ROV needed as a dead vehicle. A serious kink in the cable had caused the second failure, and required retermination.

From that moment onwards, further issues kept occurring with loss of telemetry and communications initially attributed to further kinks in the cable (Dives 254, 259, 260). Eventually the fault was detected as being an unexpected sensitivity of the fibres in the cable to turns in the end of the umbilical. To avoid further loss of telemetry and communications, it was decided to pin the bullet at the end of the umbilical to the socket on the ROV itself, such that any turns would be spread out over the full length of the cable deployed, rather than the short bit of cable between the bullet and the connections in the vehicle. From then on, no further problems were experienced with the fibres.

Dive 260

Dive 260 also experienced another problem, besides the loss of telemetry: throughout the whole expedition in the Whittard Canyon, lost fishing gear was regularly observed, requiring careful vehicle handling and frequent adaptation to the dive plans. Dive 260 was a multibeam survey, where the vehicle followed fixed tracks up and down the canyon flank. On one up-canyon track, the vehicle experienced drag. Skillful handling of the situation by the ROV team meant they immediately reversed the vehicle's movement, and a strong rope could be seen in the camera, which may have been the cause of the problem. It was decided to abort the dive, and during the vehicle recovery, the telemetry issue described above happened - leading to the eventual recognition of the reason for the fault and its repair.

3. <u>Geophysical processing</u> (Katleen Robert, Jenny Gales, Leigh Marsh & Veerle Huvenne)

Eleven types of acoustic data were processed, cleaned and mosaicked/plotted during JC125:

1. RRS *James Cook* EM120 Multibeam bathymetry (191 beams)
2. RRS *James Cook* EM120 Multibeam backscatter (12kHz)
3. RRS *James Cook* EM710 Multibeam bathymetry (200 beams)
4. RRS *James Cook* EM710 Multibeam backscatter (70-100kHz)
5. RRS *James Cook* SBP120 sub-bottom profiler data
6. Autosub EM2040 Multibeam Bathymetry (256 beams)
7. Autosub EM2040 Multibeam Backscatter (200kHz)
8. Autosub Edgetech High frequency Sidescan (410kHz)
9. Autosub Edgetech CHIRP profiles
10. ISIS Reson 7125 Multibeam Bathymetry (512 beams)
11. ISIS Reson 7125 Multibeam backscatter (400kHz)

The software packages used were CARIS HIPS & SIPS v.8.0 for shipboard bathymetry, Fledermaus FMGT for shipboard backscatter, CARAIBES for AUV and ROV bathymetry, PRISM v5.0 for AUV and ROV backscatter and AUV sidescan sonar, and a combination of Matlab, Linux code, SeismicUnix and SeisView for the CHIRP and SBP profiles.

Not all systems were run at the same time, Tables 3.1-3.3 give an overview of the datasets that were produced, the settings employed and the resolutions of final processing results.

3.1. Shipboard EM120 Multibeam Bathymetry (191 beams)

Multibeam data were collected with a shipboard Simrad EM120 system along all long transits and a few dedicated multibeam surveys. For dedicated surveys, a speed of 8kn was used, occasionally reduced to 6kn when data quality was too poor. All other transits were carried out at full speed (~10kn). The system was kept in 'AUTO' mode with varying expected depths to account for the quickly varying terrain, and swath width was fixed at 60deg on either side, with equidistant spacing. A sound velocity profile (SVP) was taken at Haig Fras as well as in the deeper channel of Whittard Canyon and employed for the remainder of the surveys. A 10m offset had to be applied to the HaigFras SVP. Additional sound velocity profiles were recorded during certain CTD station, and will be available for post-processing if deemed necessary.

Data processing was carried out in CARIS Hips & Sips v8.0. For each area, a new project was created, using UTM zone 29 (see Table 3.1). The vessel file used was James_Cook_EM120_JC125.hvf, and had the following offsets:

Time Corr: 0.00
X (m): 0.013
Y (m): 4.988
Z (m): 6.965
Pitch (deg): 0.00
Roll (deg): 0.00
Yaw (deg): 0.00

The data were imported as .all (Generic Simrad data), and were checked for navigation and attitude (generally OK). The software Polpred (National Oceanography Centre) was used to predict the tides for both Haig Fras and Whitthard Canyon, the data were merged and a BASE surface with 5m (Haig Fras) and 50m (Whittard Canyon) grid sizes were calculated. Smaller dedicated surveys such as the Dangaard and Explorer Canyon region were processed at 25m. Data cleaning was carried out on the individual lines using the Subset Editor. Eventually the grids were interpolated (5x5) to fill individual gaps, and exported as ASCII .txt files with lat, long and depth. They were converted into negative depths, and turned into .grd grid files in Surfer (using inverse distance to power 2, with search radius 2 x pixel size), and imported into the cruise ArcGIS (needs setting of the Spatial Reference).

3.2. Shipboard EM120 Multibeam Backscatter (12kHz)

Together with the EM120 bathymetry, backscatter data were collected. They were processed in Fledermaus Geocoder Toolbox ('FMGT') v7.4.2b, using default processing for all steps. A project was created for each area (UTM zone 29). The source files were imported, using the default options for the coordinate system. From there, we let the software identify the suggested pixel size, based on the dataset content. An appropriate pixel size close to this value was then chosen (20m for Whittard, Dangaard and Explorer Canyons, 5m for Haig Fras), and the data were run through the default set of processing steps ('Mosaic' command). They were exported as GeoTiff and imported straightaway into ArcGIS.

Table 3.1 Overview of bathymetry, backscatter and sub-bottom surveys (including shipboard, AUV and ROV)

Area	EM710 bathy	EM710 backsc	EM120 bathy	EM120 backsc	Multibeam lines	SBP120	EM2040 bathy	EM2040 backsc	Reson7125 bathy	Reson7125 backsc	SVP	Tide	offsets	Output Filename
Haig Fras	2m	1m	5m	2.5m	0-50	Y	-	-	-	-	JC124_HaigFras_SVP_JD222	HaigFras2015		JC124_HaigFras_EM120_05m.grd JC124_HaigFras_EM120_Backscatter.tiff JC124_HaigFras_EM710_02m.img JC124_HaigFras_EM710_Backscatter.tiff
M86	-	-	-	-	-	-	3m	1m	-	-	1493.svp	HaigFras2015	roll 0.5	JC124_HaigFras_M86_03m.img jc124_haigfras_m86_em2040.img
Transit 1	-	-	5m (Shelf) 50m (Canyon)	5m	0-26	Y	-	-	-	-	JC124_HaigFras_SVP_JD222			jc125_transit1_em120_shelf_05m.img JC125_Transit1_EM120_Canyon_50m.grd jc125_transit1_em120_backscatter.img
Whittard Canyon	-	-	50m	20m	27-390	Y	-	-	-	-	20150815_115738_JC125_2_thinned_done_salinity_03500	Whittard2015		JC125_WhittardCanyon_EM120_50m.img JC125_WhittardCanyon_20m_Backscatter.tiff
Sand Waves	5m	2m	-	-	68-119	Y	-	-	-	-	20150815_115738_JC125_2_thinned_done_salinity_03500	Whittard2015		JC125_SandWaves_EM710_05m.img JC125_SandWaves_EM710_backscatter.img
Dangaard and Explorer Canyons	-	-	25m	15m	27-30, 83-108	Y	-	-	-	-	20150815_115738_JC125_2_thinned_done_salinity_03500	Whittard2015		JC125_DangaardExplorer_EM120_25m.img JC125_DangaardExplorer_EM120_backscatter.img
M90	-	-	-	-	-	-	5m	2m	-	-	1503_svp.vel		heading 180 roll *-1	JC125_WhittardCanyon_M90_05m.img jc125_whittardcanyon_m90_backscatter_02m.img
M91	-	-	-	-	-	-	3m	2m	-	-	set to 1526		heading 180 roll *-1	JC125_WhittardCanyon_M91_03m jc125_whittardcanyon_m91_backscatter_02m.img
M92	-	-	-	-	-	-	3m		-	-	set to 1504		roll -20	JC125_m92_200kHz_UTM.grd
M92	-	-	-	-	-	-	3m		-	-	set to 1504		roll -20	JC125_m92_400kHz_UTM.grd
M92	-	-	-	-	-	-	2m		-	-	set to 1504		roll -20	JC125_m92_200kHz_x2beams.grd
M93	-	-	-	-	-	-	2m		-	-	set to 1504		roll -20	JC125_m93_200kHz_UTM.grd
M94	-	-	-	-	-	-	0.5m		-	-	set to 1504		roll -20	JC125_M94_loop1_400kHz_UTM.grd
M94	-	-	-	-	-	-	0.5m		-	-	set to 1504		roll -20	JC125_M94_loop2-3_400kHz_UTM.grd
M95	-	-	-	-	-	-	2m		-	-	set to 1504		roll -20	JC125_WhittardCanyon_M95_02m.img
M96	-	-	-	-	-	-	5m		-	-	set to 1504		roll -20	JC125_WhittardCanyon_M96_05m.img
D260	-	-	-	-	-	-	-	-	0.5m	0.2m			roll 0.7, pitch -0.6	JC125_D260_Backscatter.img
D261	-	-	-	-	-	-	-	-	0.5	0.2m			roll 0.7, pitch -0.6	D261_dtm_sh.flt JC125_D261_Backscatter.img
M97	-	-	-	-	-	-	5m				set to 1499		roll -20	JC125_D260_USBL_Bathy.img
D264	-	-	-	-	-	-	-	-	0.2m					D264_Line01_40m_dtm_BackRotated_UTM.asc
D264	-	-	-	-	-	-	-	-	0.2m					D264_Line02_20m_dtm_BackRotated_UTM_smooth.asc D264_Line03_20m_dtm_BackRotated_UTM_smooth.asc D264_Line04_20m_dtm_BackRotated_UTM_smooth.asc
D264	-	-	-	-	-	-	-	-	0.05m					D264_Line05_10m_dtm_BackRotated_UTM_smooth.asc D264_Line06_10m_dtm_BackRotated_UTM_smooth.asc D264_Line07_10m_dtm_BackRotated_UTM_smooth.asc D264_Line08_10m_dtm_BackRotated_UTM_smooth.asc
M98	-	-	-	-	-	-	3m		-	-	set to 1499		roll -20	JC125_M098_Bathy.img
M99	-	-	-	-	-	-	2m		-	-	set to 1499		roll -20	JC125_M099_02m.img
Transit 2	-	-		5m	391-427	Y	-	-	-	-	20150815_115738_JC125_2_thinned_done_salinity_03500	Whittard2015		JC125_Transit2_EM120_Shelf_15m.txt JC125_transit2_em120_backscatter.jpg
														To be processed ashore

3.3. Shipboard EM710 Multibeam Bathymetry (200 beams)

The EM710 multibeam was only used for dedicated shallower water surveys at Haig Fras and the Sand wave area of Whittard Canyon. The data were processed in Caris HIPS and SIPS as for the EM120 data (same SVP and tide files, cleaning and exporting procedure). They were imported into the same project, but using different fieldsheets and under a different vessel file (James_Cook_EM710_JC125.hvf) with the following offsets:

Time Corr: 0.00
X (m): 1.832
Y (m): 19.199
Z (m): 6.944
Pitch (deg): 0.00
Roll (deg): 0.00
Yaw (deg): 0.00

However, the vessel file available did not seem to take into account the drop keel and this offset still needs to be added. Moreover, there remained a ~5m offset between depths from the EM710 with respect to those acquired with the EM120. The Haig Fras area was processed to 2m resolution and 5m for the sand wave area.

3.4. Shipboard EM710 Multibeam Backscatter (70-100kHz)

As for the EM120 backscatter, the EM710 backscatter was imported under different projects (UTM zone 29) in Fledermaus Geocoder Toolbox ('FMGT') v7.4.2b, using default processing for all steps and exported as GeoTiff in ArcGIS. Haig Fras and the Sand Waves area were processed to 1m and 2m respectively.

3.5. Shipboard SBP120 sub-bottom profiler (2.5-6.5 kHz)

Each time the EM120 data were recorded, the SBP120 was switched on and data were also recorded. Preceding piston coring activities, the SBP120 was also briefly turned on to help inform site choice for core deployment. The settings developed for the previous cruise (JC-123) were applied for the shallow (<500 m water depth) water sites and included:

- External trigger (EM120)
- Ping interval 500 ms
- Linear chirp up pulse, ranging from 2500 to 6500 Hz
- Minimised pulse shape (80%), 5ms
- Source power starting at -10db, decreased to -30db at some point because there seemed to be too much energy in the water column. Later on this turned out to be the effect of too much gain.
- Beam width Tx: Normal, Rx: Wide 10, Number of Beams: 1
- Calculating delay from depth (EM120)
- Processing included Filters, AGC, Gain and TVG

For the deep (>500 m water depth) water sites:

- External trigger (EM120)
- Ping interval 500 ms
- Linear chirp up pulse, ranging from 2500 to 6500 Hz
- Minimised pulse shape (13%), 30ms
- Source power between -10db and -30db
- Beam width Tx: Normal, Rx: Wide 10, Number of Beams: 1
- Calculating delay from depth (EM120)
- Processing included Filters, AGC, Gain and TVG
- Gain Correction enabled with transmission loss ranging from -5 to -3.

Data were stored in segy format for both raw and 'processed' data (i.e. convoluted with the source sweep). Files were saved using the 'Directory for segY files' option in separate folders for each station and named by time-stamp.

In order to visualise the profiles, segY files were imported into SeisView (version 2.25.4) with the following settings applied and exported as time-stamped .bmp images (Fig. 3.1).

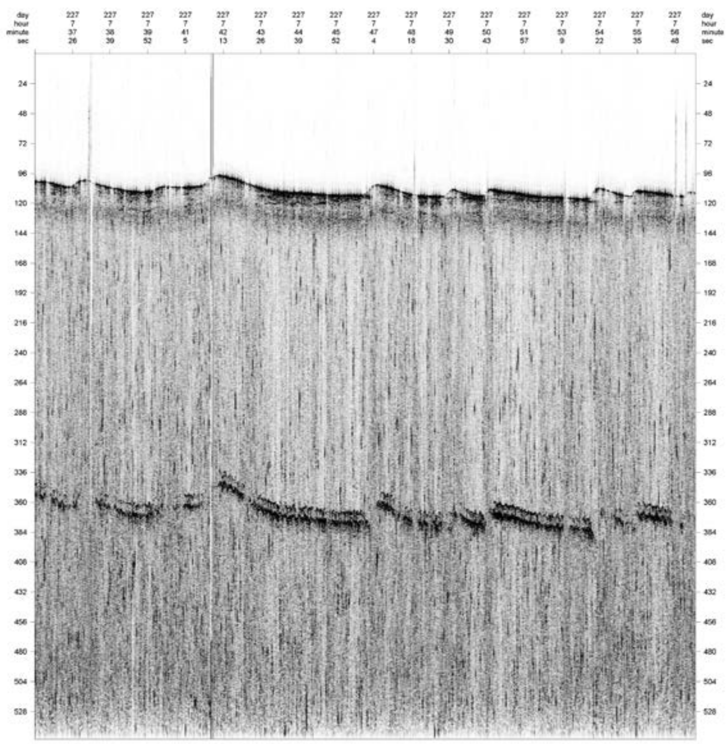


Fig. 3.1 Example of shipboard SBP120 sub-bottom profiler data in SeisView

3.6. Autosub EM2000 Multibeam Bathymetry (256 beams)

Autosub6000 is equipped with an EM2040 system which has three possible working frequencies: 200, 300 and 400kHz, and the possibility of doubling the number of beams. As one of the aims of this cruise was to develop new procedures for sideways mapping, many different settings were employed, sometimes during the same dive. Settings employed are outlined in Tables 3.1-3.2.

Table 3.2. Overview of the settings employed for each survey (including shipboard, AUV and ROV)

Area	Survey	Altitude	Distance from Wall	Frequency	Ping Rate	Beam Angle	Sweep
Haig Fras	MBES	-	-	70-100kHz	-	120°	-
M86	MBES	50m	-	410kHz	-	-	16ms, 2-13kHz
M86	SS	15m	-	410kHz	-	-	16ms, 2-13kHz
M86	SS	3m	-	410kHz	-	-	16ms, 2-13kHz
M87	SS	3m	-	410kHz	-	-	16ms, 2-13kHz
M87	SS	15m	-	410kHz	-	-	16ms, 2-13kHz
Transit 1	MBES	-	-	12kHz	Auto	120°	-
Whittard Canyon	MBES	-	-	12kHz	Auto	120°	-
Sand Waves	MBES	-	-	12kHz/	Auto	120°	-
Dangaard and Explorer Canyons	MBES	-	-	12kHz/	Auto	120°	-
M88	SS	3m	-	410kHz	-	-	16ms, 2-13kHz
M88	SS	15m	-	410kHz	-	-	16ms, 2-13kHz
M89	SS	3m	-	410kHz	-	-	16ms, 2-13kHz
M89	SS	15m	-	410kHz	-	-	16ms, 2-13kHz
M90	MBES	120m	-	200kHz	Auto	Optimal	-
M91	MBES	120m	-	200kHz	Auto	Optimal	-
M92	MBES	540m E 570m W	120m	200kHz	Auto	Optimal	-
M92	MBES	540m E 570m W	120m	400kHz	Auto	Optimal	-
M92	MBES	540m E 570m W	120m	200kHz X2 Beams	Auto	Optimal	-
M93	MBES	570m E 600m W	100m	200kHz X2 Beams	Auto	Optimal	-
M94	MBES	570m E 600m W	75m	400kHz X2 Beams	Auto	Optimal	-
M94	MBES	570m E 600m W (loop 2) 670m depth E 700m W (loop 3)	60m	400kHz X2 Beams	Auto	Optimal	-
M95	MBES	40m	120m	400kHz X2 Beams	Auto	Optimal	-
M96	MBES	120m	120m	400kHz X2 Beams	Auto	140°	-
D260	MBES	60-65m	-	400kHz	10p/s	120-140°	-
D261	MBES	40m	-	400kHz	10p/s	140°	-
M97	MBES	60m central 120m all other lines	120m	200kHz X2 Beams	10p/s	Auto	-
D264	MBES		40m	400kHz	10p/s	140°	-
D264	MBES		20m	400kHz	10p/s	140°	-
D264	MBES		10m	400kHz	10p/s	140°	-
M98	MBES	120m	120m	200kHz X2 Beams	Maximum	140°	
M99	SS	15m	-	410kHz	-	-	16ms, 2-13kHz
M99	MBES	75m	-	200kHz X2 Beams	Maximum	140°	

Missions 89-91 were carried out with the sonar in a downward position, while for missions M92-M100 the system was mounted sideways (-20 roll offset) to allow for better coverage of vertical structures. As previous attempts (see JC-120 cruise report) at processing EM2040 data in CARIS HIPS & SIPS were unsuccessful, all missions were processed in the CARAIBES software, written at IFREMER.

The processing flow included following steps:

- *Tm2040*: importation of .all files, creation of .mbg (bathymetry) and .nvi (navigation) file for each. The function also allows the extraction of the sound velocity file used for data recording (.vel). Offsets between the EM2040 sounder (Rx) and Navigation reference (Phins) had to be imported, and were interpreted as the offsets when going from navigation to EM2040: 2.202m ahead, 0.00m across, -0.08m below.
- *Ananav*: quick check on the navigation. This was also used to generate a 'Time division file' to later split navigation lines into more practical units.
- *Celeri*: creating a .vel sound velocity file from a generic text file containing the sound velocity profile under the vehicle (2 columns needed: depth and sound velocity to 2 decimal places). This was only carried out for HaigFras and the value applied was based on the SVP carried out at that site. Thereafter, a surface sound velocity based on the SVP carried out at Whittard Canyon was applied a priori based on the planned depth of the missions.
- *CmpLay*: application of the new sound velocity profile, at the same time disabling the 'compensation layer mode'. It turns out that the EM2040 data is recorded without sound velocity profile, only with indication that the surface sound velocity (i.e. the sound velocity at the transducer) is a certain value.
-*Cosima*: Application of a tide from an ascii file. As Haig Fras was relatively shallow a tide table was created based on the Polpred predicted tide which had been used for the shipboard processing.
- *EdiMbg*: function to display and extract individual parameters. This was mostly used to remove drop outs in the roll and pitch or export attitude values to text files for further editing.
- *Coratt*: application of attitude correction. Athough the EM2040 system had been remounted correctly from the JC120 cruise, the settings for two dive M90-91 were wrongly applied and the heading had to be changed by adding a heading offset of -180deg ('bias' option, constant value). As a result of this, the roll also had to be inverted. Roll records for each .mbg file were extracted (using *EdiMbg*) and concatenated in a text editor, and then inverted (either in the text editor, by some clever 'search & replace' or in a spreadsheet, making sure the column structure is maintained).

Missions for which the multibeam system was mounted sideways were processed with the application of a constant bias of -20.

- *FusMbg*: concatenation of .mbg files into sections corresponding to the different lines or the entirety of each survey.
- *FusNav*: concatenation of .mbg files into sections corresponding to the different lines or the entirety of each survey.

- *GenNav*: Splitting of navigation lines using a 'Time division file'. This was employed to separate a navigation file for which all lines had been merged using *FusNav* or to create a single file for each line excluding the turns.
- *GenMul*: Splitting of bathymetry files using a 'Time division file'. This allowed each survey line to be represented by a single .mbg file with the same splitting points as for the navigation.
- *RegBat*: Interactive navigation shifting. As the canyon topography is quite complex with quickly changing depths, there were a few missions when the doppler navigation of Autosub lost contact with the seabed. As a result, some of the lines were not where the navigation of Autosub indicated. In these cases, the navigation lines were shifted until contours and overlapping features between consecutive lines were matched.
- *GenXY*: Updating of bathymetry files based on new navigation. To help determine the position of the AUV, for M92-94, it was tracked by the ship using USBL. The USBL navigation data were used to update the .mbg file and a more spatially accurate dtm was created. However as USBL navigation can be noisy, this dtm was only used to inform navigation shifts (by using it as a bathymetry background) in *RegBat*.
- *CalBat*: calibration module - was used to check for calibration, any offsets were applied using *Coratt* and are recorded in Table 2.
- *Odicce*: cleaning module of CARAIBES, can be used to clean data, or to carry out diagnostics, as the soundings of each line/file can be displayed in different colours.
- *Mailla*: gridding of the .mbg files to create a DTM (.dtm file). Under the cartography tab, the projection can be set. Data were either processed in UTM zone 29 or Mercator with standard parallel 48.
- *Cocoul*: visualisation of the gridded data on a map (note that View3D can be used as well for a 3D view, but may need special graphics settings in the Linux emulator).
- *MntAsc*: exportation of .dtm files to .flt (& associated .hdr) for direct importation into ArcGIS (after specification of the Spatial Reference, Fig. 3.2). This was also used to export .dtm files into xyz format for importation into point cloud viewing softwares such as CloudCompare.
- *Zascii*: Ascii file creation for soundings. This was also employed to export raw soundings into point cloud processing software or to be gridded using other algorithm in Fledermaus or Surfer 10.

3.7. Autosub EM2040 Multibeam Backscatter (200 - 300 - 400kHz)

Processing of the multibeam backscatter was carried out in the PRISM (v5, National Oceanography Centre) software. Transfer of data to PRISM was done via the Kongsberg Replay system which converts the raw .all files to proc format which can be read by PRISM. This was carried out on concatenated .all files (as only the first file possessed the required header information), creating a single large file per mission. Only backscatter for down-looking missions (M86-M91) was processed on board as additional steps will need to be developed to handle the -20 roll offset.

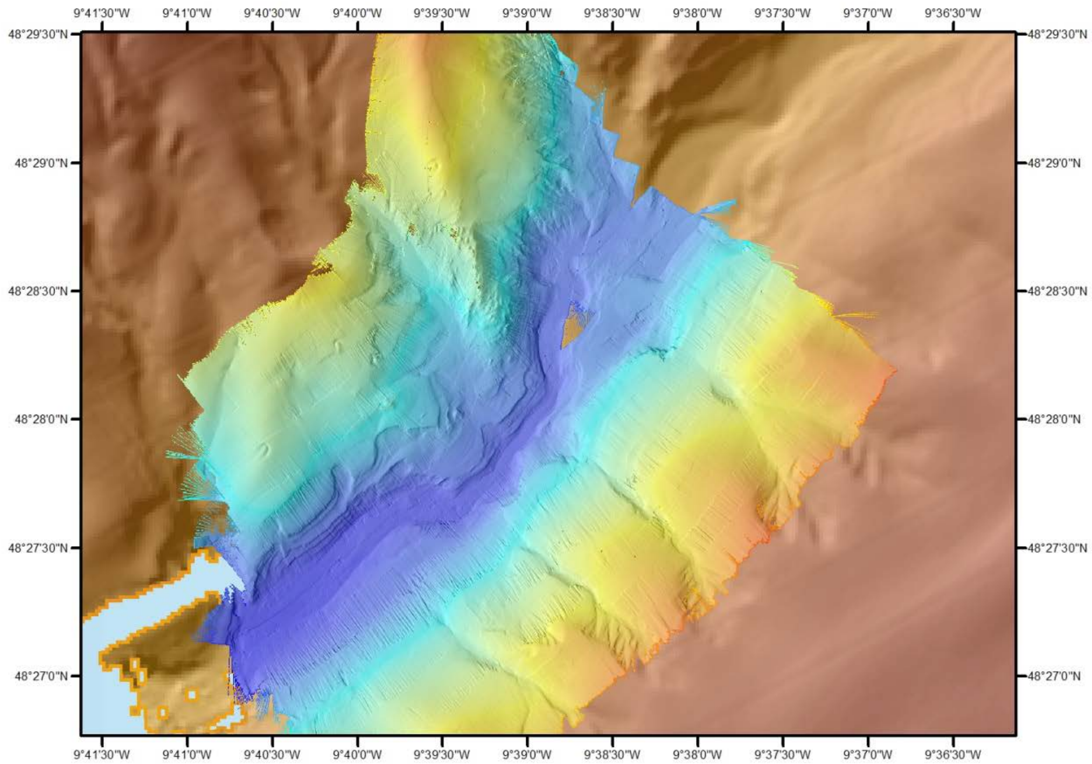


Fig. 3.2 Detail of EM2040 bathymetry from M98.

The resulting proc files were then converted in PRISM:

- Conversion to PRISM format in the cdf directory: *em710cdlinux*
- *do_create_index* to create index file in cdf directory, copy to parent directory
- *do_make_nav* in the cdf directory (no-header option), copy to nav folder

For dives where doppler lock had been lost and navigation needed to be rectified, the shifted .nvi files (from *RegBat*) from Caraibes were expected to generic text files using *NavExp* and edited to fit the Prism format for .nav files. The *wireout* function was used to generate the vehicle navigation file (.veh.nav) from the created .nav file.

- *maptile* automatic creation of overlapping tiles to maximize computer processing by minimizing individual tile file sizes. This was carried out in the parent directory. A Mercator projection with standard parallel 48 for Whittard Canyon and 50 for Haig Fras (latitude of true scale) was applied.
- The commands.cfg file contained the following commands:

Haig Fras
mrgnav -i %1 -o %0 -n navfile.nav -l 0,0
shade -i %1 -o %0 -n 128 -t 1,254
filter -i %1 -o %0 -b 1,21 -z -v 1,255
filter -i %1 -o %0 -b 1,301 -h -v 1,255
filter -i %2 -o %0 -b 31,301 -L -v 1,255
wtcombo -i %2 , %1 -o %0 -c 1,1 -a -128

```
restorehdr -i %1 -h %5
resol -i %2 -o %0 -r res -a
```

Whittard Canyon

```
mrgnav -i %1 -o %0 -n navfile.nav -l 0,0
shade -i %1 -o %0 -n 128 -t 1,254
filter -i %1 -o %0 -b 1,21 -z -v 1,255
filter -i %1 -o %0 -b 1,301 -h -v 1,255
filter -i %2 -o %0 -b 31,301 -L -v 1,255
wtcombo -i %2 , %1 -o %0 -c 1,1 -a -128
restorehdr -i %1 -h %5
resol -i %2 -o %0 -r res -a
```

The following line was added to the start of the command.cfg file for M90-91 to rectify the heading:

```
sshead -i %1 -o %0 -h 180
```

-*prism5* command in the parent directory (with equal range). The backscatter data were processed to varying pixel resolution depending on Autosub height (refer to Table 3.1).

Although the resulting .lan files can be directly imported into ArcGIS, as many tiles were often created, they were imported first in Erdas Imagine 2013 and mosaicked using the 'Mosaic Pro' function. Even when only one file was generated, the mosaicking function was still applied as the pyramids constructed in Erdas gave nicer results. After importation in ArcMap, files were georeferenced and displayed with high backscatter in white and low backscatter in black (Fig. 3.3).

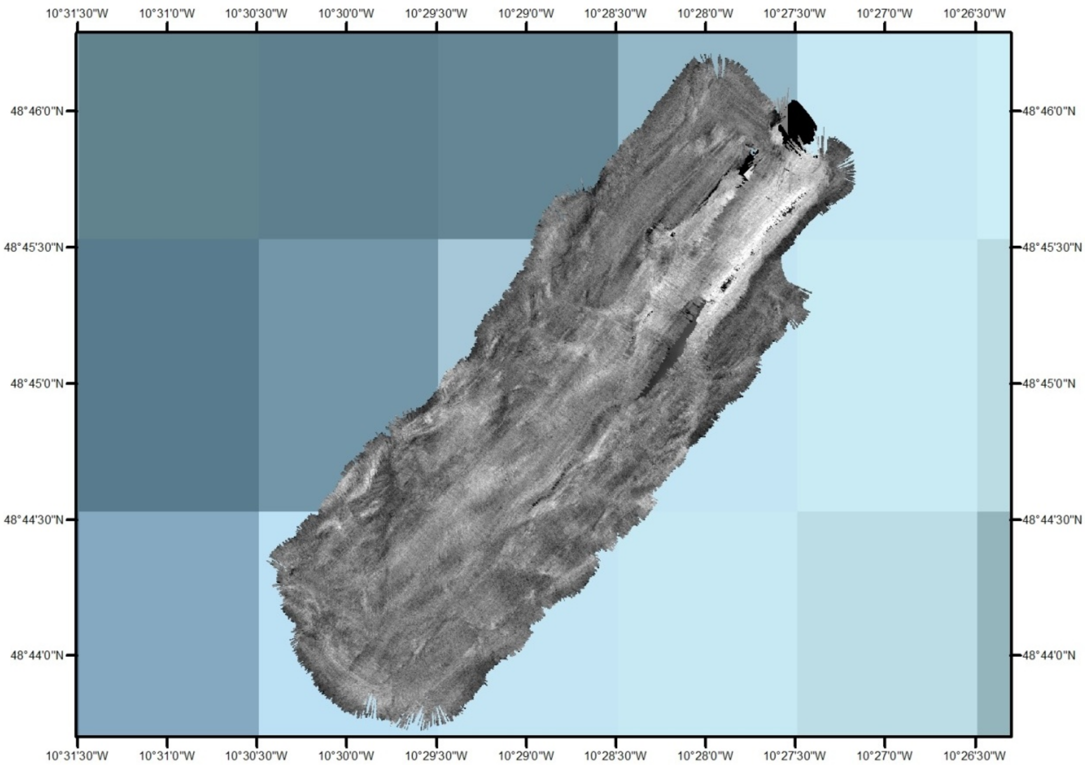


Fig. 3.3 Detail of EM2040 backscatter mosaic from M91.

3.8. Autosub Edgetech high frequency Sidescan (410kHz)

The Edgetech .jsf data files contain the low and high frequency sidescan data as well as the chirp sub-bottom profiler, all collated together. Only M100 had been setup for collecting low frequency sidescan data, but a technical issue resulted in no acoustic data being available for this mission. The Edgetech Discover 4200-FS software was used to convert the .jsf format data into .xtf format. This has the advantage of viewing the data whilst being converted. A few files were corrupted, and they were repaired with the SalvageCorrupZeros.exe routine provided by Edgetech.

The high frequency setting of the Edgetech sidescan sonar was used both for short dedicated transects (15m altitude) and during photo transects carried out by Autosub. During the conversion from .jsf to .xtf, the following Gain settings were used in the Discover software:

High Freq: Gain 15dB TVG 0dB/100m

The .xtf data were then converted into PRISM format (.cdf) using the *reson2prism* program, making use of the *loopfile* command where necessary. The original data have a sample resolution of 1.152cm but as the ping rate was 6Hz (25cm) the data were averaged and subsampled by a factor of 4 to 4.61cm for the 15m altitude data, and by a factor of 2 to 2.34cm for the 3m altitude data. Data files were given 4500 (15m altitude) or 8000 samples per side (3m altitude).

Navigation was obtained separately from Autosub data files (Mxx_EdgetechNav.txt). Heading was calculated from track heading as there seemed to be a lot of variation in the vehicle heading. Vehicle altitude was also not available and was therefore measured from the first return (*do_alt*). *Maptile* was once again used to automatically create tiles, and the commands.cfg file contained the following programs (adapting the resolution where necessary):

Haig Fras

```
mrgnav_inertia -i %1 -o %0 -u 0 -r 0.0,0.0 -n navfile.veh_nav
widealt -i %1 -o %0 -p
tobslr -i %1 -o %0 -r0.0234 , res
edge16 -i %1 -o %0 -m
shade_tobi -i %1 -o %0 -n 1000
# shade -i %1 -o %0 -n 100
# shade3 -i %1 -o %0 -c navfile
# shade5 -i %1 -o %0 -c navfile
filter -i %1 -o %0 -b 1,351 -h -v 1,5000
filter -i %2 -o %0 -b 21,351 -l -v 1,5000
wtcombo -i %2 , %1 -o %0 -c 1,1
restorehdr_tobi -i %1 -h %5
lowpass2b2 -i %2 -o %0
restorehdr_tobi -i %1 -h %3
widealt -i %2 -o %0 -h -l 50
increm -i %1 -o %0
```

Whittard Canyon

```
mrgnav_inertia -i %1 -o %0 -u 0 -r 0.0,0.0 -n navfile.veh_nav
widealt -i %1 -o %0 -p
tobslr -i %1 -o %0 -r0.0234 , res
edge16 -i %1 -o %0 -m
shade_tobi -i %1 -o %0 -n 1000
# shade -i %1 -o %0 -n 100
# shade3 -i %1 -o %0 -c navfile
# shade5 -i %1 -o %0 -c navfile
filter -i %1 -o %0 -b 1,351 -h -v 1,5000
filter -i %2 -o %0 -b 21,351 -l -v 1,5000
wtcombo -i %2 , %1 -o %0 -c 1,1
restorehdr_tobi -i %1 -h %5
lowpass2b2 -i %2 -o %0
restorehdr_tobi -i %1 -h %3
widealt -i %2 -o %0 -h -l 50
increm -i %1 -o %0
```

Using the *Prism5* command with the equal range option, sonar data were processed and geometrical correction used a 45º course deviation factor for segments and a pixel resolution of 15cm (see Table 3.1, 3.3). Results were again collated in ERDAS Imagine and mosaicked into a single image (Fig. 3.4).

Table 3.3. Overview of the sidescan sonar (including Chirp) AUV surveys

Area	EdgeTech LowRes	EdgeTech HighRes	Chirp	Mercator standard parallel	Output Filename
M86	-	0.15cm	Y	50	jc124_haigfras_m86_15malt.img
M86	-	0.15cm	Y	50	jc124_haigfras_m86_03malt.img
M87	-	0.15cm	Y		jc124_haigfras_m87_03malt.img
M87	-	0.15cm	Y		jc124_haigfras_m87_15malt.img
M88	-	0.15cm	Y	48	jc125_whittardcanyon_m88_03malt.img
M88	-	0.15cm	Y	48	jc125_whittardcanyon_m88_15malt.img
M89	-	0.15cm	Y	48	jc125_whittardcanyon_m89_03malt.img
M89	-	0.15cm	Y	48	jc125_whittardcanyon_m89_15malt.img
M90	-	-	-	48	JC125_WhittardCanyon_M90_05m.img jc125_whittardcanyon_m90_backscatter_02m.img
M99	-	0.15m	Y	48	jc125_whittardcanyon_m099_15malt.img

3.9. Autosub EdgeTech Chirp profiler (2-13 kHz sweep)

In addition to the sidescan sonar, the Edgetech system also contains a chirp profiler, which was used with a 16ms sweep. Preliminary data processing was carried out on the incoming data to be able to visualise the profiles, although further processing at base will be necessary to include the correct time delay related to the Autosub depth, amongst others.

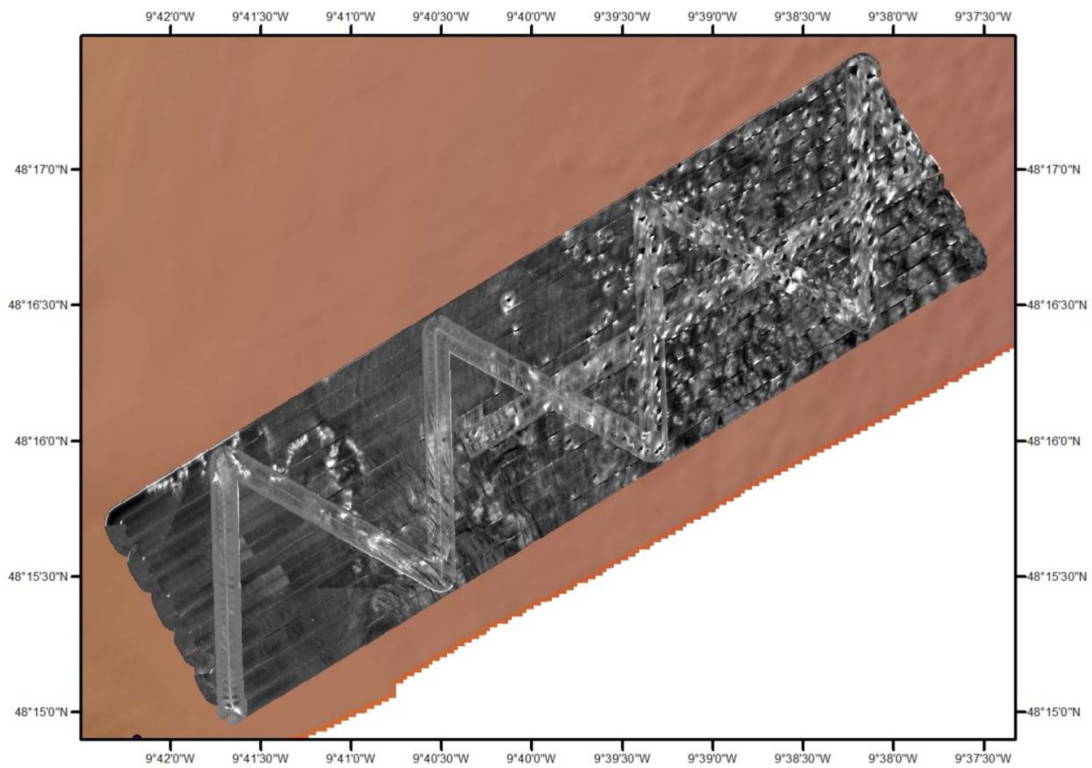


Fig. 3.4 Detail of the 15m and 3m altitude high frequency sidescan sonar data from M89 carried out near Dangaard Canyon.

Processing consisted of three steps:

- inclusion of navigation information in the .jsf files. A Matlab routine (*jsf_nav_modified.m*) written by Melis Cevatoglu from NOC was used for this step and a loop was added by Tahmeena Aslam. Required input: original .jsf file and navigation data provided by Autosub team (_10HzMxx). Output: updated .jsf file

- conversion to SEGY format, using the programme *jsf2segy* in a Linux environment (programme version adapted by Melis Cevatoglu). Input: nav-updated .jsf file, output (-o): segy file, options used: -a (use the analytical data rather than the raw data).

Example command line:

jsf2segy/ddrive/2015_JC125_126_GIS_Whittard_Acoustic/Geophysical/Edgetech/M099/RawData/ jsf_withNav/DATA0000232_output.jsf -o /ddrive/2015_JC125_126_GIS_Whittard_Acoustic/

Geophysical/Edgetech/M099/segy/DATA0000232.sgy -a

- visualisation through the SeiSee (version 2.25.4) and exported as time-stamped .bmp images (Fig.3. 5).

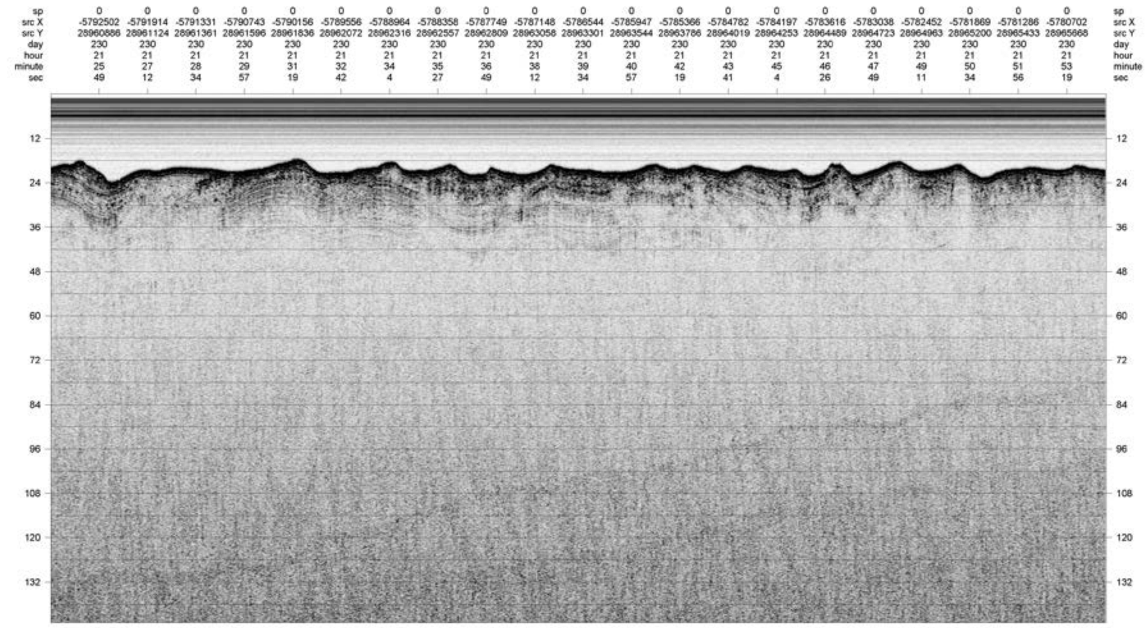


Fig. 3.5 Example CHIRP profile collected at 15m altitude, 16ms sweep, M89. X-axis: trace number, Y-axis: TWT below the Autosub vehicle.

3.10. ISIS Reson 7125 Multibeam Bathymetry (512 beams)

Three ROV swath dives were completed during the cruise (D260, D261 and D264). Dive 264 was aimed at the mapping of a vertical wall, and required a specific set-up that will be discussed later. The settings for the traditional downward looking surveys (Dives 260 and 261) are summarised in Table 3.4.

Table 4. RESON survey settings for Dive 260 and Dive 261

	Dive 260	Dive 261
MBES Frequency	400 kHZ	400 kHz
Range	150 m	100 m
Altitude	60-65 m	40 m
Line spacing	150 m	160 m
Beam angle	120-140°	140°
Power	217 dB	218 dB
Gain	15-39 dB	47 dB
Pulse Length	60 µsec	60 µsec
Absorption	90 dB/km	90 dB/km
Spreading	30 dB/km	30 dB/km
Duration (at seabed)	17 h 17 min	12 h 55 min
Survey speed	0.2-0.3 kn	0.3-0.5 kn
Pixel size	50 cm	50 cm

The maximum ping rate was kept at 10Hz, as this is the frequency of data recording of the Octans attitude sensor. With survey speeds of ~0.3kn (0.15 m/s) this gave sufficient data density along-track. The pressure reading from the Parascientific Digiquartz depth sensor is not correctly converted to depths within PDS2000, hence all data were recorded as relative depths below the vehicle. Actual vehicle depths were then applied during post-processing, using depth values recorded in TECHSAS.

The original .pds files were converted to .s7k files using PDS200's (Version 3.7.0.49) export function. Data processing was carried out in Caraibes and involved many of the same steps and functions as for the AUV bathymetry processing.

A general overview of the main steps included:

- *Tm7125*: importation of .s7k files, creation of .mbg (bathymetry) and .nvi (navigation) files for each. The function also allows the extraction of the sound velocity file used for the data recording (.vel). No offsets between the EM2040 sounder (Rx) and Navigation reference (Phins) were imported as they had been included during acquisition (Table 3.5).
- *ImpIsis*: importation of ROV's immersion, the netCDF files ***_CSVLA.cdf were converted to generic immersion text files which were then concatenated in a text editor.
- Tnmg77: conversion of netCDF doppler navigation files into .nvi.
- *Coratt*: application of attitude correction. This was used to add the depth of the vehicle (immersion) as a constant value, since all data had been recorded as the distance from the ROV to the seafloor.
- *GenXY*: Updating of bathymetry files based on new navigation. As the USBL data can be relatively noisy, the doppler .nvi files were applied to the .mbg files (except for Dive 261 where issues with the Doppler caused gaps in the data).
- *RegBat*: Interactive navigation shifting. This was employed to rectify any drift in the doppler.
- *CalBat*: calibration module - was used to check for calibration, any offsets were applied using *Coratt* and are recorded in Table 1.
- *Odicce*: cleaning module of CARAIBES, was used to clean data, or to carry out diagnostics.
- *Mailla*: gridding of the .mbg files to create a DTM (.dtm file). Under the cartography tab, the projection can be set. Data were either processed in UTM zone 29 or Mercator with standard parallel 48.
- *Cocoul*: visualisation of the gridded data on a map.
- *MntAsc*: exportation of .dtm files to .flt (& associated .hdr) for direct importation into ArcGIS (after specification of the Spatial Reference, Fig. 3.6). This was also used to export .dtm files into xyz format for importation into point cloud viewing softwares such as CloudCompare.
- *Zascii*: Ascii file creation for soundings. This was also employed to export raw soundings into point cloud processing software or to be gridded using other algorithms in Fledermaus or Surfer 10.

The last ROV multibeam dive was carried out with an entirely different setup: the SCORPIO camera was taken off and the Reson system was mounted on the front of the ROV, in a forward-looking position (Fig. 3.7), with the aim to map a steep wall in one of the inner branches of Whittard Canyon. This technique had been trialled on ISIS once before, with the previous Simrad SM2000 multibeam system (see Huvenne et al. (2011) for details and results). The offsets from the common reference point on ISIS are listed in Table 3.6.

Table 3.5 Offsets for the various sensors versus a common reference point on ISIS (front of vehicle) as used for the conventional mapping approach, within the conventional vehicle reference frame (X: positive starboard, Y: positive forward, Z: positive up, all in metres)

	X	Y	Z
Compatt (USBL)	1.01	-0.36	1.46
Doppler	0.58	-2.91	-0.17
MBES	0.215	0.115	0.344
Octans (attitude)	0.00	-0.86	-0.49
Parascientific (depth)	0.55	-1.48	0.00

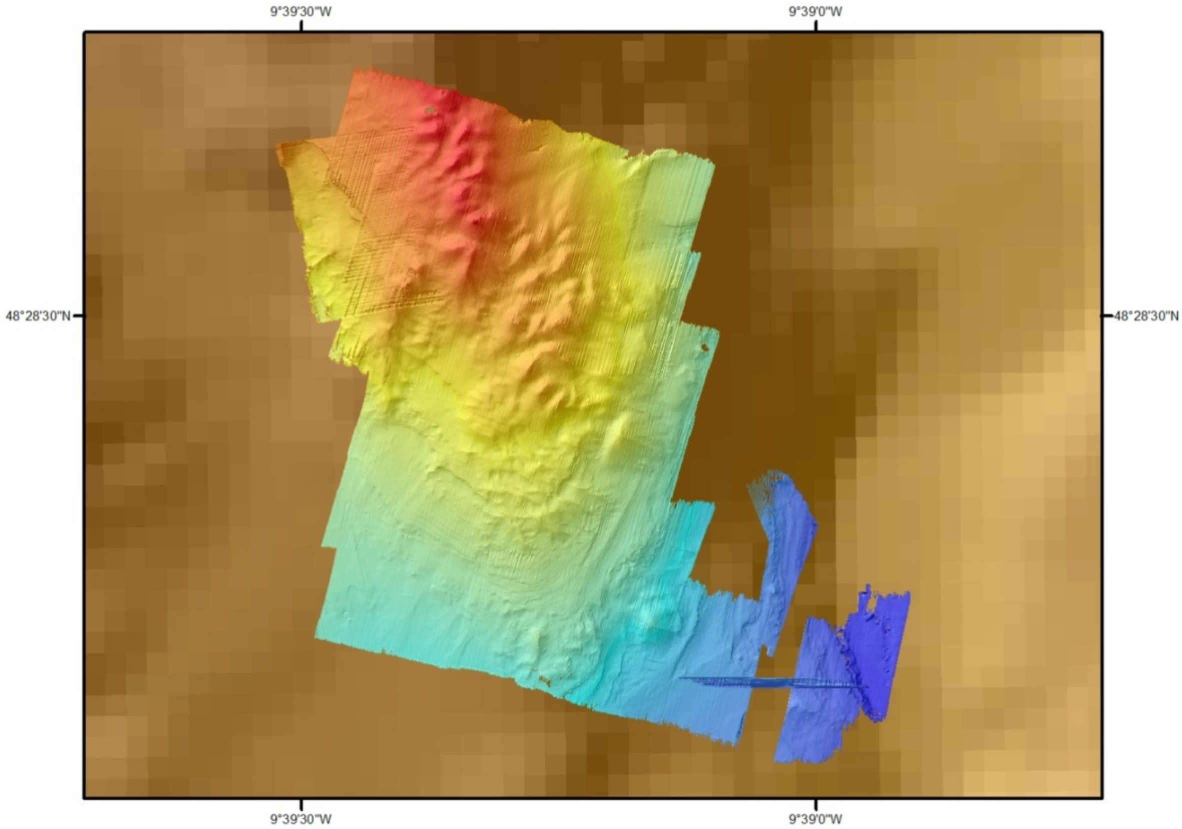


Fig. 3.6 Detail of the ROV bathymetry carried out during D261 on Explorer Canyon.

In addition, inside the 7Sk acquisition software, the hardware configuration offsets between Rx and Tx were set as follow X= -0.125m, Y= -0.125m and Z= 0.031m with head tilt= 0°.

The vehicle was flown in a set of parallel passes, each pass being carried out at a constant depth and with a constant distance from the cliff face (Table 3.7). Surveys were carried out with a heading of 128° at 40m (depths of 650m), 20m (depths of 610m, 660m and 710m) and 10m (depths of 677m, 684m, 649m and 615m) distances from the wall. For the 10m distance lines the ping rate was increased to 12p/s.

Fig. 3.7. ISIS set-up for forward-looking swath surveys.

Table 3.6 Offsets for the various sensors versus a common reference point on ISIS (front of vehicle) as used for the forward mapping approach, within the conventional vehicle reference frame (X: positive starboard, Y: positive forward, Z: positive up, all in metres)

	X	Y	Z
Compatt (USBL)	1.46	-1.01	0.36
Doppler	-0.17	-0.58	2.19
MBES	0.34	-0.22	-0.12
Octans (attitude)	-0.49	0.00	0.86
Parascientific (depth)	0.00	-0.55	1.48

The importation into Caraibes was carried out as for the previous down-mounted dives (conversion of .pds files to .s7k and .mbg using *Tm7125*, importation of ROV immersion using *ImpIsis* and netCDF doppler navigation files .gps using *Tnmg77*). In *AnaNav* a moving average (window size 100) was applied to lines 2-8 to smooth the USBL data as doppler lock could not be achieved. The .mbg and. nvi files were then merged into single files for each line, and depending on the line, the most appropriate navigation (Doppler or USBL if doppler lock could not be achieved) was exported to a text file using *NavExp*. Heave, heading, roll and pitch data were also extracted to text files for each line using *EdiMbg*. The navigation and immersion files were imported into R and subjected to a coordinate transformation following Huvenne et al. (2015) to project the vertical wall horizontally for further processing. New pitch values were calculated by inverting the sign of heading deviation from the direction of survey (128°).

Table 3.7 RESON survey settings for Dive 264

MBES Frequency	400 kHz							
Distance wall	40 m	20 m			10 m			
Depth	650 m	610 m	660 m	710 m	677 m	684 m	649 m	615 m
Beam angle	120 - 140°							
Power	217 dB							
Gain	47 dB	39 dB			30 dB			
Absorption	85 dB/km							
Spreading	30 dB/km							
Duration (at seabed)	9 h 09 min							
Survey speed	0.2 - 0.3 kn							

In Caraibes, the new navigation text files were then converted to .nvi using *Tnmg77* and applied to the appropriate .mbg file using *GenXY*. The vehicle attitudes were than transformed to represent the new configuration and applied in *Coratt* using absolute value: with the original pitch becoming the new roll and the old roll becoming the new heading. The new immersion and new pitch values previously calculated were also applied via *Coratt*. The new rotated .mbg were viewed and ping edited using Odicce, then gridded to varying resolutions (Table 3.1) using *Mailla* and exported to xyz and ascii grid format using *Mntasc*. The xyz text files were reimported into R, backrotated to a vertical position and projected into UTM Zone 29 for importation into CloudCompare.

The described steps only represent initial data processing and further work will be necessary. Once fully processed, the swath data will be integrated with the horizontal AUV and ship-borne bathymetry data, and with the species assemblage information extracted from the video data.

3.11. ISIS Reson 7125 Multibeam backscatter (400 kHz)

The .pds files were further converted using PDS2000's (version 3.9.1.0) export function to .gsf format (fully corrected option). Combining these with the .s7k files converted from PDS2000 (3.7.0.49) in Fledermaus using the 'Add Source/Paired File' function. All other steps were carried out as for the ship-board backscatter except that uncalibrated data with range of -80 to -10 dB was employed to better fit the acquired data. Further processing will need to be developed in order to extract backscatter data from the vertical mounted multibeam system.

4.Video surveying & photography (Leigh Marsh)

A total of 27 ROV dives were conducted during the CODEMAP2015 expedition. Although most dives had multiple purposes (video survey, sampling, bathymetry), during all dives video data were collected – either for specific survey or to document the ROV operations.

4.1. ROV Science Dive Summary and Navigation

A summary of the ROV dives drawn from the OFOP station files is presented in Table 4.1. Post-dive, the OFOP data (including .posi, .prot and .obs) files were saved to the "Isis Data" QNAP drive (2015_JC125_Backup>Isis>OFOP). Navigation data presented in this cruise report are drawn from the .posi files. Only navigation between "AT Bottom" and "OFF Bottom" are presented. USBL navigation was smoothed using the "navigation smooth" function in OFOP, keeping all settings to standard default values. These .txt files were used to create shapefiles for navigation tracks that are saved in the cruise GIS folder (2015_JC12X_GIS_XXX > Navigation > ROV_nav > ProcessedData >) and used subsequently in the cruise GIS.

- DiveXXX_bottom_posi.txt (navigation for "AT Bottom" to "OFF Bottom")
- DiveXXX_bottom_smooth_posi.txt (smoothed navigation for "AT Bottom" to "OFF Bottom")

The Doppler navigation has not been corrected for 'resets' and therefore is not reported. The raw data can be found in 2015_JC12X_GIS_XXX > Navigation > ROV_nav >RawData > DVLNAV. Additional ROV telemetry such as depth (Isis Paroscientific Digiquartz Pressure Sensor), altitude (Isis Kongsberg Altimeter) and heading (Isis Octans, MRU) can be found in the Techsas files, stored on "Isis Data".

Table4.1 Overview of ROV dives carried out during CODEMAP2015

Cruise	Site	Dive	Station	Action	Date	Time	SHIP_Lon	SHIP_Lat	Water_Depth (EA600)	SUB1_Lon	SUB1_Lat	Bottom_time	Full_deployment	Comments
JC124	Haig Fras	242	6	IN Water	11/08/2015	08:56:43	-7:36.1885	50:21.5	101	00:00.0	00:00.0			USBL
				AT Bottom	11/08/2015	09:23:19	-7:36.1877	50:21.5	95.8	00:00.0	00:00.0			
				OFF Bottom	11/08/2015	11:09:38	-7:36.3836	50:21.6	77.4	-7:36.4304	50:21.5	01:46:19	02:34:28	
				ON Deck	11/08/2015	11:31:11	-7:36.3847	50:21.6	74.5	-7:36.4440	50:21.5			
JC124	Haig Fras	243	8	IN Water	11/08/2015	19:07:22	-7:36.2212	50:21.5	100	00:00.0	00:00.0			USBL
				AT Bottom	11/08/2015	19:20:14	-7:36.2973	50:21.3	98.4	-7:36.4092	50:21.4			
				OFF Bottom	11/08/2015	23:20:28	-7:36.3442	50:21.5	76.3	-7:36.4227	50:21.6	04:00:14	04:40:22	
				ON Deck	11/08/2015	23:47:44	-7:36.3454	50:21.5	101	-7:36.4070	50:21.6			
JC124	Haig Fras	244	11	IN Water	12/08/2015	11:46:02	-7:55.3064	50:14.4	107	00:00.0	00:00.0			
				AT Bottom	12/08/2015	12:02:42	-7:55.3066	50:14.4	106	-7:55.3472	50:14.4			
				OFF Bottom	12/08/2015	15:30:56	-7:55.4249	50:14.1	84.2	-7:55.4706	50:14.1	03:28:14	04:18:52	
				ON Deck	12/08/2015	16:04:54	-7:55.4182	50:14.1	90.7	-7:55.4583	50:14.1			
JC125	Codemap	245	24	IN Water	16/08/2015	12:06:30	-10:01.8140	48:39.3	1333.5	00:00.0	00:00.0			
				AT Bottom	16/08/2015	13:09:44	-10:01.8173	48:39.3	1330.7	-10:01.7736	48:39.2			
				OFF Bottom	16/08/2015	15:01:24	-10:02.0112	48:39.2	1370	-10:02.0420	48:39.2	01:51:40	04:21:34	
				ON Deck	16/08/2015	16:28:04	-10:02.0591	48:39.3	1308.9	-10:01.3879	48:40.1			
JC125	Codemap	246	31	IN Water	17/08/2015	13:39:44	-9:39.1962	48:27.9	1055	-9:39.1956	48:27.9			
				AT Bottom	17/08/2015	14:29:32	-9:39.2202	48:27.9	1086.5	-9:39.1504	48:27.9			
				OFF Bottom	18/08/2015	03:37:13	-9:39.4765	48:28.7	796	-9:39.3963	48:28.7	13:07:41	14:54:08	
				ON Deck	18/08/2015	04:33:52	-9:39.3155	48:28.9	0	-9:39.3789	48:28.8			
JC125	Codemap	247	35	IN Water	18/08/2015	10:01:29	-9:47.7754	48:25.1	1452	00:00.0	00:00.0			
				AT Bottom	18/08/2015	11:02:34	-9:47.6934	48:25.1	1470	-9:47.6569	48:25.1			
				OFF Bottom	19/08/2015	01:34:23	-9:48.0008	48:26.4	741	-9:47.9497	48:26.4	14:31:49	16:38:38	
				ON Deck	19/08/2015	02:40:07	-9:48.0543	48:26.6	595	-9:48.1375	48:26.7			
JC125	Codemap	248	38	IN Water	19/08/2015	09:59:40	-10:09.6307	47:46.9	4146	00:00.0	00:00.0			
				AT Bottom	19/08/2015	12:24:49	-10:09.6622	47:47.2	4157.3	-10:09.6315	47:47.2			
				OFF Bottom	19/08/2015	17:54:57	-10:08.2623	47:47.2	4173	-10:08.2512	47:47.2	05:30:08	11:51:46	
				ON Deck	19/08/2015	21:51:26	-10:09.1510	47:48.2	4241	-10:09.1281	47:48.2			
JC125	Codemap	249	47	IN Water	21/08/2015	07:57:22	-10:01.8161	48:39.3	1337	00:00.0	00:00.0			
				AT Bottom	21/08/2015	08:57:58	-10:01.8148	48:39.3	1342	-10:01.7538	48:39.3			
				OFF Bottom	21/08/2015	18:15:29	-10:02.0912	48:39.1	1299	-10:02.0885	48:39.1	09:17:31	11:20:23	
				ON Deck	21/08/2015	19:17:45	-10:02.0899	48:39.1	1408	-10:02.0975	48:39.2			
JC125	Codemap	250	50	IN Water	21/08/2015	23:53:56	-10:05.9157	48:43.8	894	00:00.0	00:00.0			
				AT Bottom	21/08/2015	00:42:13	-10:05.9371	48:43.8	912	-10:05.9130	48:43.8			
				OFF Bottom	21/08/2015	05:49:53	-10:05.6279	48:44.1	589	-10:05.5665	48:44.1	05:07:40	06:39:55	
				ON Deck	21/08/2015	06:33:51	-10:05.6047	48:44.1	890	-10:05.5902	48:44.2			
JC125	Codemap	251	52	IN Water	22/08/2015	11:14:28	-10:27.6023	48:45.7	752.6	00:00.0	00:00.0			
				AT Bottom	22/08/2015	11:57:12	-10:27.5743	48:45.7	752.1	-10:27.6134	48:45.7			
				OFF Bottom	22/08/2015	21:31:17	-10:27.6194	48:46.0	750	-10:27.6873	48:45.8	09:34:05	10:51:47	
				ON Deck	22/08/2015	22:06:15	-10:27.4891	48:45.8	683	-10:27.5970	48:45.8			
JC125	Codemap	252	54	IN Water	23/08/2015	01:25:40	-10:22.6569	48:41.8	840	00:00.0	00:00.0			
				AT Bottom	23/08/2015	02:16:17	-10:22.5890	48:41.9	832	-10:22.6025	48:41.8			
				OFF Bottom	23/08/2015	06:16:38	-10:23.1994	48:42.1	553	-10:23.2437	48:42.1	04:00:21	05:27:26	
				ON Deck	23/08/2015	06:53:06	-10:23.2100	48:42.1	560.1	-10:23.2243	48:42.1			
JC125	Codemap	253	60	IN Water	24/08/2015	07:42:29	-10:22.5944	48:04.9	3805.7	00:00.0	00:00.0			
				AT Bottom	24/08/2015	09:56:50	-10:22.5937	48:04.9	0	-10:22.5815	48:04.9			
				OFF Bottom	24/08/2015	17:01:33	-10:21.8026	48:05.9	3237	-10:21.7917	48:05.9	07:04:43	11:44:43	
				ON Deck	24/08/2015	19:27:12	-10:21.8009	48:05.9	3473	-10:21.7917	48:05.9			
JC125	Codemap	254	76	IN Water	27/08/2015	05:39:28	-9:39.2723	48:28.4	865	00:00.0	00:00.0			
				AT Bottom	27/08/2015	06:29:43	-9:39.2707	48:28.4	911	-9:39.2370	48:28.4			
				OFF Bottom	27/08/2015	16:22:38	-9:38.2457	48:27.8	0	-9:38.1947	48:27.8	09:52:55	11:48:16	
				ON Deck	27/08/2015	17:27:44	-9:38.1594	48:27.7	629	-9:35.9734	48:27.4			
JC125	Codemap	255	78	IN Water	27/08/2015	22:58:30	-10:27.6019	48:45.7	00:00.0	00:00.0	00:00.0			
				AT Bottom	27/08/2015	23:43:09	-10:27.6456	48:45.7	00:00.0	-10:27.6090	48:45.7			
				OFF Bottom	28/08/2015	07:16:06	-10:27.3302	48:45.5	412	-10:27.3118	48:45.5	07:32:57	08:49:55	
				ON Deck	28/08/2015	07:48:25	-10:27.3314	48:45.5	481	00:00.0	00:00.0			
JC125	Codemap	256	80	IN Water	28/07/2015	15:49:51	-10:28.2374	48:45.2	777	00:00.0	00:00.0			
				AT Bottom	28/07/2015	16:44:12	-10:28.1954	48:45.3	825	-10:28.2271	48:45.2			
				OFF Bottom	29/08/2015	05:58:52	-10:28.5353	48:45.2	659.1	-10:28.5329	48:45.3	13:14:40	15:03:30	
				ON Deck	29/08/2015	06:53:21	-10:28.6003	48:45.2	0	-10:28.5773	48:45.2			
JC125	Codemap	257		IN Water	29/08/2015	19:14:27	-11:11.7389	48:36.5	2745	00:00.0	00:00.0			
				AT Bottom	29/08/2015	21:29:54	-11:11.6819	48:36.5	0	-11:11.7066	48:36.5			
				OFF Bottom	30/08/2015	06:14:36	-11:10.0968	48:37.5	2156	-11:10.0347	48:37.5	08:44:42	12:39:16	
				ON Deck	30/08/2015	07:53:43	-11:10.1105	48:37.5	2137	-11:10.0920	48:37.5			
JC125	Codemap	258	87	IN Water	30/08/2015	22:02:53	-10:01.0193	48:38.2	1412	00:00.0	00:00.0			
				AT Bottom	30/08/2015	01:25:47	-10:00.6890	48:38.5	1279	-10:00.7363	48:38.5			
				OFF Bottom	30/08/2015	01:40:01	-10:00.6878	48:38.5	1274	-10:00.7371	48:38.6	00:14:14	04:57:06	Poor visibility - recovered ROV
				ON Deck	30/08/2015	02:59:59	-10:00.5629	48:38.8	1169	-10:00.6611	48:38.7			
JC125	Codemap	259	91	IN Water	31/08/2015	15:10:22	-9:59.7893	48:23.9	2865.6	00:00.0	00:00.0			
				AT Bottom	31/08/2015	17:33:25	-9:59.7264	48:24.0	3080	-9:59.7831	48:24.0			
				OFF Bottom	01/09/2015	01:17:37	-10:00.4511	48:25.0	1719	-10:00.5745	48:25.0	07:44:12	12:08:01	
				ON Deck	01/09/2015	03:18:23	-9:59.8329	48:24.9	0	-9:59.9251	48:25.0			
JC125	Codemap	260	96	IN Water	01/09/2015	17:23:55	-10:00.0017	48:24.1	0	-9:59.9223	48:24.1			
				AT Bottom	01/09/2015	20:02:01	-9:59.9336	48:24.1	2831	-9:59.9862	48:24.1			
				OFF Bottom	02/09/2015	08:34:58	-10:00.2900	48:24.3	2451.2	-10:00.3423	48:24.4	12:32:57	17:16:41	
				ON Deck	02/09/2015	10:40:36	-10:00.3918	48:24.3	2330	-10:00.3382	48:24.3			
JC125	Codemap	261	105	IN Water	02/09/2015	07:33:48	-9:39.3980	48:28.2	983.3	00:00.0	00:00.0			
				AT Bottom	02/09/2015	08:36:37	-9:39.3926	48:28.3	941.8	-9:39.4245	48:28.3			
				OFF Bottom	02/09/2015	19:10:51	-9:39.1982	48:28.5	881	-9:39.3190	48:28.4	10:34:14	12:55:07	
				ON Deck	02/09/2015	20:28:55	-9:39.1586	48:28.2	919	-9:39.2786	48:28.3			
JC125	Codemap	262	109	IN Water	04/09/2015	03:07:21	-10:05.9800	48:44.1	832	00:00.0	00:00.0			
				AT Bottom	04/09/2015	04:03:37	-10:05.8898	48:44.1	789	-10:05.9709	48:44.1			
				OFF Bottom	04/09/2015	11:05:29	-10:05.4599	48:44.2	485	-10:05.4249	48:44.2	07:01:52	08:33:52	
				ON Deck	04/09/2015	11:41:13	-10:05.4828	48:44.2	550	-10:05.5144	48:44.2			
JC125	Codemap	263	110	IN Water	04/09/2015	15:27:19	-10:00.9446	48:38.2	1458	00:00.0	00:00.0			
				AT Bottom	04/09/2015	16:44:53	-10:00.8792	48:38.2	1448	-10:00.9423	48:38.2			
				OFF Bottom	05/08/2015	03:21:03	-10:00.1015	48:38.5	1131	-10:00.0679	48:38.5	10:36:10	13:11:46	
				ON Deck	05/08/2015	04:39:05	-10:00.0590	48:38.3	1127	-10:00.0124	48:38.2			
JC125	Codemap	264	114	IN Water	05/09/2015	14:27:17	-10:27.5135	48:45.7	752.9	00:00.0	00:00.0			
				AT Bottom	05/09/2015	15:27:57	-10:27.4848	48:45.7	644	-10:27.4383	48:45.7			
				OFF Bottom	05/09/2015	22:47:11	-10:27.6634	48:45.5	767	-10:27.6114	48:45.5	07:19:14	09:08:37	
				ON Deck	05/09/2015	23:35:54	-10:27.7057	48:45.4	567	-10:27.7476	48:45.5			
JC125	Vibrocore Trials	265	129	IN Water	07/09/2015	09:15:11	-9:52.0534	48:43.0	216	00:00.0	00:00.0			
				AT Bottom	07/09/2015	09:36:45	-9:52.0536	48:43.0	217	-9:52.0408	48:43.1			
				OFF Bottom	07/09/2015	11:33:10	-9:52.0427	48:43.0	218	-9:52.0255	48:43.1	01:56:25	02:37:10	
				ON Deck	07/09/2015	11:52:21	-9:52.0448	48:43.0	217	-9:52.0355	48:43.0			
JC125	Vibrocore Trials	266	131	IN Water	07/09/2015	13:45:27	-9:50.5927	48:44.0	198	00:00.0	00:00.0			
				AT Bottom	07/09/2015	14:06:41	-9:50.5528	48:44.0	197	-9:50.5596	48:44.0			
				OFF Bottom	07/09/2015	15:52:43	-9:50.5219	48:44.0	203.2	-9:50.5246	48:44.0	01:46:02	02:31:44	
				ON Deck	07/09/2015	16:17:11	-9:50.5933	48:44.0	196	-9:50.5621	48:44.0			
JC125	Vibrocore Trials	267	133	IN Water	07/09/2015	17:50:47	-9:51.2962	48:42.2	229	00:00.0	00:00.0			
				AT Bottom	07/09/2015	18:08:42	-9:51.4091	48:42.2	229	-9:51.4190	48:42.3			
				OFF Bottom	07/09/2015	19:43:44	-9:51.1315	48:42.2	225	-9:51.1252	48:42.3	01:35:02	02:17:29	
				ON Deck	07/09/2015	20:08:16	-9:51.2495	48:42.2	227	-9:51.1899	48:42.3			
JC125	Vibrocore Trials	268	137	IN Water	08/09/2015	09:14:56	-10:08.3058	47:46.6	4149	00:00.0	00:00.0			
				AT Bottom	08/09/2015	11:55:48	-10:08.3169	47:46.5	4183	-10:08.3021	47:46.6			
				OFF Bottom	08/09/2015	13:25:02	-10:08.2930	47:46.7	4180.8	-10:08.2784	47:46.8	01:29:14	06:38:31	
				ON Deck	08/09/2015	15:53:27	-10:08.4736	47:46.8	0	-10:08.3525	47:46.8			
											Total	**181:35:15**	**246:01:03**	

4.2. Video Imagery and Lighting

Imaging and lighting equipment (Table 4.2; Fig. 4.1) carried by the *Isis* ROV during the JC125 dive campaign included three optically corrected High-Definition (HD) cameras mounted to the front of the vehicle.

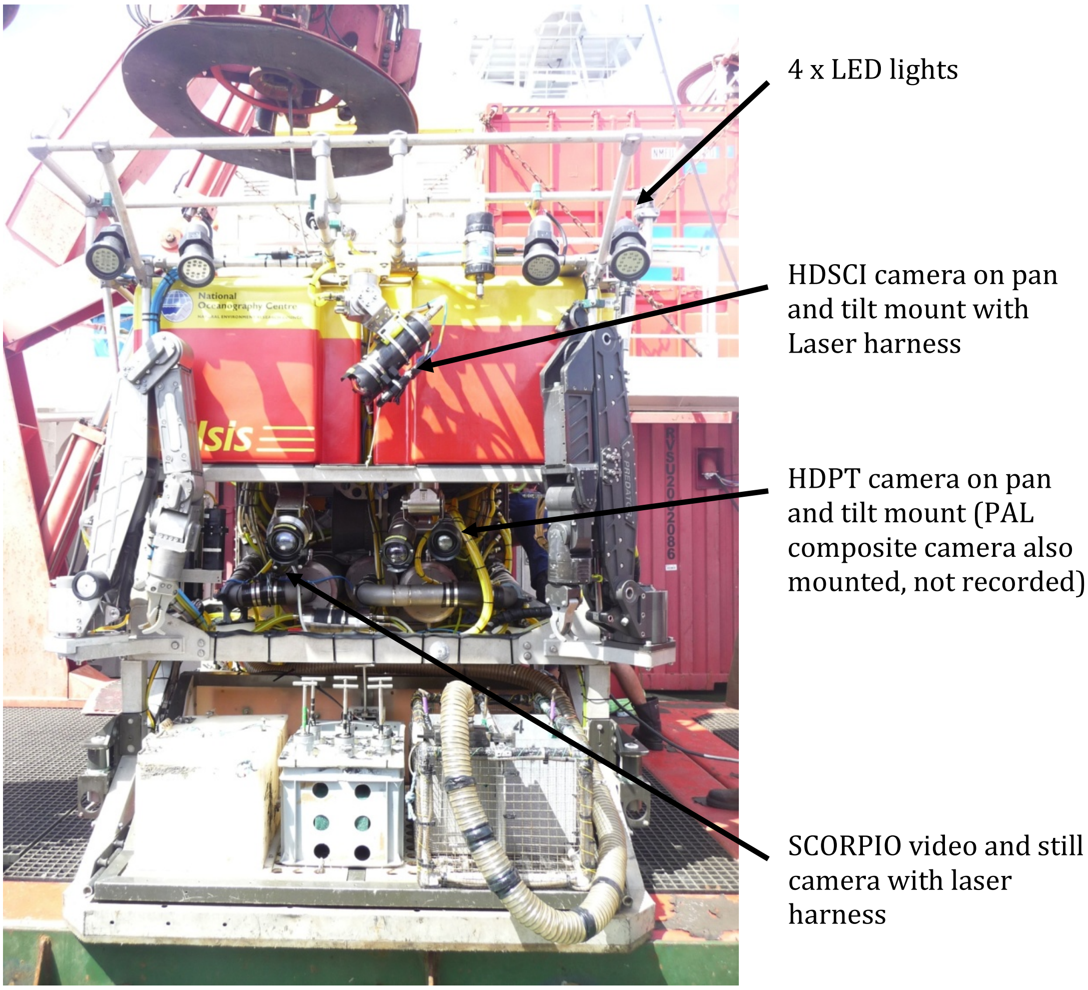


Fig. 4.1 Isis ROV video camera configuration

HDPT (HD Pilot) was mounted on a pan-and-tilt module central to the vehicle and was used primarily for piloting and sampling procedures. HDSCI (HD Science) was also mounted on a pan-and-tilt module above the HDPT, central to the vehicle. Watch leaders and the scientific party have full control of the pan-and-tilt and zoom functions of this camera during dive operations. The HD video and stills camera (SCORPIO) was mounted on a fixed bracket on starboard of the centre line of the vehicle. Other cameras on the *Isis* ROV used for piloting (not recorded for science) include numerous composite video cameras and one low-light aft camera.

Four LED lamps provided illumination for the cameras on a fixed-mount lighting bar at the front of the vehicle (Fig. 4.1). To provide a fixed scale in images, two lasers were mounted 0.1m apart parallel to the focal axis of the HDPT and SCORPIO cameras.

Table 4.2 Overview of cameras and their configuration used on ROV Isis

Camera	**Model**	**Video Resolution**	**Stills Image Resolution**	**Format recorded**	**Lasers**
HD Pilot (HDPT)	Insite Mini Zeus	1920 x 1080 HD		Apple ProRes 422	Yes
HD Science (HDSCI)	Insite Mini Zeus	1920 x 1080 HD		Apple ProRes 422	
Super Scorpio (SCORPIO)	Insite Super Scorpio	1920 x 1080 HD	12.3 Effective Megapixels (4672 x 2628)16:9 Format	Apple ProRes 422	Yes
Pilot (PAL) composite	Insite Pegasus	720 x 576 PAL 450 horizontal lines		Apple ProRes 422	

The ideal camera configuration is that discussed in above and set out in Fig. 4.1. The following section outlines variations to the configuration during JC125:

- Dive 247 - Port Scorpio laser failed (GF) flooded
- Dive 248 - Port Scorpio laser faint. Laser module replaced for Dive 249
- Dive 249 - Port Scorpio laser fail - Dive 250 onwards working lasers moved from HDPT to Scorpio
- Dive 250 - lasers Scorpio only
- Dive 251 - lasers Scorpio only
- Dive 252 - lasers Scorpio only
- Dive 253 - lasers Scorpio only
- Dive 254 - lasers working on both HDPT and Scorpio for remaining dives
- Dive 254 - fibre issue when running 360 around coral mound. Temporary dropout of Scorpio HD feed
- Dive 264 - vertical swath dive HDPT and HDSCI only
- Dive 265 - Vibrocore HDPT only (occasional recording from PAL tool cameras. Files saved as SCIATK)
- Dive 265 - Vibrocore HDPT only (occasional recording from PAL tool cameras. Files saved as SCIATK)
- Dive 265 - Vibrocore HDPT only (occasional recording from PAL tool cameras. Files saved as SCIATK)

4.3. Recording protocols during dive operations

All of the HD camera feeds correspond to an AQA dual KiPro recording deck in the *Isis* ROV control van. At the start of each dive the timecode was checked so that all videos are correctly time-stamped (GMT). In addition, on arrival at the seafloor, the internal timestamp of the SCORPIO camera was synced with that of the KiPro deck recording the SCORPIO HD feed. Each KiPro deck and camera has three corresponding 300GB solid-state drives (SSD). At the start of the cruise, it was decided that all three HD cameras feeds would be recorded (Apple ProRes 422, 1920 x 1080).

Recording would commence on deployment, and would continue to record on descent to the seabed. On the seabed, all three cameras were stopped simultaneously and the KiPro recording deck was changed to a second SSD. During operational dive hours, the video footage was recorded in 2-hour files of approximately 110GB each. On approaching the seabed, the HDSCI, HDPT and SCORPIO cameras were white balanced to provide the best representation of true colour at the depth of the imagery being recorded. The total number of hours of video recorded (bottom time) for each dive is shown in Table 4.3. As soon as the vehicle left the seabed, the KiPro recording disks were changed again, to enable easier extraction of 'on bottom' footage.

Table 4.3 Details of video data recorded for each ROV dive

Dive	**Bottom Time**	**Comments**
242	02:53:23	
243	02:07:16	
244	01:59:29	
245	01:34:16	
246	12:26:55	
247	14:18:55	
248	05:20:02	
249	08:16:11	
250	03:57:29	
251	07:23:30	
252	02:04:16	
253	05:41:43	
254	09:09:08	Loss of scorpio for fibre
255	07:14:19	
256	12:07:32	
257	10:49:07	
258	02:00:21	Poor visibility – dive aborted
259	06:15:41	
260	00:00:00	Downward MBES
261	00:00:00	Downward MBES
262	06:25:17	
263	09:52:33	
264	00:00:00	Vertical MBES
265	02:38:31	Vibrocore trials
266	01:46:00	Vibrocore trials
267	02:22:07	Vibrocore trials
268	01:21:48	Vibrocore trials
Total bottom time video	**135:24:41 (not inc. descent, ascent or MBES)**	

4.4. Stills Imagery during dive operations

During operational dive hours the SCORPIO camera was set to take stills images (4672 x 2628; 16:9 Format) every 30 seconds. The 'snap photo' command could be used on the DEVCON GUI to capture extra stills – this had no effect on the images taken at 30-second intervals. Where possible, the 'field of view' on the SCORPIO camera was maintained. As a result of the variable topography of the seafloor (steep vertical walls to flat slopes), the GUI was used to zoom in or out where appropriate.

The interval stills capture function could be switched off during periods of detailed filming as to not interrupt the HD feed with focusing of the stills camera. Footage captured during these periods produced broadcast quality footage.

Total number of images captured is shown in Table 4.4.

Post dive, the SCORPIO photos were transferred to the "Isis Data" drive. Dives 242-245 and Dives 254-263, the date and time stamp associated with the file through "Finder" (on Mac) and "Explorer" (on windows) is displayed in BST however, the ExHif metadata associated with these files is correct (Fig. 4.2). For Dives 246-253 all display correct file data and ExHif metadata (Fig. 4.3).

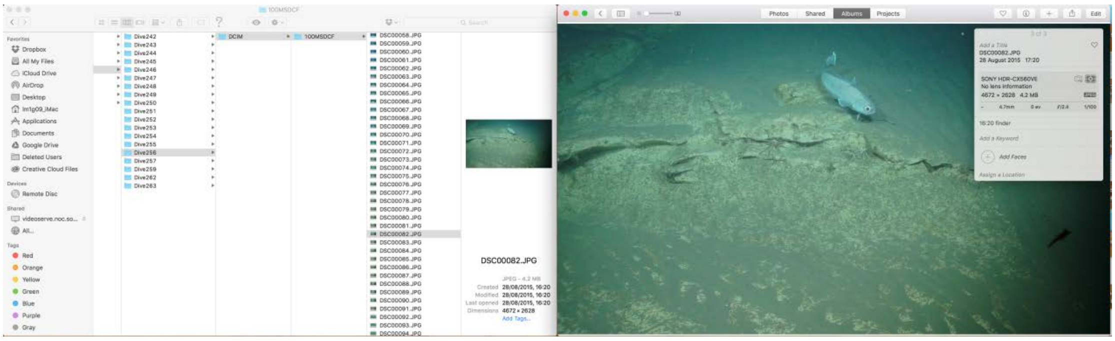


Fig. 4.2 Example image for Dive 256. On the left, you can see that the file data is showing a capture time of 16:20 (BST) however, on the right, the ExHIF data shows a capture time of 17:20 (GMT)

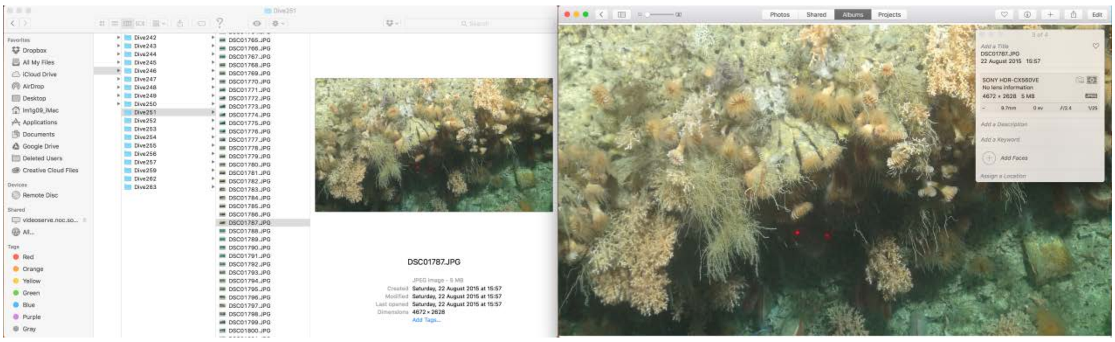


Fig. 4.3 Example image for Dive 251. On the left, you can see that the file data is showing a capture time of 15:57 (GMT) which corresponds to the ExHIF data on the right.

Table 4.4 SCORPIO stills collected per ROV dive

Dive	Start file	Date	Start time	End file	Date	End time	GB	Total Images
242	DSC00002	11/08/2015	10:04	DSC00145	11/08/2015	11:15	0.57	147
243	DSC00001	11/08/2015	19:31	DSC00514	11/08/2015	19:31	1.89	516
244	DSC00001	12/08/2015	12:18	DSC00414	12/08/2015	15:44	1.57	416
245	DSC00001	16/08/2015	13:35	DSC00194	16/08/2015	13:35	0.56	197
246	DSC00001	17/08/2015	15:47	DSC02048	17/08/2015	15:47	8.79	2050
247	DSC00001	18/08/2015	12:13	DSC01996	19/08/2015	03:19	7.86	1997
248	DSC00001	19/08/2015	13:41	DSC00688	19/08/2015	18:46	2.53	689
249	DSC00001	21/08/2015	10:16	DSC01224	21/08/2015	20:50	4.64	1225
250	DSC01225	22/08/2015	01:55	DSC02025	22/08/2015	07:00	3.29	804
251	DSC01225	22/08/2015	13:15	DSC02764	22/08/2015	22:57	6.68	1542
252	DSC00006	23/08/2015	03:33	DSC00775	23/08/2015	03:33	2.76	774
253	DSC00006	23/08/2015	11:12	DSC01214	24/08/2015	20:24	4.12	1210
254	DSC00006	27/08/2015	06:30	DSC01179	27/08/2015	17:24	4.85	1176
255	DSC00006	27/08/2015	23:56	DSC01223	28/08/2015	07:14	5.59	1222
256	DSC00006	28/08/2015	16:59	DSC02130	29/08/2015	06:09	8.9	2129
257	DSC00006	29/08/2015	19:49	DSC01174	20/08/2015	06:29	4.26	1173
258	-	-	-	-	-	-	-	Poor vis.
259	DSC00006	31/08/2015	18:46	DSC01391	01/09/2015	15:39	5.21	1388
260	-	-	-	-	-	-	-	ROV MBES
261	-	-	-	-	-	-	-	ROV MBES
262	DSC00006	04/09/2015	04:24	DSC01324	04/09/2015	12:16	5.76	1323
263	DSC00010	04/09/2015	18:45	DSC01658	04/09/2015	18:45	6.1	1653
264	-	-	-	-	-	-	-	ROV MBES
265	-	-	-	-	-	-	-	Vibro core
266	-	-	-	-	-	-	-	Vibro core
267	-	-	-	-	-	-	-	Vibro core
268	-	-	-	-	-	-	-	Vibro core
Total							**85.93**	**21631**

4.5. Data storage

Every 2 hours the three KiPro SSD (HDPT, HDSCI and SCORPIO) were transferred to the JC125 LaCie (Mac OS Extended) 42TB RAID disks. One copy was made to the "Master 1 Drive" and one copy to the "Backup 1 Drive". The PI will retain the "Master 1 Drive". File storage is as follows:

DiveXXX	HDPT	HDPT_XX.mov
	HDSCI	HDSCI_XX.mov
	SCORPIO	SCORPIO_XX.mov

The *"Backup 1 Drive"* will be kept at the National Oceanography Centre, Southampton for a limited time period. Please refer to the *Isis* ROV cruise report for further information.

All HD media logs completed in the ROV van can be found as an .xls workbook, stored on the QNAP drive. All times completed are for the HDSCI camera (HD Media Log JC125.xls).

4.6. Additional data storage

All the SCORPIO images (along with the Techsas files), are also backed-up on the cruise QNAP under the "Isis Data". In addition, the following edited imagery has been backed up onto the cruise QNAP:

JC125 Highlights (produced for the British Science Festival) are included in HD (1920 x 1080) along with the original highlights clips selected from each dive.

- Edited highlights from members of the scientific party
- Screen captures from members of the scientific party
- Selected images used for the cruise Twitter feed
- A selection of the "best" SCORPIO" stills images to be used for presentations, press releases etc.

5. Faunal sampling (Inge Van Den Beldt, Raissa Hogan, Katleen Robert)

5.1. Introduction

Biological samples were collected to be used as species vouchers for habitat mapping research, as well as for genetic, taxonomic, ecological and biological studies. They were collected with the ROV Isis, using the claws, slurp or scoop.

A total of 197 specimens were sampled in 15 dives in the Whittard and Explorer Canyons (Full sampling table provided in Appendix C). The specimen list includes mainly species from the taxon Cnidaria: Hexacorallia: orders Scleractinia (*Lophelia*, *Madrepora*, *Solenosmilia, Desmophyllum*); Actiniaria; Antipatharia; Zoantharia; and Octocorallia: orders Alcyonacea and Pennatulacea. Representatives from the following taxa were also specifically collected or were brought up together with other biological or geological samples: Echinodermata (Ophiuroidea, Asteroidea, Crinoidea, Holothuroidea), Mollusca (Gastropoda, Bivalvia, Polyplacophora), Crustacea (Cirripedia, Amphipoda, Brachiura), Brachiopoda, Tunicata, Porifera and Polychaeta.

These samples were collected for specific projects and processed according to their protocols and objectives. Once achieved, voucher specimens will be stored in the NOC collection.

5.2. General sampling protocol

ROV Sample Collection:

1. Wanted specimens were photographed and/or recorded on video while *in situ,* as the morphology of some species, e.g. soft corals, pennatulids and actinians, may change when they are brought up. Since the collected and eventually identified specimen needs to be linked with specimens seen on other imagery footage, it is very important to have good *in situ* stills or frame grabs (Fig. 5.1).
2. The specimens were collected by the claws, the slurp gun or the scoop depending on the specimen. Fragile and delicate specimen such as actinians and pennatulids are better slurped, while it is easier to collect harder specimens such as scleractinians, anthipatharians and gorgonians with the claws of the ROV.
3. Buckets were labelled with ROV bio boxes and slurp chamber numbers as well as the event number. The buckets were filled with filtered seawater and left in the Cold Lab (4ºC) for a few hours prior the end of the dive. The temperature of the filtered seawater needs to be similar to that of the seawater where the samples were collected; this is to prevent a temperature shock for the specimen(s).
4. When the ROV arrived on deck, the samples were transferred into labelled buckets and brought to the cold lab.

Processing of samples in the lab:

1. All collected specimens were registered in the “Biology Logbook” including the date, Julian day, station number, dive number, event number, bio-sample number,

description of the specimen, container where it was preserved, type of preservation and recipient.

2. Each specimen received a specific sample code with the cruise number, station, dive, event and bio-sample numbers (i.e. JC125/st nº/dive nº/ev nº/bio nº). Subsamples of a specimen were additionally given letters.
3. All collected specimens were photographed in the cold lab prior to preservation with scale and sample label visible. If necessary, close-ups were also taken.
4. The majority of specimens were preserved in 96% ethanol and placed in a suitable size labelled container or plastic bag with a label written in 2B pencil on waterproof paper inside the sample container. Samples that will be used for histological research were first preserved in buffered 4% formalin, before being transferred to 96% ethanol after being washed in filtered seawater. Some of the stony corals (scleractinians) were left in "bleach" for 2 days before drying at room temperature while others were wrapped in muffled foil and frozen at -80°C and will be used for organic bio-geochemical analysis. Fossil scleractinian corals were dried at room temperature without receiving any other treatment and will be used for organic bio-geochemical analysis as well. Refer to following sections for more detail procedures of specific samples.

5.3. Specific sampling protocols

Pennatulacea and Antipatharia samples

Samples of Antipatharia and Pennatulacea from Whittard and Explorer Canyons will be part of the research on deep-sea corals of the Northeastern Atlantic, developed by Dr. Louise Allcock and PhD candidate Raissa Hogan (Ryan Institute, National University of Ireland, Galway). These samples will be an important component to assess the phylogeography, genetic structure and connectivity of Antipatharia and Pennatulacea populations over different spatial scales and bathymetric ranges. This will help improve the understanding of their evolution and the protection required for these vulnerable marine species. However, the taxonomy and identification of deep-sea taxa are still unclear, with new species frequently being described. Therefore, the first step of this project is to assess the diversity of species from the Whittard Canyon with a combination of molecular work and traditional morphological investigations.

We collected 11 specimens of Pennatulacea comprising eight species in six genera in depths ranging between 764 and 4173 m. These included one species of each of the genera *Halipteris, Anthoptilum, Distichoptilum* and *Kophobelemnon*, two species of *Pennatula* and two species of *Umbellula*.

Eight specimens belonging to three genera of Antipatharia were sampled in depths ranging between 667 and 1272 m, including: four specimens of *Antipathes*, two specimens of *Parantipathes* and two specimens of *Stichopathes*.

Procedure to collect these groups was:

1. **Pennatulacea (Sea pens)**. Some sea pens are sensitive to touch and withdraw into the sediment as soon as the robotic arm touches them. Therefore, it was important to line the robotic arm carefully at the base of the stem and then make a grab for them. Some long sea pens were pulled out of the sediment with the robotic arm. Large specimens were dropped directly in one of the three bio-boxes of the ROV. It was often easier to feed small specimens into the slurp sampler. Care had to be taken when we slurped sea pens out of the sediment, since it can fill the slurp chamber with sediment.
2. **Antipatharia (Black corals)**. Black corals are mostly very robust and could be collected with the claws of the robotic arms. In some cases, it was possible to slurp them, mainly species such as *Antipathes sp.*.

In addition to the previously described procedure, for Antipatharia (black corals) and Pennatulacea (sea pens) a small piece of the specimen (subsample) were preserved in an Eppendorf with 96% ethanol.

<u>Voucher specimens</u>

During the cruise, voucher specimens were collected for Katleen Robert, a post-doctoral researcher at NOCS, and for Inge van den Beld, a PhD candidate at IFREMER in France. Katleen Robert is working on habitat mapping and suitability modelling within Whittard Canyon. Inge van den Beld is working on the distribution of cold-water coral habitats in the submarine French canyons of the Bay of Biscay. Her study area is ranging from Arcachon Canyon, in the southern Bay of Biscay, to the canyon just south of Whittard Canyon in the northern Bay of Biscay. Although Whittard Canyon is not included in her PhD, it was expected that some of the unknown specimens could be found in this canyon, since it is only a few nautical miles away from the most northern canyon included in her study.

Both projects are based on the analysis of image footage taken by ROVs (Katleen and Inge) and/or towed cameras (Inge). However, images can be limiting in terms of species identification. As such, specimens were taken of species whose identification via imagery remained unclear. Through consultation with experts, these will be identified and by linking the images of the collected specimen, the unknown species on the imagery can be identified. Identification will be done in the laboratories of NOCS or IFREMER, mostly by taxonomic experts, either by sending these samples or opportunistically as these experts come to visit either NOCS or IFREMER.

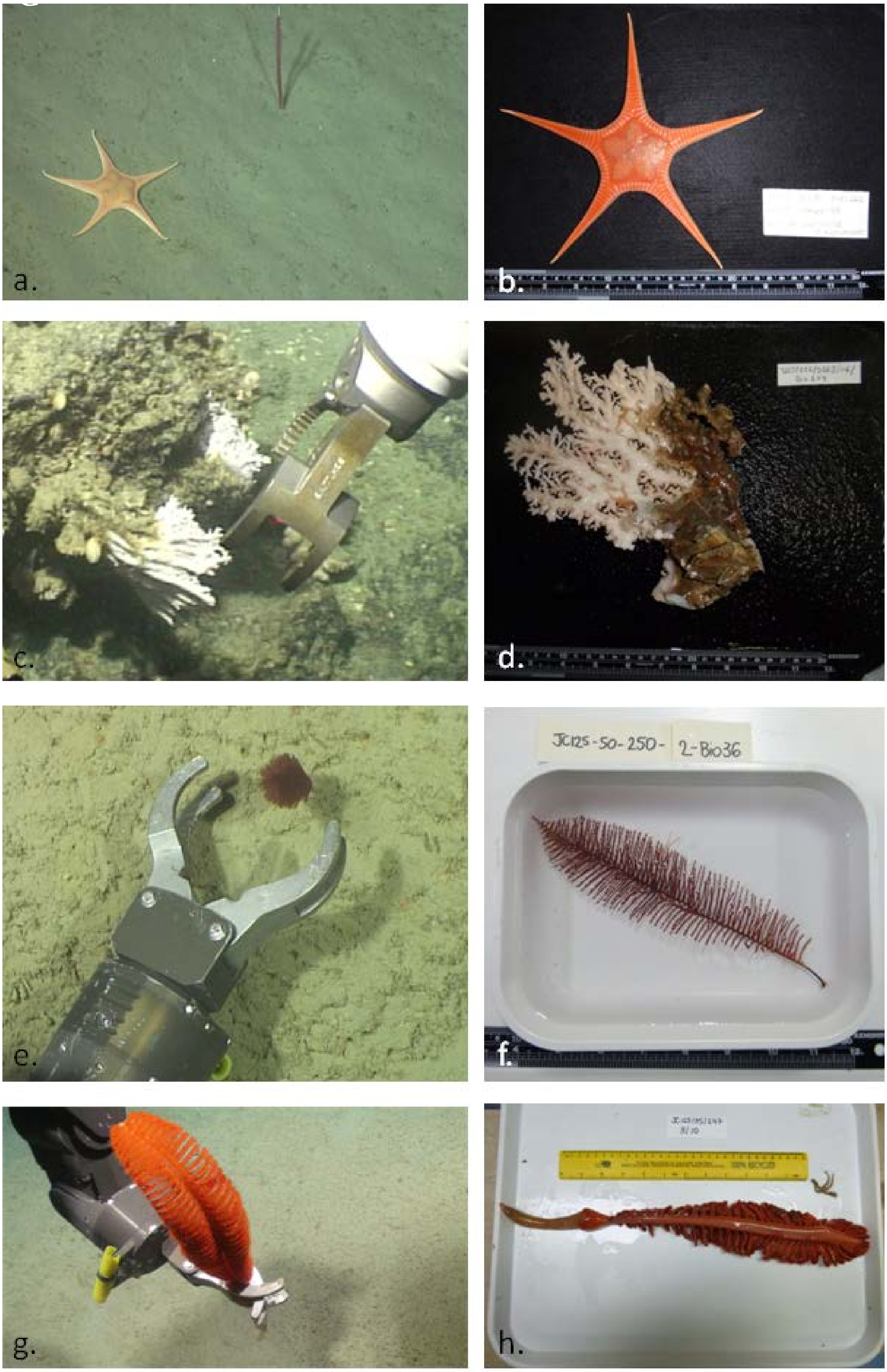


Fig. 5.1 Images taken in situ (left) and in the lab (right) from a Nymphaster asteroid (A-B), a Stylasterid hydrocoral (C-D), a Parantipathes black coral (E-F) and a Pennatula seapen (G-H).

6. Acesta excavata study (Laura Peteiro)

During the J125 expedition we developed the first phase of the ConDeep project related to the Whittard Canyon: (1) placing larval traps and (2) collecting adults at two different branches of the Whittard Canyon (Fig. 6.1). The locations were selected based on previous expeditions which discovered, in both branches, vertical walls where *Acesta* was present but with very different densities. At one of the branches the community is dominated by *Acesta* (Acesta Branch) and in the other one the community is dominated by corals (Lophelia Branch).

6.1. Deployment of larval traps

At each of the branches we deployed 3 Passive larval traps (Fig. 6.2) using the ROV ISIS. The larval traps consisted on 4 PVC tubes attached together, acting as housing for 4 tubes with a funnel inside to prevent resuspension of collected materials. Tubes were filled with DMSO fixative (20%DMSO in Milli-Q water saturated with NaCl) . To avoid spills during deployment, the PVC tubes where covered with parafilm secured with a rubber band and a fuse which dissolves after 2 days of immersion opening the tubes (Fig. 6.2). The larval traps were hanged from the respective walls with the hydraulic arm of the ROV using a hook attached to the larval traps (Fig. 6.2 and 6.3). At the Acesta wall, the Larval trap Nº3 was not hanged from the wall but deployed at a flat surface nearby because of the lack of suitable features on the rock to attach the trap to (Fig.6.3).

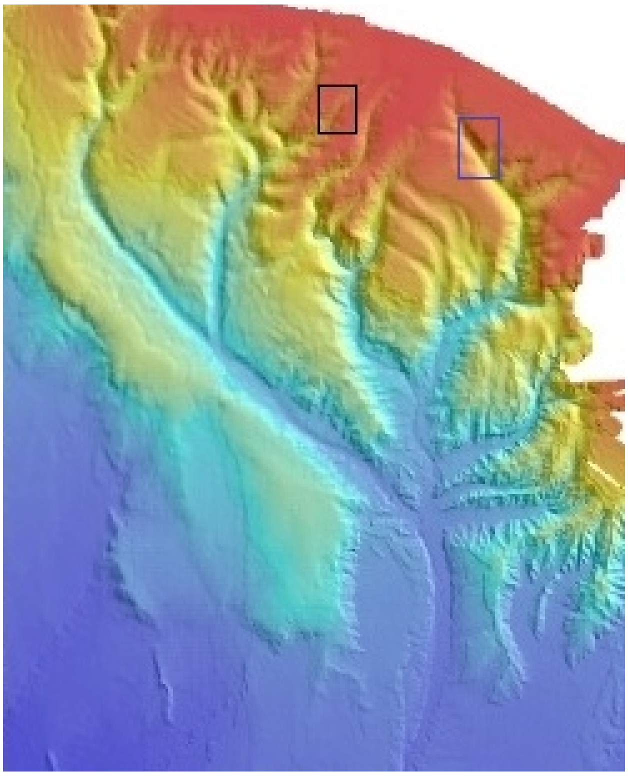


Fig. 6.1 Map of Whittard Canyon highlighting the study areas. ***Black square:*** *Acesta Wall,* ***Blue square****: Lophelia Wall*

The information about the position and depth of the traps is detailed in Table 6.1 Larval traps will be retrieved during summer 2016 by a RV Celtic Explorer expedition lead by Dr. Louise Allcock (NUI Galway).

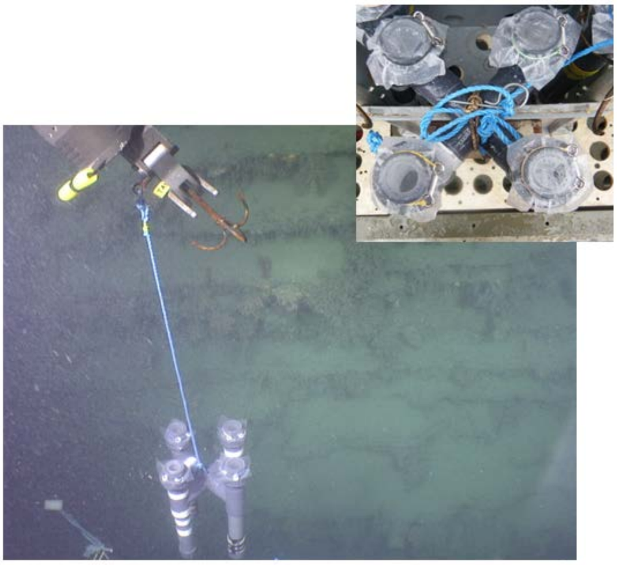


Fig. 6.2 Larval traps during deployment and detail of the closing mechanism in the top right corner

Table 6.1 Details of the deployment of the larval traps

Canyon Branch	Station Nº	Dive Nº	Date	Start Time	End Time	Trap Nº	Lat	Long	Depth (m)	Video File Nº
Lophelia	49	249	21/08/2015	11:22:53	12:09:40	1	48˚ 39.146	-10˚ 02.148	1309	35
Lophelia	49	249	21/08/2015	13:00:30	13:11:44	2	48˚ 39.115	-10˚ 02.121	1308	35
Lophelia	49	249	21/08/2015	12:19:30	12:56:10	3	48˚ 39.120	-10˚ 02.124	1309	35
Acesta	51	251	22/08/2015	16:43:00	17:08:15	1	48˚ 45.787	-10˚ 27.758	581.2	46
Acesta	51	251	22/08/2015	20:09:15	20:15:10	2	48˚ 45.882	-10˚ 27.685	542	48
Acesta	51	251	22/08/2015	21:00:00	21:27:00	3	48˚ 45.896	-10˚ 27.691	530	48

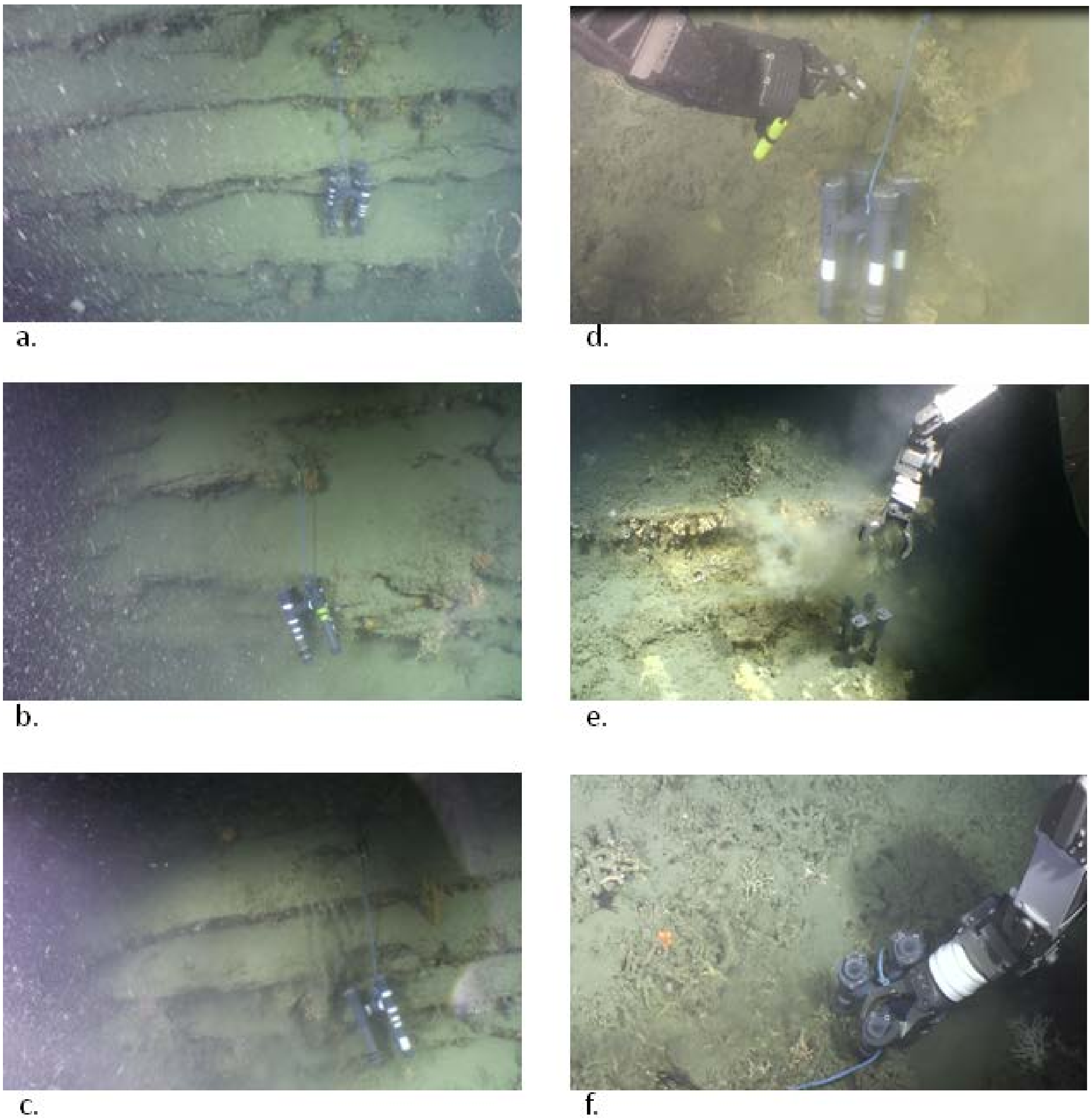


Fig. 6.3 Larval traps deployed at the Lophelia wall (A, B and C for Larval traps 1, 2 and 3 respectively) and Acesta wall (D, E and F for Larval traps 1, 2 and 3 respectively).

6.2. Sampling of adults

A total of 72 specimens of Acesta were collected with the slurp of the ROV ISIS during 5 different dives (Table 6.2). Three of those individuals (biosamples 34d, 34s and 62i) were not positively identified because of their small size (between 0.5 and 2 cms) but they were preserved in EtOH 95% for future genetic identification

Table 6.2 Details of the location and depth of all the individuals collected

Canyon Branch	Wall	Station Nº	Dive Nº	Date	Time	Latitude	Longitude	Depth (m)	Nº indivs. Sampled
Lophelia	West	49	249	21/08/2015	13:44	48˚39.126	10˚02.126	1309.2	1

Lophelia	West	49	249	21/08/2015	13:44	48˚39.126	10˚02.126	1309.2	1
Lophelia	West	49	249	21/08/2015	13:53	48˚39.127	10˚02.129	1307.3	1
Lophelia	West	49	249	21/08/2015	13:59	48˚39.127	10˚02.131	1308.7	1
Lophelia	West	49	249	21/08/2015	14:00	48˚39.125	10˚02.129	1308.9	1
Lophelia	West	49	249	21/08/2015	14:02	48˚39.126	10˚02.129	1308.9	1
Lophelia	West	49	249	21/08/2015	14:08	48˚39.125	10˚02.129	1308.5	2
Lophelia	West	49	249	21/08/2015	14:10	48˚39.124	10˚02.129	1308.5	2
Lophelia	West	49	249	21/08/2015	14:12	48˚39.124	10˚02.129	1308.5	1
Lophelia	West	49	249	21/08/2015	14:29	48˚39.124	10˚02.127	1313.3	8
Lophelila	West	109	262	04/09/2015	08:35	48˚44.255	10˚05.416	483.5	11
Acesta	West	52	251	22/08/2015	20:00	48˚45.882	10˚27.685	541	1
Acesta	West	52	251	22/08/2015	20:24	48˚45.880	10˚27.684	547	2
Acesta	West	52	251	22/08/2015	20:29	48˚45.881	10˚27.683	547	4
Acesta	West	80	256	29/08/2015	03:42	48˚45.027	10˚28.564	698	8
Acesta	West	80	256	29/08/2015	04:17	48˚45.208	10˚28.565	698.7	4
Acesta	East	78	255	28/08/2015	02:46	48˚45.564	10˚27.514	692	14
Acesta	East	78	255	28/08/2015	05:07	48˚45.516	10˚27.578	692.8	9

We visited both sides of the Acesta and Lophelia branches to collect specimens, but we found that the East wall of the Lophelia branch (Dive 263) has different geology and community assemblages, Acesta was scarce at that location and we did not collect any specimen there.

Processing of samples in the lab:

1. All collected specimens were registered in the "Biology Logbook" including the date, Julian day, station number, dive number, event number, bio-sample number, description of the specimen, container where it was preserved, type of preservation and recipient.

2. Each event received a specific sample code with the cruise number, station, dive, event and bio-sample number (i.e. JC125/st nº/dive nº/ev nº/bio nº). Specimens from the same event were additionally given letters.

3. All collected specimens were photographed in the cold lab prior to preservation with scale and sample label visible.

4. All the specimens were measured with valves fully closed using a calliper to obtain measures of height (umbo to the far distal point on the free edge), width (maximum dimension perpendicular to the height axis) and thickness (maximum dimension perpendicular to height and width measurements, taken with valves fully closed) of each individual.

5. For DNA analyses, a piece of tissue from the adductor muscle was dissected and immediately preserved in 95% ethanol.

6. For histological examination, the kidney-shaped gonad, which is attached dorsally to the posterior adductor muscle was dissected and preserved in 4% seawater formaldehyde for 48 hours and then transferred to 70% ethanol. During the first dive, no clear gonads were observed. Therefore, after the second dive the whole body was preserved (Table 6.3).

7. For elemental fingerprinting analysis, shells were frozen (-22ºC) for posterior examination of the larval shell if still present.

Some of the specimens were broken, or just a piece recovered, in that case only samples for genetics were collected (Table 6.3).

Table 6.3. Detail of the subsamples taken from each individual

Station Nº	Dive Nº	Bio Nº	Genetics (microvial 95% EtOH)	Gonads (25ml 70% EtOH)	Whole body (bag 70% EtOH)	Rest of Body (bag-22ºC)	Shells (bag - 22ºC)
49	249	34a	√			√	√
49	249	34b	√			√	√
49	249	34c	√			√	√
49	249	34d	√			√	√
49	249	34e	√			√	√
49	249	34f	√			√	√
49	249	34g	√			√	√
49	249	34h	√			√	√
49	249	34i	√			√	√
49	249	34j	√			√	√
49	249	34k	√			√	√
49	249	34l	√			√	√
49	249	34m	√			√	√
49	249	34n	√			√	√
49	249	34o	√			√	√
49	249	34p	√			√	√
49	249	34q	√			√	√
49	249	34r	√			√	√
49	249	34s	√			√	√
52	251	45	√			√	√
52	251	50a	√			√	√
52	251	50b	√	√		√	√

52	251	50c	√	√		√	√
52	251	50d	√	√		√	√
52	251	50e	√	√		√	√
52	251	50f	√	√		√	√
52	251	50g	√				
78	255	61a	√		√		√
78	255	61b	√		√		√
78	255	61c	√		√		√
78	255	61d	√		√		√
78	255	61e	√		√		√
78	255	61f	√		√		√
78	255	61g	√		√		√
78	255	61h	√		√		√
78	255	61i	√				
78	255	61j	√		√		√
78	255	61k	√		√		√
78	255	61l	√		√		√
78	255	61m	√		√		√
78	255	61n	√		√		√
78	255	62a	√		√		√
78	255	62b	√		√		√
78	255	62c	√		√		√
78	255	62d	√		√		√
78	255	62e	√		√		√
78	255	62f	√		√		√
78	255	62g	√		√		√
78	255	62h	√		√		√
78	255	62i	√				
80	256	78a	√		√		√
80	256	78b	√		√		√
80	256	78c	√		√		√
80	256	78d	√		√		√
80	256	78e	√		√		√

80	256	78f	√		√		√
80	256	78g	√		√		√
80	256	78h	√		√		√
80	256	78i	√		√		√
80	256	78j	√		√		√
80	256	78k	√		√		√
80	256	78l	√				
109	262	176a	√		√		√
109	262	176b	√		√		√
109	262	176c	√		√		√
109	262	176d	√		√		√
109	262	176e	√		√		√
109	262	176f	√		√		√
109	262	176g	√		√		√
109	262	176h	√		√		√
109	262	176i	√		√		√
109	262	176j	√		√		√
109	262	176k	√		√		√

7. Coring

7.1. Piston coring

A total of nine piston cores were collected from the Whittard Canyon region (*Figure 2*) during JC125. All cores were recovered using a 6-12 m-long modified NIOZ piston corer. Piston core locations were recorded when the core had penetrated the seabed from a USBL beacon fitted to the coring rig, and water depth recorded from the shipboard EM720/120 multibeam system. Recovered cores were split on board in 1.5 m sections to allow stratigraphic logs to be produced and preliminary interpretations to be made (Fig. 7.1). The archive half was photographed and the split cores (both archive and working halves) were then wrapped in cling film, placed in core boxes, and put in cold storage.

Using new acoustic data collected during the cruise, and existing data from within the study area, a series of coring sites were selected (Fig. 7.2) that would 1) provide further information on the Quaternary turbidite stratigraphy of Whittard Canyon, 2) provide information on the most recent (Holocene) flow events in different branches of the canyon, and 3) provide new insights into intra-canyon processes, e.g. flow spreading at frontal splays.

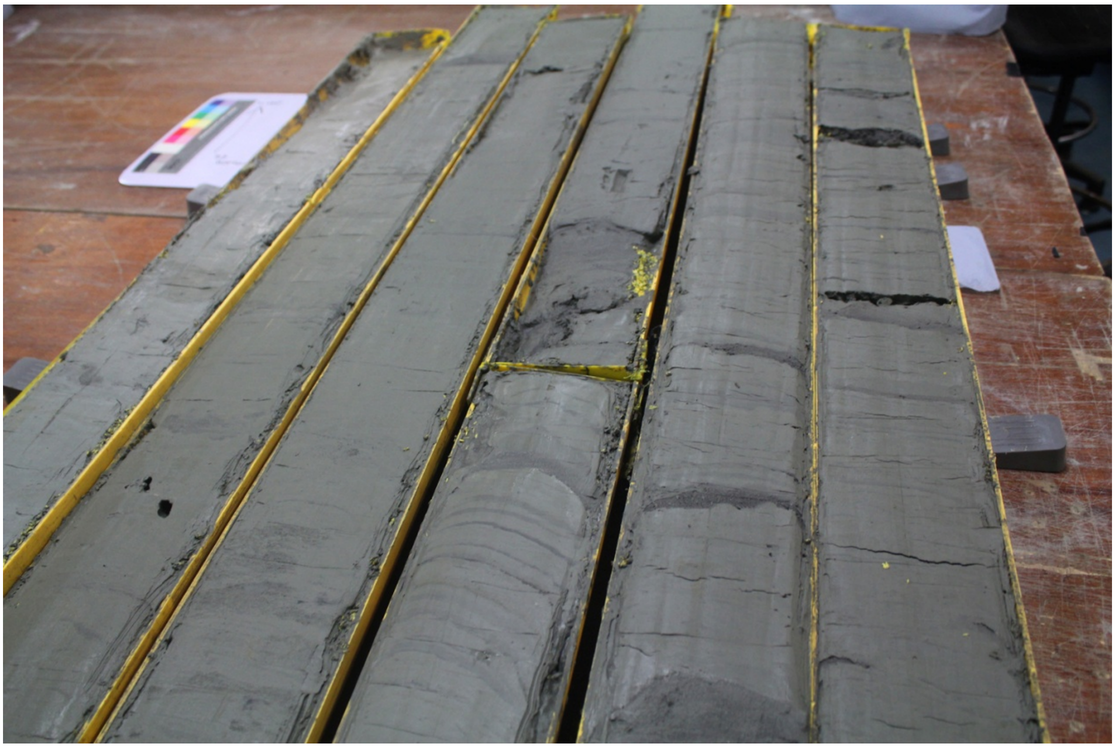


Fig. 7.1 Photo showing sediment core laid out for visual observation and logging. Note the abundance of thin-bedded muddy turbidites with sand/silt bases, and the increasing mud content upcore (towards the upper left).

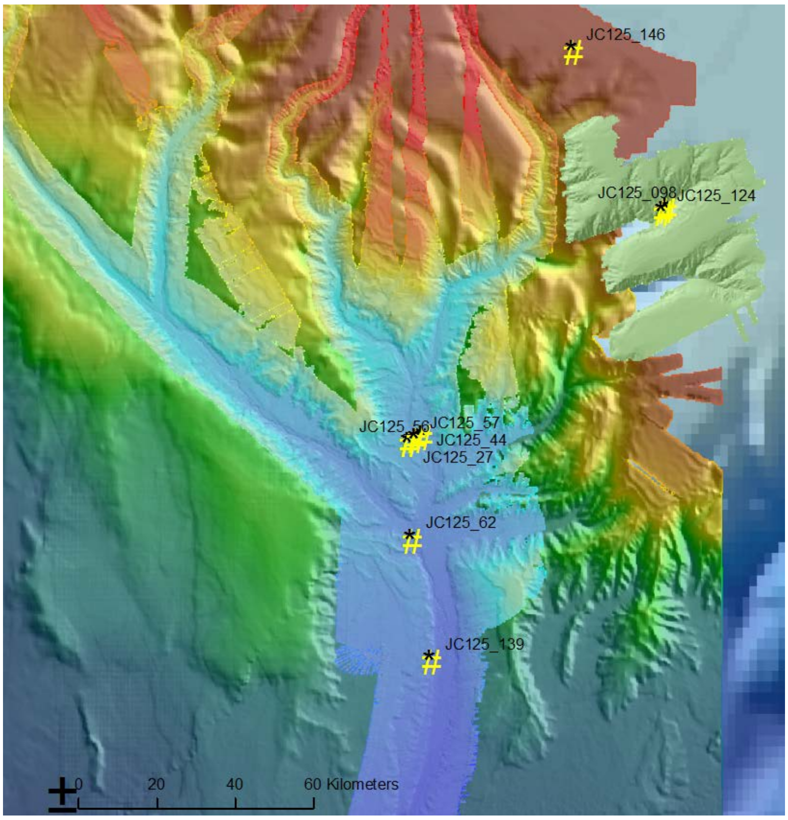


Fig. 7.2 Map of Whittard Canyon showing locations of retrieved piston cores.

Most of the cores were dominated by thin-bedded, muddy, and often organic-rich turbidites with sand/silt bases up to a few cm thick (Fig. 7.1); in some cores these were interspersed with rare, presumably locally derived, debrites, e.g. in core JC125-56. Hemipelagic sediments were also present, particularly in the upper 30 cm of some cores (presumably representing Holocene background sedimentation). Bioturbation was commonly observed, and was particularly intense in cores JC125-98 and JC125-124 recovered from the margins of a gully feeding into the main canyon. Core JC125-139 recovered from the lower canyon floor showed evidence for a significant erosional hiatus, and most likely targeted an erosional scour. Blackish sulphide staining was prevalent in several cores, although this soon faded upon exposure to air.

Most cores showed a typical upward transition from abundant to rare turbidites (Fig. 7.1), reflecting gradual shutdown of the Whittard Canyon system as sea levels rose at the end of the last Glacial period. However, there were some indications for recent flow events at some locations, which will be confirmed through detailed dating work.

The cores were recovered from the following broad areas (see also Fig. 7.2 and Table 7.1):

Cores JC125_27/44/56/57 targeted a series of stepped terraces on a bend above the thalweg below where the central and eastern canyon branches converge (Fig. 7.3A).

Cores JC125_98/124 targeted the sides of a gulley adjacent to the upper reaches of a central canyon branch at depth of 630m and 730m respectively (Fig. 7.3B)

Core JC125_62 was taken from a terrace adjacent to the thalweg where the western canyon branch converges with the central and eastern canyon branch. Core JC139 targeted a terrace adjacent to where the thalweg disappears and a large flat channel opens up (Fig. 7.3C).

Core JC146_146 was taken on sandy bedforms at the canyon head *(Fig. 7.3D).*

Table 7.1 Overview of piston cores

Number	J Date	lat	long	Depth (m)	Core length (m)	No of Sections	Trigger core	Barrel length	Comments	Sediment composition
JC125_15	226	48.43805	-10.797917	3234	n/a	n/a	n/a	12m	Piston core rig lost - possible bent barrel, wire snapped after attempted removal.	n/a
JC125_27	229	48.105467	-10.230333	3722	1.82	3	yes	12m	Terrace to west of thalweg. Core catcher failed, lower section of core lost, barrel showed ~9m penetration.	Fine sandy turbidites above chaotic debrite of two mud compositions and contorted thin fine sand beds.
JC125_44	232	48.1149	-10.199383	3699	8.95	7	yes	12m	Second terrace on eastern side of thalweg.	Holocene mud deposits above 1-8cm scale fine sandy turbidites with mud caps. Lower sections show many thin, <1mm, fine sand/silty turbidite events.
JC125_56	235	48.104517	-10.229667	3714	7	5	yes	12m	Second attempt at coring west terrace where core JC125_27 was taken.	Hemiplegic muds and two thick (10's cm) sandy turbidits above large 1.7 meter thick chaotic debrite of contorted thin sandy turbidites and mud together a second mud composition. Below this is a series of thin stacked fine sand/silt turbidites of which the bottom 2.6m show a high organic content.
JC125_57	235	48.110233	-10.214683	3758	1.43	1	no?	6m	First terrace on eastern side of thalweg. Core disturbance due to suction collapse of liner.	Ten fine sand units 2-20cm thick with mud caps, some showing gradded bedding.
JC125_62	236	47.95635	-10.223833	3984	2.89	1	yes	6m	Terrace on east side of thalweg where the main canyon branches converge.	Hemiplegic mud with several <1mm scale fine sand turbidites above 4 thicker (2-10cm) fine sand turbidites which show signs of sand flow from the coring process.
JC125_098	245	48.46325	-9.637233	633	4.7	4	no	6m	Edge of gulley adjacent to canyon (Explorer canyon)	Very bioturbated mud and thin <1mm sandy/silt layers, three fine sand turbidites 2-6cm thick.

Table 7.1 (continued)

Number	J Date	lat	long	Depth (m)	Core length (m)	No of Sections	Trigger core	Barrel length	Comments	Sediment composition
JC125_099	245	48.461633	-9.642483	739	n/a	n/a	n/a	12m	Trigger not fired, possible failure of hydrostatic release.	n/a
JC125_100	245	48.461183	-9.642733	725	n/a	n/a	n/a	6m	Repeat attempt at prevous site (JC125_099). Failed core - trigger arm not fired.	n/a
JC125_122	249	48.4593	-9.6463	729	n/a	n/a	n/a	6m	Repeat attempt SW of prevous site (JC125_099). Failed core - trigger arm not fired.	1 meter of very compacted, due to trigger not firing, sediment retrieved from barrel and kept for bulk sampling.
JC125_124	249	48.4594	-9.6462	732	4.5	3	no	6m	Repeat attempt at prevous site (JC125_122). Hydrostatic release not fitted to trigger arm.	Compotent mud with several units 4-10cm thick of increased fine sand an one fine sandy turbidite. Biotrbation throughout, lower part shows increased black sulphate content.
JC125_139	251	47.7688	-10.1778	4170	1.3	1	yes	6m	Terrace 25m above canyon thalweg/scour	Hemiplegic mud 25cm thick with an unconformable contact with bioturbated organic rich mud with frequent thin 1-10mm fine sand/silt turbidites
JC125_144	252	47.7859	-10.1605	4160	n/a	n/a	no	6m	Core barrel bent, 2m of sediment in tube but completely distroyed by sediment flow upon pull out.	n/a
JC125_146	253	48.7039	-9.8529	170	1.5	1	no	6m	USBL did not work, position taken from ship. Dammage to to of piston core, likely fell over. Possible suction.	medium grained homogenous sands with shell fragments.

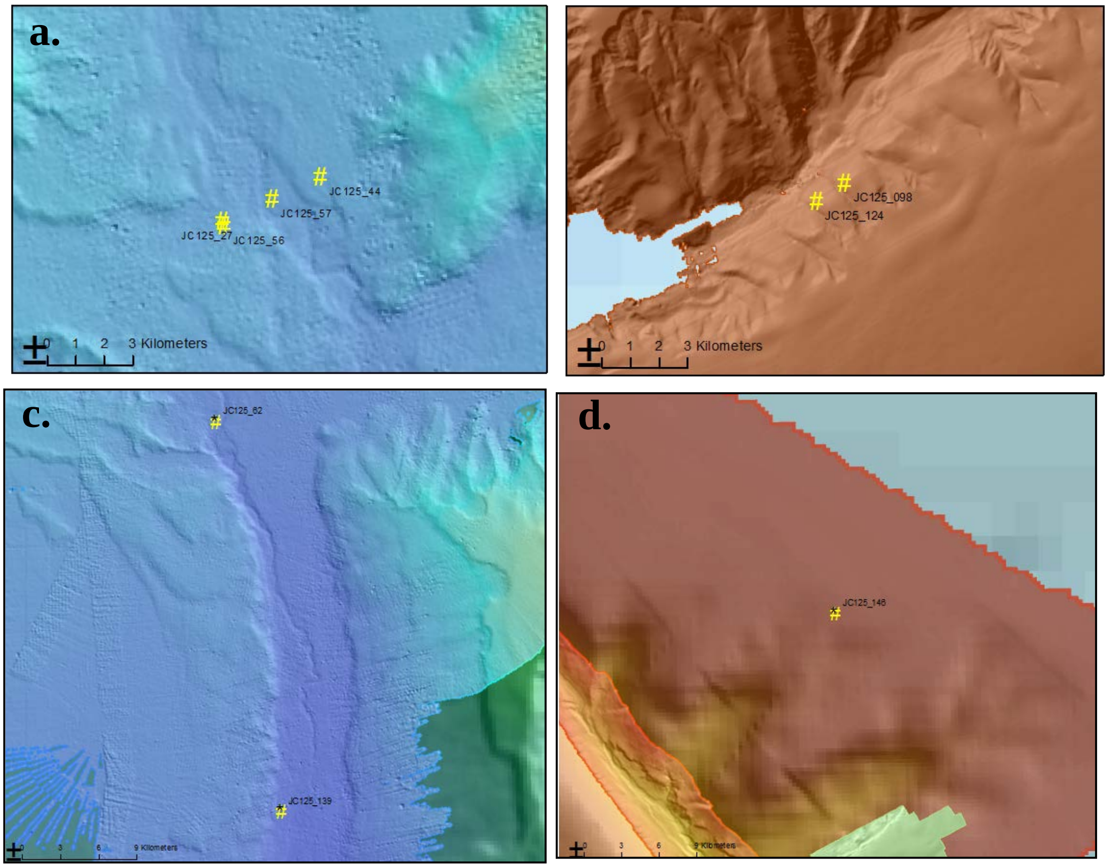


Fig. 7.3: Bathymetry of the four coring areas and locations of cores.

7.2. Mega cores

A mega-corer (large multi-corer) was typically deployed at the same sites as the piston cores so that undisturbed sediment from the sediment-water interface could be sampled (Fig. 7.4).

For each deployment, two whole mega-core tubes were removed retaining the seawater, capped with rubber bungs and placed in the -80°c freezer for biological analysis. Geological sub-samples were taken from two further mega-core tubes, capped, and placed in cold storage for splitting under controlled conditions on land. A list of the megacores recovered is provided in Table 7.2.

Fig. 7.4 Photo showing the mega-corer shortly after recovery, with the sediment-water interface preserved within the core.

Table 7.2 Megacore recovery

Number	J Date	lat	long	Depth (m)	Comments
JC125_028	229	48.1056	-10.2304	3723	2x biology , 2x geology
JC125_045	232	48.1142	-10.1994	3697	2x biology , 2x geology
JC125_058	236	48.1102	-10.2147	3757	2x biology , 2x geology
JC125_063	237	47.9563	-10.2239	3984	2x biology , 2x geology
JC125_101	246	48.4633	-9.6374	665	2x biology , 2x geology
JC125_103	246	48.4196	-9.7954	1473	Failed
JC125_123	249	48.4594	-9.6462	726	2x biology 2x geology
JC125_141	252	47.7769	-10.1778	4172	2x biology 3x geology
JC125_143	252	47.7797	-10.1382	4179	4x geology

8. ROV Vibrocore tests

Test sites were chosen to provide groundtruthing of the sedimentary regimes of an area of sandwaves at the head of Whittard Canyon and in the canyon thalweg using shipboard subbottom profiler data, sidescan sonar and multibeam backscatter data, where available. Areas of known sandy substrate were targeted. Different depth ranges were chosen to test both shallow and deep water coring capability. The vibrocore set-up on the ROV is illustrated in Fig. 8.1.

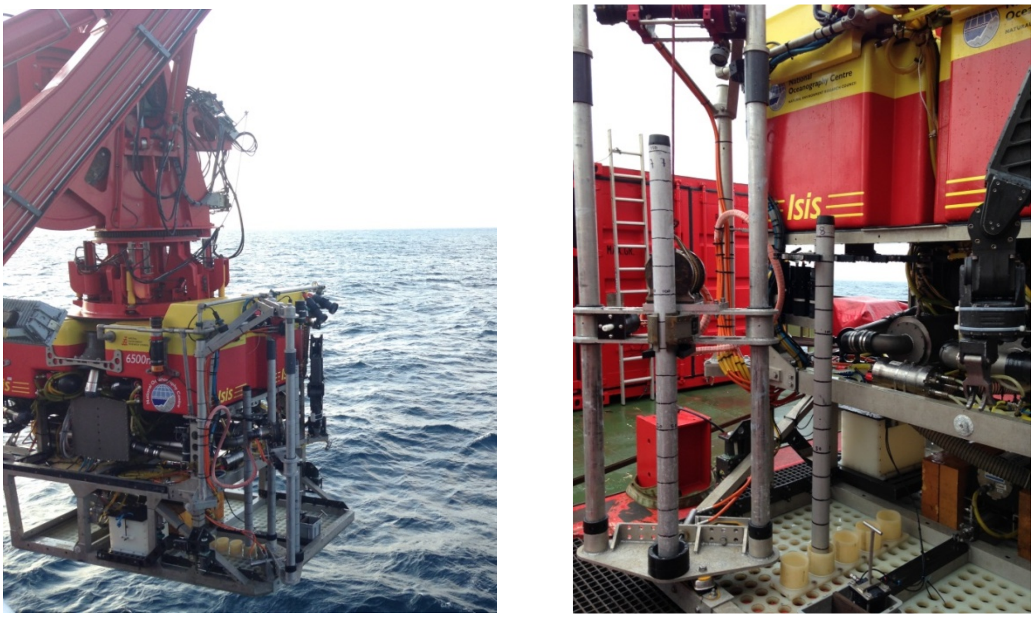


Fig. 8.1 Photographs illustrating deployment and set-up of ROV-based vibrocore

Five cores were successfully recovered during the shallow water (~200m water depth) component of the vibrocore trials (Table 8.1; Fig. 8.2). Apart from the first barrel, which was damaged as a result of the core cutter not staying open , all cores recovered substrate ranging from medium grained sand to muddy-sand with core recovery ranging from 0.34 to 1.02m (Fig. 8.3). The vibrocore system has proven successful in shallow water.

During the deep-water (~4200m water depth) component of the trials, the communication bottle that activates the hydraulic vibrocore functions failed, thus terminating vibrocore activities. The vibrocore therefore remains to be tested in deep-water.

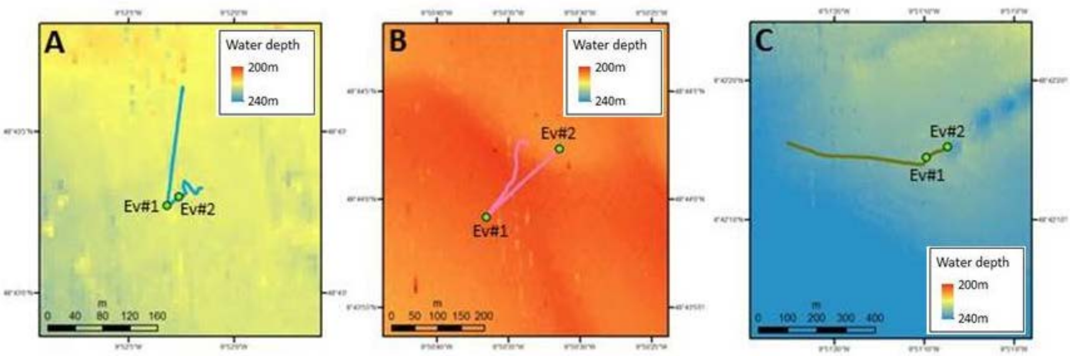


Fig. 8.2 Vibrocore test site locations. A is JC125_129; B is JC125_131; C is JC125_133.

Table 8.1. Vibrocore station list and sample summary

Station number	*Core ID*	*Latitude*	*Longitude*	*Water depth (m)*	*Core length*	*Substrate*
JC125_129 (Dive 265)	Ev#1 Barrel ID 1	48 43.045	-9 52.053	219	0m	*(Cutter problem)*
JC125_129 (Dive 265)	Ev#2 Barrel ID 2	48 43.051	-9 52.044	218	1.02m	Medium sand
JC125_131 (Dive 266)	Ev#1 Barrel ID 3	48 43.986	-9 50.609	202	0.88m	Medium sand
JC125_131 (Dive 266)	Ev#2 Barrel ID 4	48 44.039	-9 50.524	204	0.52m	Medium sand
JC125_133 (Dive 267)	Ev#1 Barrel ID 5	48 42.241	-9 51.163	226	0.60m	Muddy sand
JC125_133 (Dive 267)	Ev#2 Barrel ID 6	48 42.254	-9 51.124	230	0.34m	Muddy sand

Fig. 8.3 Examples of sediment recovered. A is from JC125_131#1; B is from JC125_131#2. C is from JC125_133#1; D is from JC125_133#2

9. CTD and SAPS (Billy Platt)

9.1. CTD system configuration

1) One CTD system was prepared. The water sampling arrangement was a 24-way stainless steel frame system (s/n SBE CTD9), 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-4380, Frequency 0 (primary)
Sea-Bird 4C conductivity sensor, s/n 04C-2165, Frequency 1 (primary)
Digiquartz temperature compensated pressure sensor, s/n 100898, Frequency 2
Sea-Bird 3P temperature sensor, s/n 03P-4383, Frequency 3 (secondary)
Sea-Bird 4C conductivity sensor, s/n 04C-2580, Frequency 4 (secondary)
Sea-Bird 5T submersible pump, s/n 05T-5301, (primary)
Sea-Bird 5T submersible pump, s/n 05T-7371, (secondary)
Sea-Bird 32 Carousel 24 position pylon, s/n 32-19817-0243
Sea-Bird 11plus deck unit, s/n 11P-22559-0532 (main)
Sea-Bird 11plus deck unit, s/n 11P-19817-0495 (back-up logging)

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

Sea-Bird 43 dissolved oxygen sensor, s/n 43-1624 (V0)
Benthos PSA-916T altimeter, s/n 41302 (V2)
WETLabs light scattering sensor, s/n BBRTD-169 (V3)
Chelsea Aquatracka MKIII fluorometer, s/n 88-2615-126 (V4)
Chelsea Alphatracka MKII transmissometer, s/n 07-6075-001 (V5)

3) Sea-Bird 9*plus* configuration file JC124_0869_ss_NMEA.xmlcon was used for the stainless steel frame CTD casts 001 – 003.
Sea-Bird 9*plus* configuration file JC125_1142_SS_NMEA Was used for the remaining stainless steel frame CTD casts.

4) The second water sampling arrangement was a 24-way stainless steel frame system (s/n SBE CTD6). The spare sensors were as follows:
Sea-Bird 9plus underwater unit, s/n 09P-71442-1142
Sea-Bird 3P temperature sensor, s/n 03P-4116, 03P-4381 and 03P-4872.
Sea-Bird 4C conductivity sensor, s/n 04C-3272 and 04C-3529.
Digiquartz temperature compensated pressure sensor, s/n 124216.
Sea-Bird 5T submersible pump, s/n 05T-7514.
Sea-Bird 32 Carousel 24 position pylon, s/n 32-34173-0493.
Sea-Bird 11plus deck unit, s/n 11P-22559-0532 (main)
Sea-Bird 11plus deck unit, s/n 11P-19817-0495 (back-up logging)

5) The auxiliary input initial sensor configuration was as follows:
Sea-Bird 43 dissolved oxygen sensor, s/n 43-1940 and 43-2818.

Benthos PSA-916T altimeter, s/n 47597
WETLabs light scattering sensor, s/n BBRTD-1163.
Chelsea Aquatracka MKIII fluorometer, s/n 88-2960-163
Chelsea Alphatracka MKII transmissometer, s/n 09-7107-001

Total number of casts – 20 S/S frame.
Casts deeper than 2000m - 2 S/S frame.
Deepest cast - 3950m S/S frame.

9.2. CTD Technical details

S/S CTD on CTD2

During CTD cast 001 and 002 the altimeter was not working. A problem was found in the y-cable. The cable was swapped for a spare and the altimeter worked well for the duration of the cruise.

After CTD cast 002 it was noticed that the CTD wire had been incorrectly run through one of the last sheave blocks. Approximately 100 metres of wire had been run over a flat of metal instead of round the sheave block. The wire was re-run correctly and after inspection of the wire and consultation with the CPOS it was decided that the wire was good for use. During CTD cast 003, on the upcast from 3950m at a depth of approximately 3667m, all coms with the CTD package were lost. During recovery the section of wire that had been run over the metal flat was inspected and found to have the outer armor opening up and without any tension on it. It was decided that as a matter of course that section of wire would be cut off. 130 metres was removed.

Immediately after the re-termination was completed it was load tested by following the normal procedure of being pulled at 0.5T, 1.0T, 1.5T and 2.0T. It was held for 5 minutes at each and re-torqued between each.

The mechanical termination was re-torqued, as per standard operating procedure, initially after every cast until no further movement was observed and then periodically between casts. It was also meggered and recorded a value of >550 MOhms.

The 9plus was proved to be not working and upon later inspection was found to be flooded.

From cast 004 – 020 9plus 09P-71442-1142 was used.

During CTD casts 008, 009 and 010 there were issues with leaking water sampling bottles. The lanyards were lengthened by removing the knot in them and they mostly sealed fine after that.

During CTD casts 016 and 017 there were large differences in the data from the transmissometer between the upcast and the down cast, particularly at depth. Upon later inspection it was found that water had gotten into the connector and caused the pins to corrode. As the Y-cable was shared between the transmissometer and the flouomreter the Y-cable and both instrument cables were swapped. The instruments worked well after this.

Full technical details on the CTD settings and configurations are provided in Appendix E.

Further Notes:

Throughout the cruise there was regularly grease found on the CTD frame. This was coming from the core wire in several ways. Directly from the core wire when it was stowed in the CTD hanger, from the hands and overalls of the personnel working around the CTD frame after contact with the core wire and also by dripping down from the sheave blocks onto the CTD package. Small lumps of grease were found inside the CTD frame and on the bottles on regular occasions. There is a definite risk of causing contamination of samples when the core wire is being used alongside the CTD package with the current levels of grease on the wire.

AUTOSAL

A Guildline 8400B, s/n 68426, was installed in the Electronics workshop as the main instrument for salinity analysis. A second Guildline 8400B, s/n 68598, was installed in the Electronics workshop as a spare instrument. The Autosal set point was 24C, and samples were processed according to BOCE cruise guidelines: The salinometer was standardized at the beginning of the first set of samples, and checked with an additional standard analysed prior to setting the RS. Once standardized the Autosal was not adjusted for the duration of sampling.

A standard was analysed after each crate of samples to monitor & record drift. Only one crate of salt samples were taken from CTD water bottles.

Standards were labeled sequentially and decreasing, beginning with number 999. Standard deviation set to 0.00002

Part way through running the samples, after sample number 536 the power to the Autosal was lost for approximately 10 minutes. Upon return of power the instrument was left alone for a further 10 minutes to allow temperature in the bath to stabilise. The heat lamps were noted to be flashing on and off in a similar manner to before the power lose so analysis was continued.

9.3. SAPS

Six CTD deployments were used to also deploy the SAPS filtering system for colleagues in the John Moore University (Liverpool; Dr. Kostas Kiriakoulakis). The aim was to obtain a good insight into the particulates in the water column, especially close to the richest benthic communities (coral wall, Acesta wall), and especially in terms of the presence and nature of the Organic Matter (labile or not?). Initially, difficulties were experienced, with the filters tearing and getting damaged nearly every time because of the high particle load in the water. Pumping times were already reduced (30-90mins), but upon further discussion with the colleagues in Liverpool, it transpired that the filters had been placed in the wrong position in the SAPS housing. Once this was rectified, correct samples were obtained. The CTD and SAPS deployments are listed in Table 9.1.

Table 9.1 Overview of CTD casts, including SVP and SAPS deployments

Site	Station No	Gear No	Event Gear Code	JDay (Start)	Start Date	Start Time GMT	Start Lat Degr N	Start Lat Min N	Start Long Degr W	Start Long Min W	Start Waterdepth meter	Comments
Haig Fras	1	CTD01	CTDProfile	222	10/08/2015	10:58:00	50	23.828	7	42.74	110	CTD stayed longer at the bottom to check the comms with the beacons (AUV and ROV) deployed. AUV deployed not working. A second CTD will be deployed with a spare beacon. No data recorded on deck at the end of the survey.
			SVP	*222*	*10/08/2015*	*10:58:00*	*50*	*23.828*	*7*	*42.74*	*110*	
Haig Fras	2	CTD02	CTDProfile	222	10/08/2015	11:56:00	50	23.8294	7	42.7398	109	
Whittard Canyon	13	CTD03	CTDProfile	225	13/08/2015	21:29:00	47	57.574	10	13.02	3956	Deep CTD in central axis of WC. Coms failed during upcast at 3667 m.
			SVP	*225*	*13/08/2015*	*21:29:00*	*47*	*57.574*	*10*	*13.02*	*3956*	
Whittard Canyon	21	CTD04	CTDProfile	227	15/08/2015	15:53:00	48	23.369	9	59.768	2985	
Whittard Canyon	25	CTD05	CTDProfile	228	16/08/2015	17:11:00	48	39.307	10	2.067	1369	
			SAPS	*228*	*16/08/2015*	*17:52:00*	*48*	*39.307*	*10*	*2.067*	*1369*	*SAPS pumping for 30 min at 1752 m, 20 m above bed. Slight tear in filter edge. 'O ring' (??!) droppred on filter.*
Whittard Canyon	40	CTD06	CTDProfile	232	20/08/2015	03:54:00	48	39.209	10	2.003	1371	
			SAPS	*232*	*20/08/2015*	*04:56:00*	*48*	*39.209*	*10*	*2.003*	*1371*	*SAPS pumping for 30 mins at 1350m depth, 20m above bed*
Whittard Canyon	42	CTD07	CTDProfile	232	20/08/2015	10:30:00	48	45.66042	10	27.6558	760	
			SAPS	*232*	*20/08/2015*	*11:00:00*	*48*	*45.66042*	*10*	*27.6558*	*760*	*SAPS pumping for 90 mins at 700m depth, 60 m above bed. One of the filter was a little bit broken after opening the SAP.*
Canyons MCZ	65	CTD08	CTDProfile	237	25/08/2015	10:29:00	48	27.7065	9	38.0083	608	1 bottle leaked/3 fired.
Canyons MCZ	66	CTD09	CTDProfile	237	25/08/2015	12:15:00	48	27.9483	9	38.31654	755	2 bottles leaked/3 fired.
Canyons MCZ	67	CTD10	CTDProfile	237	25/08/2015	13:56:00	48	28.0932	9	38.6082	908	1 bottle leaked/3 fired.
Canyons MCZ	68	CTD11	CTDProfile	238	26/08/2015	10:01:00	48	28.49286	9	39.1917	878.05	3 bottles fired.
			SAPS	*238*	*26/08/2015*	*10:55:00*	*48*	*28.49286*	*9*	*39.1917*	*878.05*	*SAPS pumping for 90 mins at 850m depth, 50m above bed*
Canyons MCZ	69	CTD12	CTDProfile	238	26/08/2015	13:32:00	48	27.69918	9	38.0133	608	3 bottles fired.
Canyons MCZ	70	CTD13	CTDProfile	238	26/08/2015	15:02:00	48	27.944	9	38.31306	750	2 bottles fired.
Canyons MCZ	71	CTD14	CTDProfile	238	26/08/2015	18:36:00	48	28.091	9	38.6017	905	1 bottle leaked/2 fired.
Canyons MCZ	72	CTD15	CTDProfile	238	26/08/2015	20:03:00	48	28.319	9	38.93	1068	2 bottles fired.
Canyons MCZ	73	CTD16	CTDProfile	238	26/08/2015	21:54:00	48	28.8631	9	39.6378	766	3 bottles fired.
Canyons MCZ	74	CTD17	CTDProfile	238	26/08/2015	23:31:00	48	29.465	9	40.2573	596	2 bottles leaked/3 fired.
Whittard Canyon	93	CTD18	CTDProfile	244	01/09/2015	08:36:00	48	28.49382	9	39.19326	897	No bottle fired.
			SAPS	*244*	*01/09/2015*	*09:12:00*	*48*	*28.49382*	*9*	*39.19326*	*897*	*SAPS pumping for 90 mins at 850m depth, 50m above bed*
Whittard Canyon	116	CTD19	CTDProfile	249	06/09/2015	02:27:00	48	39.221	10	2.012	1370	No bottle fired.
			SAPS	*249*	*06/09/2015*	*03:11:00*	*48*	*39.221*	*10*	*2.012*	*1370*	*SAPS pumping for 30 mins at 1350m depth, 20m above bed*
Whittard Canyon	119	CTD20	CTDProfile	249	06/09/2015	12:35:00	48	29.17	10	2.945	1655	No bottle fired.

10. Glider (Tahmeena Aslam)

The main aim of the Seaglider deployment was to collect information on the hydrography within Whittard Canyon and map the internal tide field. The focus was on the easternmost canyon limb where our numerical model suggests elevated internal tide energy.

The plan for the Whittard Canyon deployment was to deploy and pilot a Seaglider for a period of roughly 21 days around the eastern limbs of the canyon. The Seaglider measures conductivity, temperature, depth (CTD), dissolved oxygen concentration, optically derived chorophyll *a* concentration and optical backscatter at two wavelengths (470 nm and 700 nm). An echosounder was also installed on the Seaglider, but did not work for the duration of the cruise due to firmware incompatibility. The Seaglider would be deployed as and when the cruise science schedule and a weather window allowed. The ship CTD rosette would be deployed after Seaglider deployment and recovery to collect data with which to calibrate the Seaglider sensors. Time permitting, the Seaglider would occupy a series of nine 36-hour tide-resolving stations (VM1-9) with at least one station occupied twice, at spring tide and neap tide (Figure 1, Table 1). To adequately resolve the M2 and K1 internal tides, the Seaglider would have to make at least 12 dives over each 36 hours and stay within 2.5 km of the target location.

Seagliders allow missions to be modified 'on the fly' so the final mission varied slightly from planned. The total mission time was slightly less then 22 days and 8 stations were occupied (VM1-6, 9, 11). Stations VM3 and VM6 where occupied twice, slightly before neap tide and bracketing spring tide. Stations VM7 and VM8 were replaced with a new station (VM11) in response to a large internal tide being observed at VM9. All stations except for VM11 were occupied for at least 36 hours and the Seaglider stayed within 2.5 km of the target location the vast majority of the time, making between 13 and 20 dives to 1000 m or near-bottom. VM11 was cut short due to a concerning roll error and the Seaglider pilot requested that the recovery be bought forward. VM11 was 10+8 hours with a 4-hour gap during which time the glider was tested with two shallow dives. Apart from VM11 the Seaglider performed as well as could be expected in the challenging tidal regime of Whittard Canyon. Throughout the whole mission the Seaglider was having problems turning (a possible problem with roll) but provided it stayed in water deeper than 700 m it stayed on target. Navigational problems occurred when the Seaglider moving into shallower water between stations; the decrease in dive time to turn, and an increase in tidal currents, caused it to frequently deviate away from its intended target. The pilot mitigated against this by, where possible, navigating around the ridges between the canyon limbs. VM5 was a challenge due to the narrowness of the canyon at this location. Much of the station time was spent over the walls of the canyon; only three dives reached near the canyon axis.

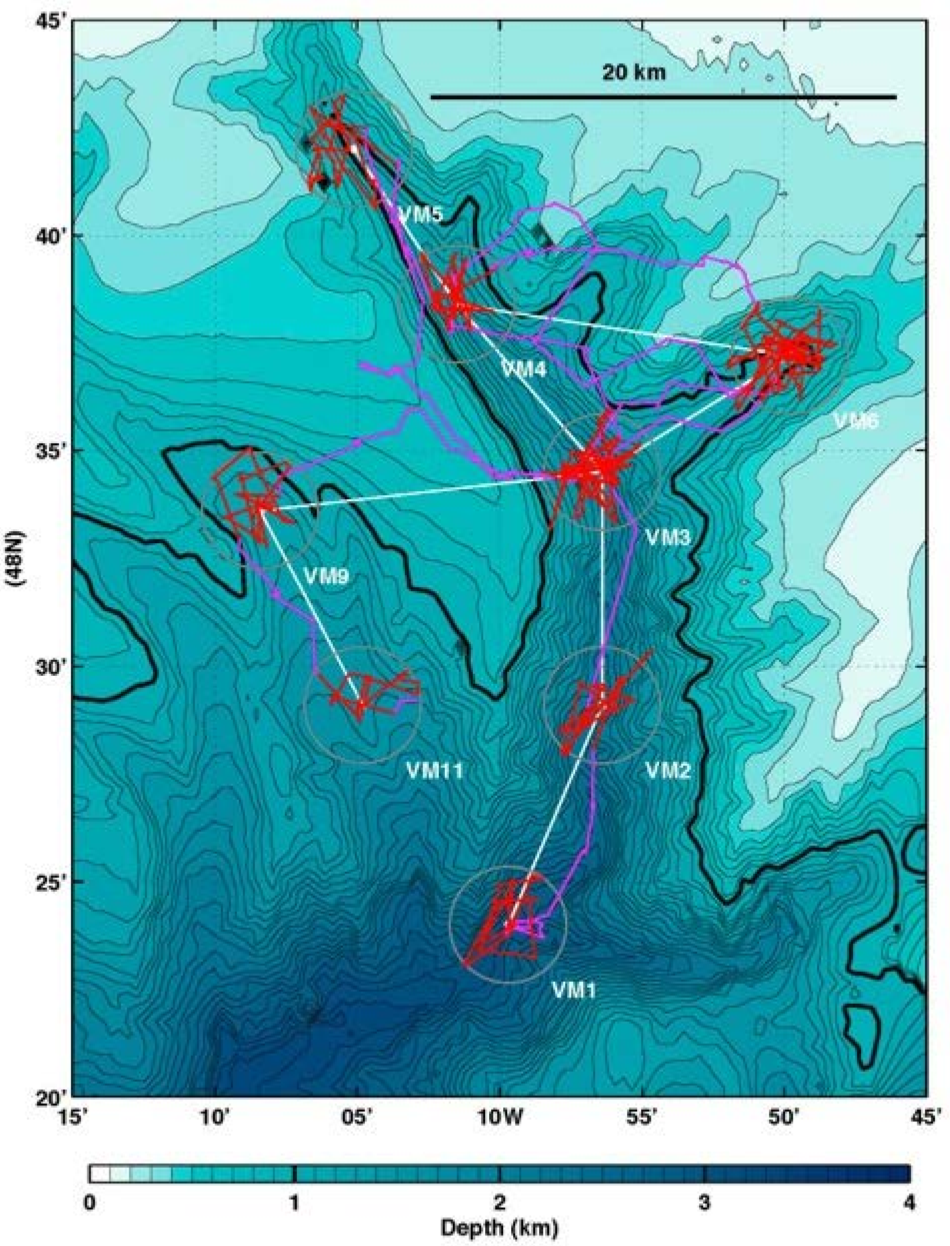


Fig. 10.1 Glider mission plan

Table 10.1 : Locations of glider stations

Location	Latitude	Longitude
VM1	48°24.0N	09°59.7W
VM2	48°29.1N	09°59.7W
VM3	48°34.5N	09°56.4W
VM4	48°38.4N	10°01.5W
VM5	48°42.3N	10°05.4W
VM5a	48°41.7N	10°04.5W
VM6	48°37.2N	09°49.8W
VM7	48°37.8N	10°18.6W
VM8	48°32.7N	10°21.6W
VM9	48°33.6N	10°08.4W
VM10	48°25.2N	09°47.4W
VM11	48°29.1N	10°04.8W

Table 10.2 Glider deployment timeline

5th-8th August 2015	ARGOS tag setup, assembly of SG537
9th August 2015	Sailed from Southampton, UK
15th August 2015	**Deployment of SG537**
	Station 020, deployment of SG537
	Station 021, Cast 004 ship deployed CTD to 2857 m for Seaglider calibration
6th September 2015	**Recovery of SG537**
	Station 020, recovery of SG537
	Station 119 , Cast 020 ship deployed CTD to 1655 m for Seaglider calibration
12th September 2015	Dock in Southampton, UK
15th August 2015	**Deployment day**
09:18	Self test on SG537 filename: <150815_selftest_01.log> . Aborted due to communications problems. Moved Seaglider to a more exposed position on deck.
10:56	Self test on SG537 filename: <150815_selftest_02.log> . Timed out.
11:42	Self test on SG537 filename: <150815_selftest_03.log> . Timed out.
12:24	Self test on SG537 filename: <150815_selftest_04.log> successful.
13:04	Sea-launch started for SG537 filename <150815_sg537_sealaunch.log>. No problems encountered. Confirmed ready to launch 13:12
14:11	Buoyancy test for SG537 carried out. Seaglider

	sitting in water correctly.
14:27	SG537 deployed using the Rigid Rope technique.
	SG537 Deployment location: **48º 23.673N 09º 59.762W**
15:53	Ship deployed CTD to 2857 m for 15th August15:53 to 17:53 Seaglider sensor calibration **Position of CTD: 48º 23.369N 09º 59.768W** Maximum depth: 2857 m (bottom)
6th September 2015	**Recovery day**
11:54	SG537 recovered using the Looped Lasso technique **SG537 Recovery position:** **48º 29.169N 10º 02.945W**
12:35	Ship deployed CTD to 1655 m for 6th September 12:35 to 14:01 Seaglider sensor calibration **Position of CTD: 48º 29.170N 10º 02.945W** Maximum depth: 1655 m (bottom)

11. Ship systems (Martin Bridger)

11.1. Ship scientific computing systems

Data was logged by the Techsas data acquisition system into NetCDF files. The format of the NetCDF files is given in the file NMFSS_NetCDF_Description_Cook_v2.docx. The instruments logged are given in JC125_Ship_fitted_information_sheet_JC.docx. Data was additionally logged into the RVS Level-C format, which is described in the NetCDF document.

Summary data was generated using the Near Real Time (NRT) software written for returning data to BODC. The summary data was produced from the NetCDF files logged by Techsas. The true wind speed and direction were calculated by the NRT software. Summary data are included at one minute intervals. The latitude and longitude are spot values at that time stamp. All other values have been averaged over one minute. The time stamp is the time at the start of the averaging period. If a data value is not available or valid at a time period then the data has been replaced by a fill value of 99999.0.

A second set of summary data has been generated from the level-C data giving 1 second resolution and 1 minute average data with fixed width fields. In the averaged data . The latitude and longitude are spot values at that time stamp. All other values have been averaged over one minute. The time stamp is the time at the start of the averaging period. If a data value is not available or valid at a time period then the data field is blank.

11.2. Position and attitude

All GPS and attitude measurement systems were run throughout the cruise. The Seapath system is the vessel's primary GPS system, outputting the position of the ship's common reference point in the gravity meter room. The POSMV is the GPS that is repeated around the vessel and sent out to other systems.

11.3. Meteorology and surface monitoring package

The Surfmet system was run throughout the cruise. Please see the separate BODC information sheet JC125_Surfmet_sensor_information_sheet.docx for details of the sensors used and the calibrations that need to be applied. The calibration sheets are included in the directory Ship_Systems\Met\SURFMET\calibrations. The non-toxic water supply was active from 15 221 1721 until 15 253 1530.

11.4. Kongsberg EA600 single beam echosounder

The EA600 single beam echo sounder was run throughout the cruise. It was used with a constant sound velocity of 1500 ms^{-1} throughout the water column to allow it to be corrected for sound velocity in post processing. The EA600 was not synchronised to the K-Sync synchronisation system.

11.5. Kongsberg EM120 and EM710 multibeam echosounders

The EM710 shallow water system was used in the shallow regions. The system requires calibration for each use as it is installed on the drop keel. These were lowered to 1.5m when required in order to obtain the best possible multibeam data.

No formal calibration of the EM710 took was performed. The scientists took responsibility for post calibration based on tracklines they chose.

The EM120 was run throughout the cruise. Occasionally the system failed. This often happened when sudden depth changes from deep >2000m to shallow <500m. In order to get the system back up and running, it was necessary to shutdown the entire system for 10 minutes or more.

No sensor settings were changed in SIS from the previous configuration.

The Sound Velocity Profiles section of this report describes the sound velocity profiles used during the cruise.

11.6. Sound velocity profiles

The sound velocity profiles used in the EM120 & EM710 multi-beam are shown below (also applied to USBL Ranger2 environment):

Date:	File No.	Time:	Position:		File Depth:	Serial No.
10082015	FILE44.000	10:36	50°23.830N	7°42.740W	103m	22241
14082015	FILE46.000	14:02	48°25.130N	10°47.700W	3978m	22241
14082015	FILE10.000	14:02	48°25.130N	10°47.700W	3978m	22355

Both MIDAS SV Probe were used for the second cast to get a comparison between the two. They both gave the same readings.

11.7. SBP120 sub-bottom profiler

The SBP120 Sub-bottom profiler was run throughout the cruise. All *seg (processed) and *.raw (raw) data was logged.

11.8. 75 kHz and 150 kHz hull mounted ADCP systems

Set up for bottom tracking, …. Bins …. Water depth ….

11.9. Wamos wave radar

The WAMOS wave radar was run throughout the cruise. All data was logged and is included on the data disk (not PI copy as requested), but a summary of its output is given in the PARA*.jco files.

12. Haig Fras survey (Russell Wynn, Alex Callaway)

12.1. Repeat mapping

Upon arrival at the study site on 10 Aug 2015, a CTD and SVP deployment was carried out to characterise water column properties and calibrate the AUV and shipborne echo-sounder instruments. Following a short vessel-based MBES reconnaissance survey, Autosub6000 was then deployed for its first mission (M86). A quick check of the data revealed that both the MBES and SSS systems were operating correctly, although the vehicle ballasting had not been optimal and a strong roll offset had to be applied to the data. Unfortunately only a few useful photographs were collected as the result of a camera logger problem.

Autosub6000 was deployed for its second mission (M87), and again, the SSS survey was successful, but no MBES data were collected. As a result of technical problems that needed time to get resolved before Autosub could be deployed, the multibeam mission had to be culled to allow Autosub to finish its mission within the foreseen working time at Haig Fras, and before adverse weather was coming in. This time, however, the photography part of the mission was very successful and >40000 images were collected. The processed sidescan sonar data from the three missions at the site are shown in Fig. 12.1.

12.2. ROV surveys

The aim of the ROV *Isis* surveys was to target an unsurveyed isolated pinnacle, and a previously surveyed section of reef, with the objective of acquiring video and photograph data from near-vertical wall and overhang features at each site (Fig. 12.2). ROV *Isis* carried out three surveys, two at an isolated feature towards the north east of the SCI and another at a region of expected wall towards the south west of the site.

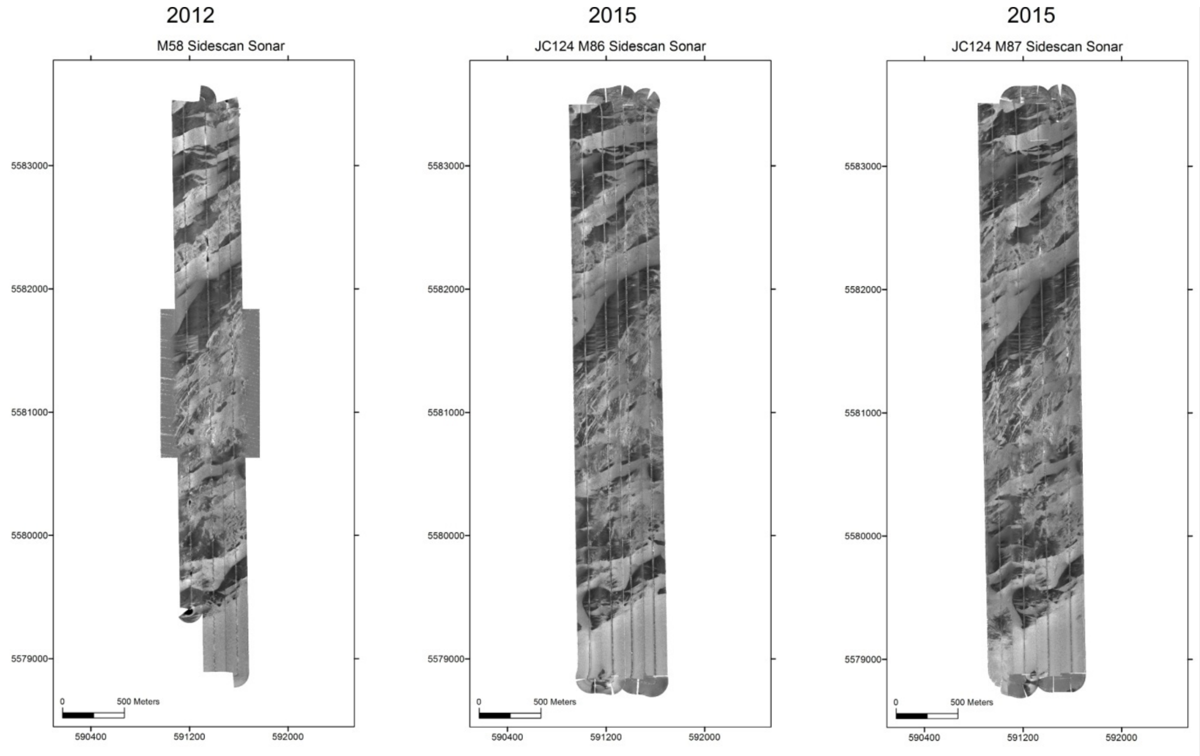


Figure 12.1 Sidescan sonar data from the Greater Haig Fras rMCZ in 2012 and during the two repeat surveys in 2015. Light tones = high backscatter.

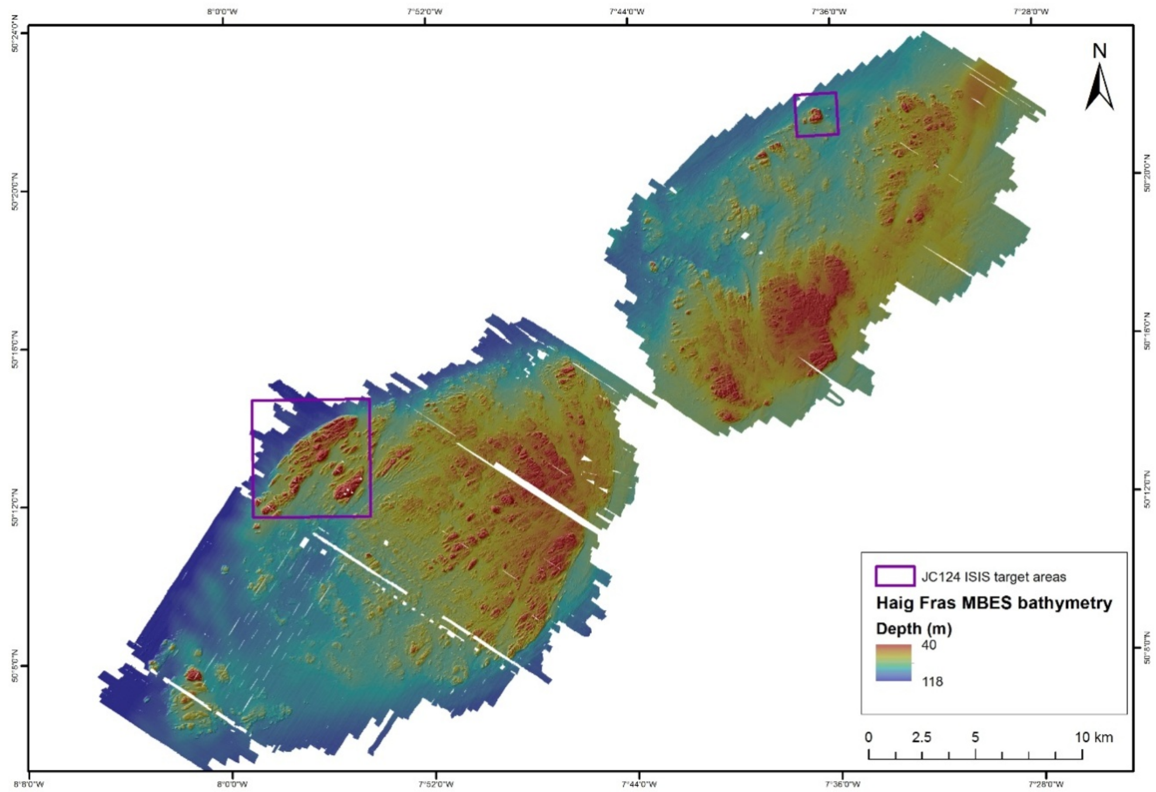


Fig. 12.2 Target areas for ROV Isis dives at the Greater Haig Fras rMCZ: ROV dives 242 and 243 targeted the isolated pinnacle in the northeast of the site; ROV dive 244 targeted the northwest margin of the reef.

ROV Isis dive 242

The first of the ROV *Isis* surveys was undertaken between 08:50 and 11:26 on 11 Aug and targeted an isolated rock outcrop combining a series of vertical and horizontal transects (Fig. 12.3). After deployment and initial checks of the vehicle at seabed, observations began at 10:09. An initial transition from boulder and cobble field to rock outcrop was observed (Fig. 12.3). The cobble and boulder field supported a high abundance and diversity of taxa. *Salmicina dysteri* and *Axinella infundibuliformis* were prevalent on the cobble field with occasional observations of echinoderms and decapods. Upon reaching the rock outcrop, *Corynactis viridis* and *Caryophillia smithii* were observed in high densities, with *Crossaster papposus* observed occasionally (Fig. 12.4). The rock outcrop appeared to be composed of pink granite with visible quartz veins and jointing (Fig. 12.4). ROV *Isis* left the seabed at 11:09, after collecting approximately 1 hr of video data and 144 photographs.

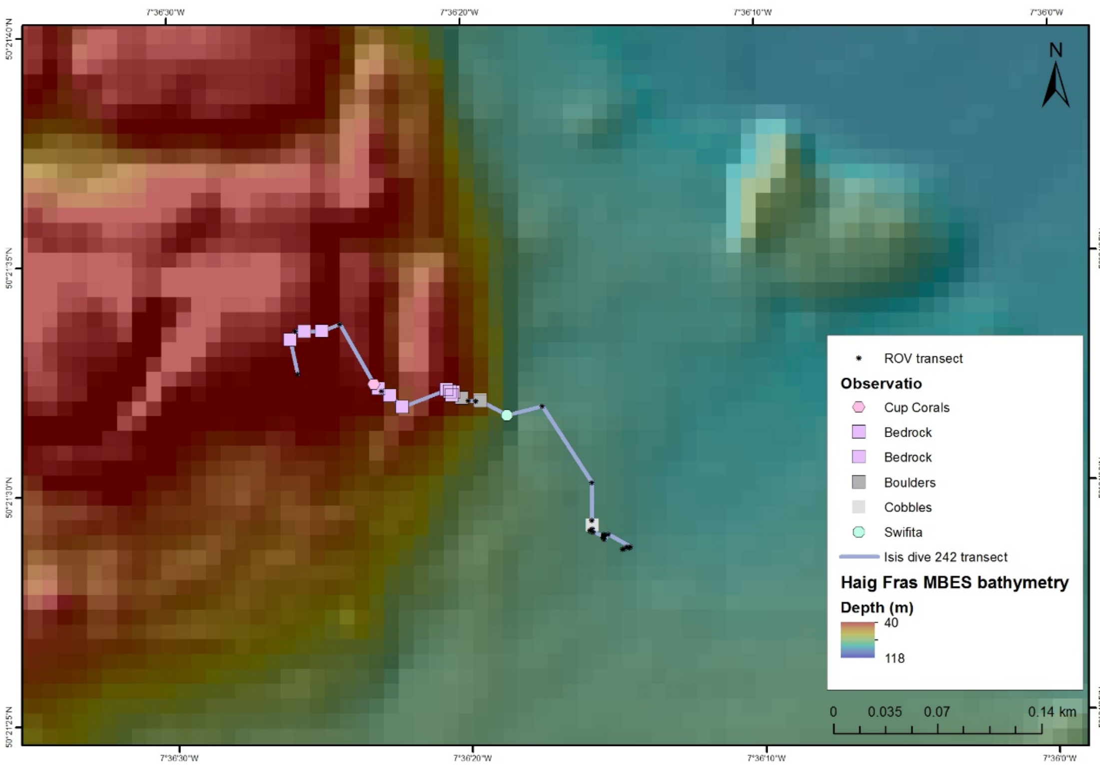


Fig.12.3 Dive track and key observations from ROV Isis dive 242 as recorded in OFOP.

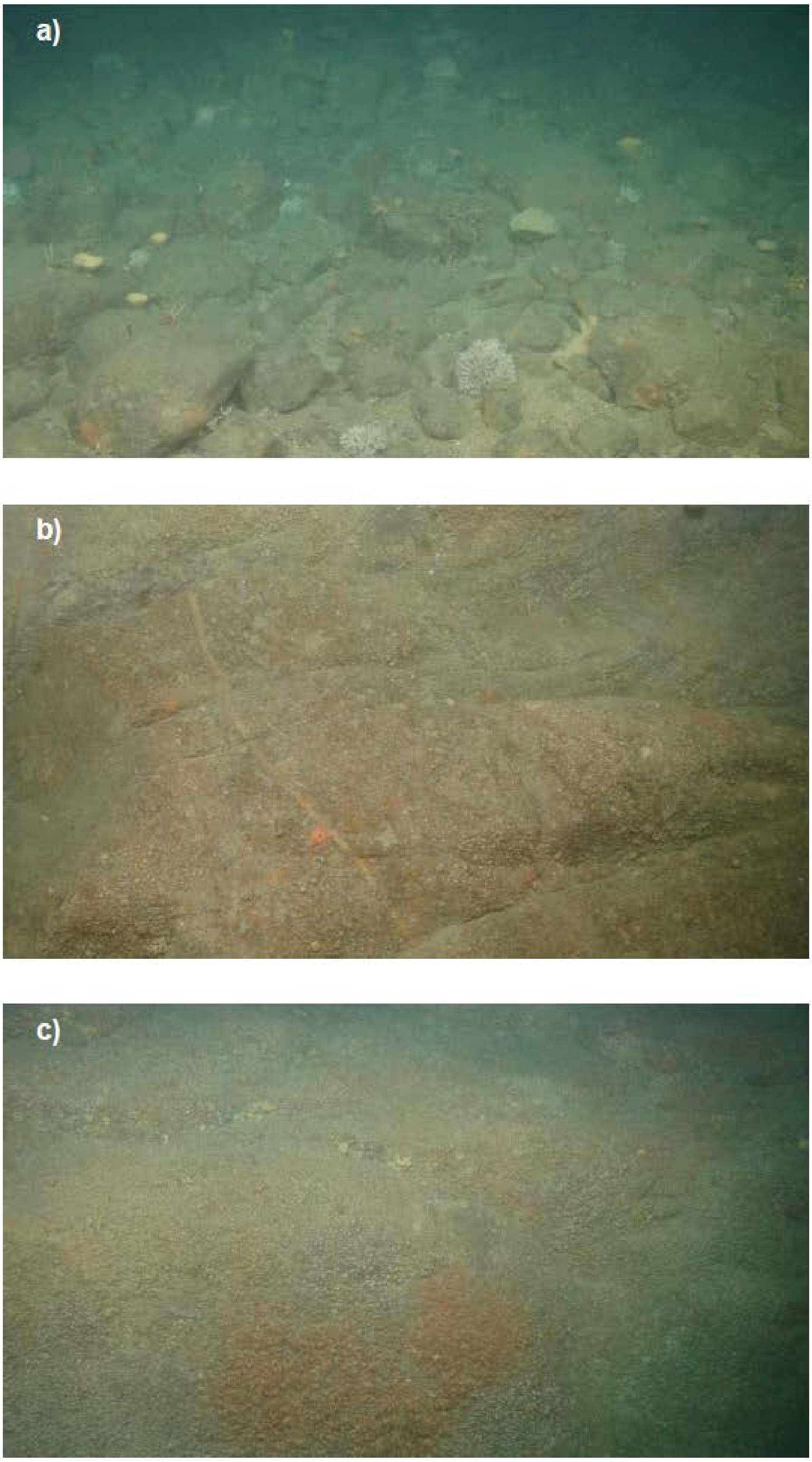


Fig. 12.4 Images captured by the Scorpio camera on ROV Isis dive 242; a) boulder and cobble field with Axinella infundibuliformis and Salmacina dysteri, b) exposed rock outcrop with quartz vein, c) Corynactis viridis on reef top.

ROV Isis dive 243

The second ROV *Isis* dive reached the seabed at 19:20 on 11 Aug, and again targeted an isolated rock outcrop combining a series of vertical and horizontal transects (Fig. 12.2). Dive 243 was to follow the planned route from dive 242, before traversing the outcrop and investigating more features both on the reef and over the surrounding sediments. The dive began on a boulder and cobble field populated by sponges, polycheate worms and echinoderms. However, less than an hour into the dive the ROV USBL and Doppler positions were noticed to be incorrect. The dive was halted for 2 hrs whilst the issue was investigated and repaired. The dive then continued onwards towards the reef. *Corynactis viridis*, *Neocrania anomola* and *Porania pulvillus* were observed in high abundances. The reef was investigated for less than an hour before the navigation system on ROV *Isis* failed and the dive was ended. ROV *Isis* left the seabed at 23:20 on 11 Aug, after collecting approximately 4 hrs of video data, 460 photographs and two biological samples (*Swiftia spp*. samples for taxonomic verification).

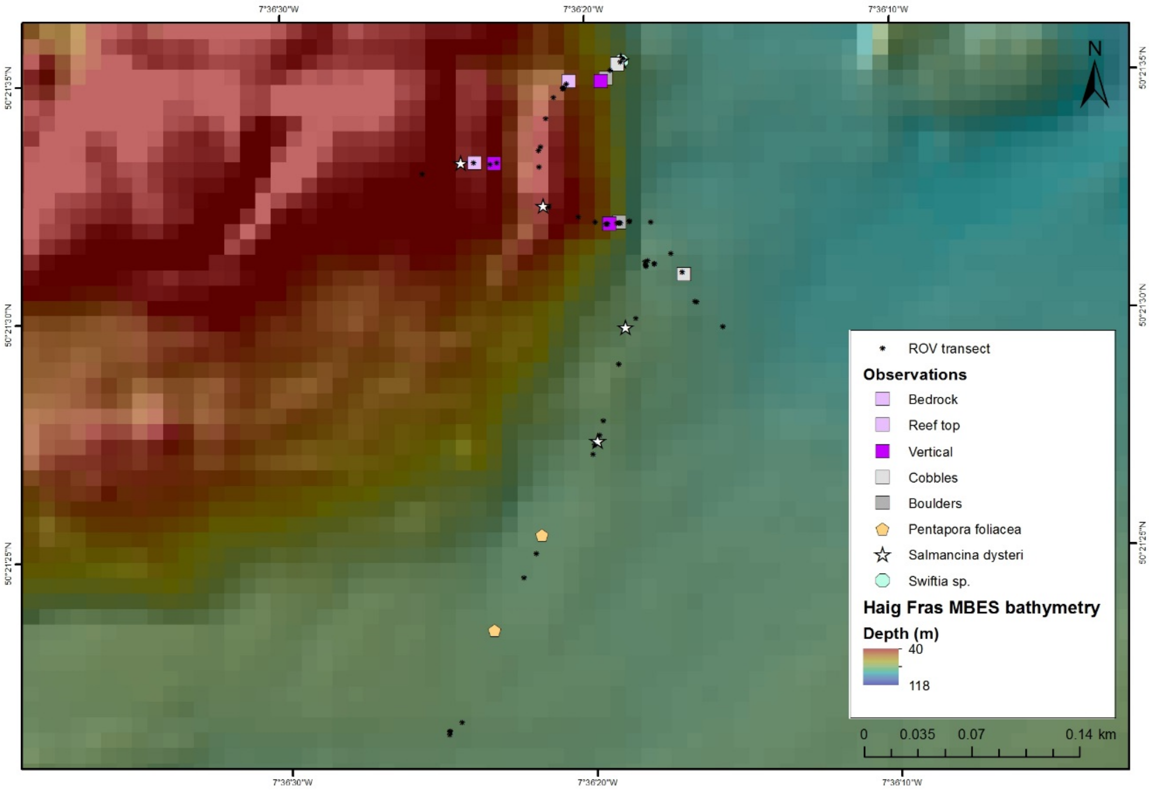


Fig.12.5 Dive track and key observations from ROV Isis dive 243 as recorded in OFOP.

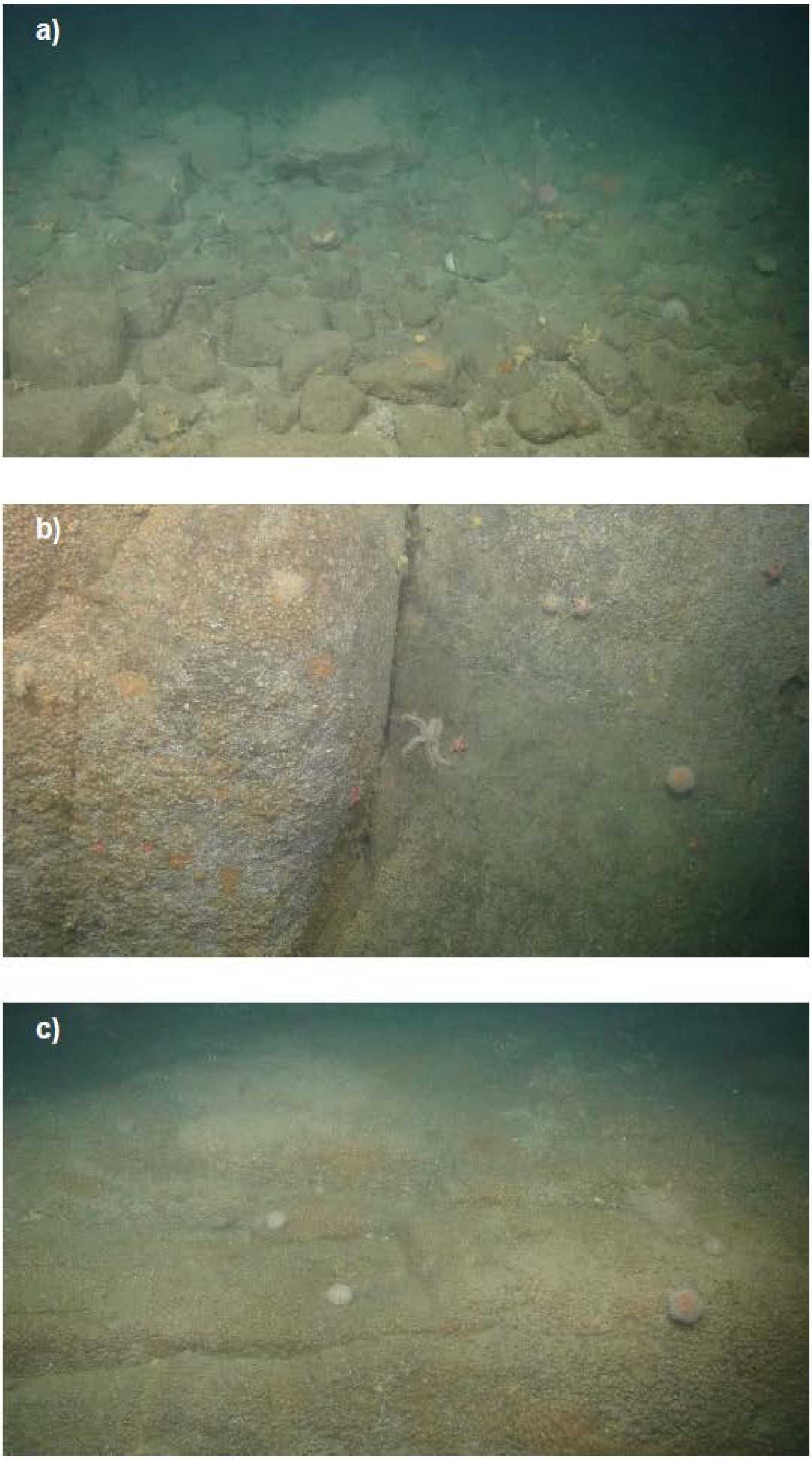


Fig.12.6 Images captured by the Scorpio camera on ROV Isis dive 243; a) boulder and cobble field with Axinella infundibuliformis and Salmacina dysteri, b) vertical rock face with Marthasterias glacialis, c) Corynactis viridis on reef top.

ROV Isis dive 244

The third ROV *Isis* dive planned to sample an area in the southwest region of Haig Fras where there appeared to be an opportunity to carry out horizontal transects along a large wall structure and investigate sediment waves to the north of the reef (Fig. 12.2). ROV *Isis* reached the seabed at 12:02 on 12 Aug and proceeded to investigate the sediment wave features. A push core was attempted but was unsuccessful due to the low cohesion of the sandy sediment. The coarse sand was scooped into a magnetic tube and ROV *Isis* transited to the wall. A series of horizontal and vertical transects were undertaken revealing a stepped nature to the reef wall (Fig. 12.7). At the base of the wall *Axinella infundibuliformis* occurred in relatively high densities. The rock face was more silted than at the previous site and Devonshire cup corals (*Caryophillia smithii*) and *Neocrania anomola* were most prevalent throughout the dive (Fig. 12.8). ROV *Isis* left the seabed at 15:30.

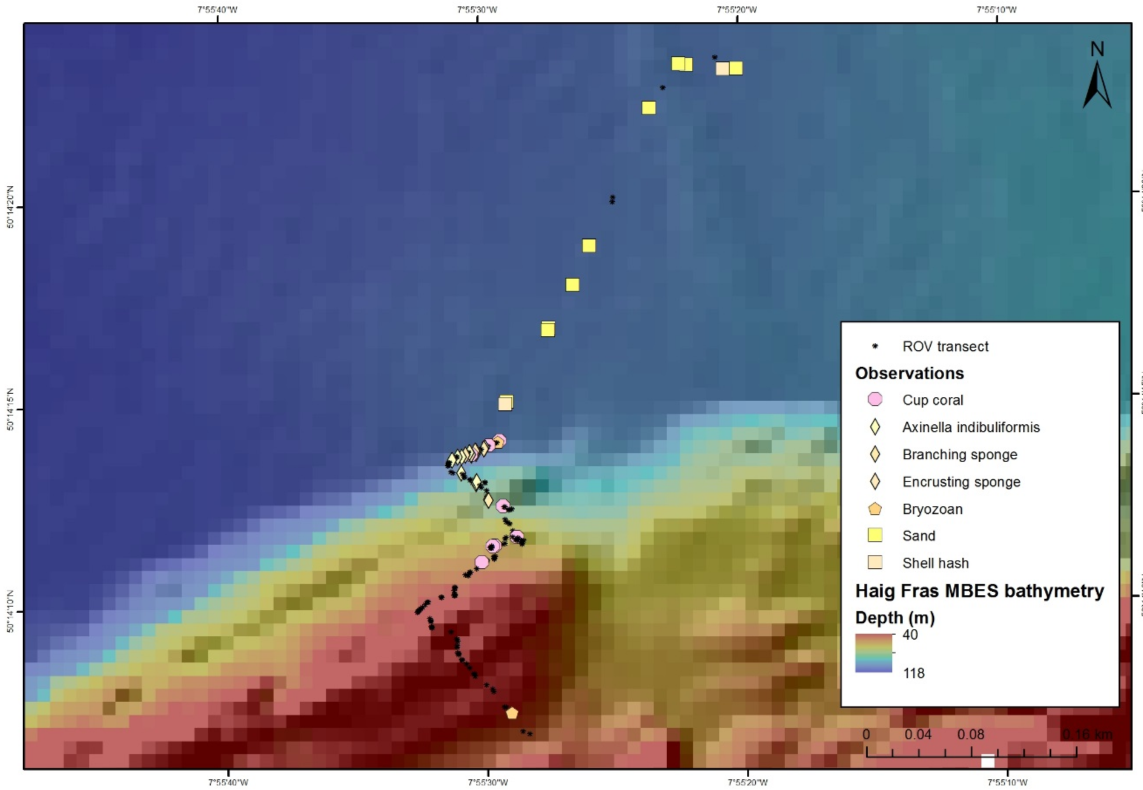


Fig. 12.7 Dive track and key observations from ROV Isis dive 246 as recorded in OFOP

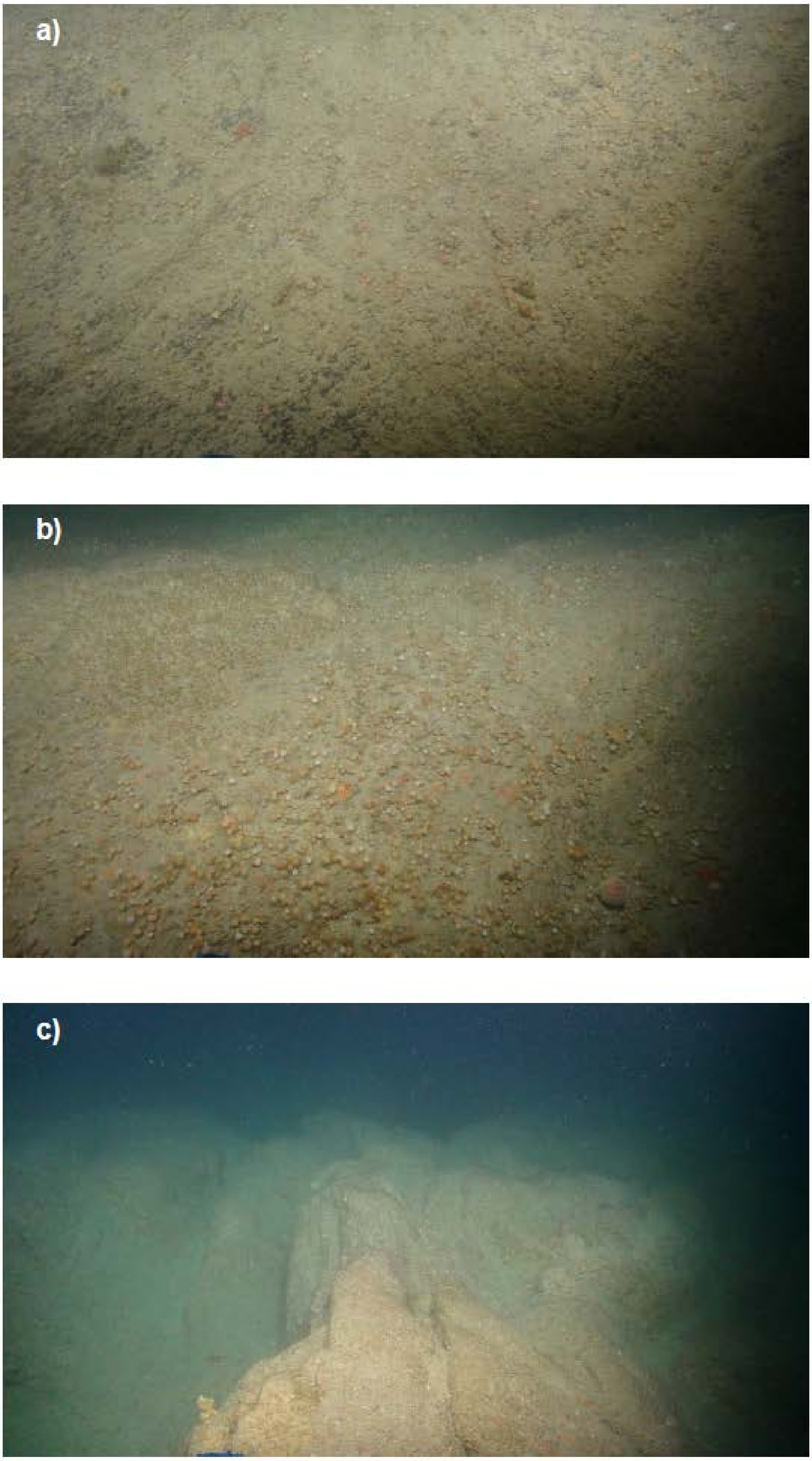


Fig.12.8 Images captured by the Scorpio camera on ROV Isis dive 243; a) silted rock face with Caryophillia smithii, b) reef top plateau with Caryophillia smithii, c) reef top with Corynactis viridis and Neocrania anomola.

13. <u>Canyons MCZ survey</u> (Alex Callaway, Russell Wynn)

The survey at The Canyons MCZ was initially carried out between 15 and 19 August 2015, comprising MBES survey, AUV missions and ROV dives. Additional survey operations within the MCZ were carried out on 27 August (ROV ground-truthing) and 03 September (ROV MBES survey).

13.1. Shipboard multibeam

Firstly, a MBES survey was carried out using the hull-mounted EM120 system on RRS *James Cook*. The survey targeted areas that were not covered by the MESH MBES survey in 2007 (Fig. 13.1) whilst ensuring adequate overlap for integration of the data sets. Once these data had undergone initial processing and gridding at 25 m, they were compared against the locations of the vehicle-based surveys suggested by JNCC to ensure that safe AUV and ROV operations could be carried out.

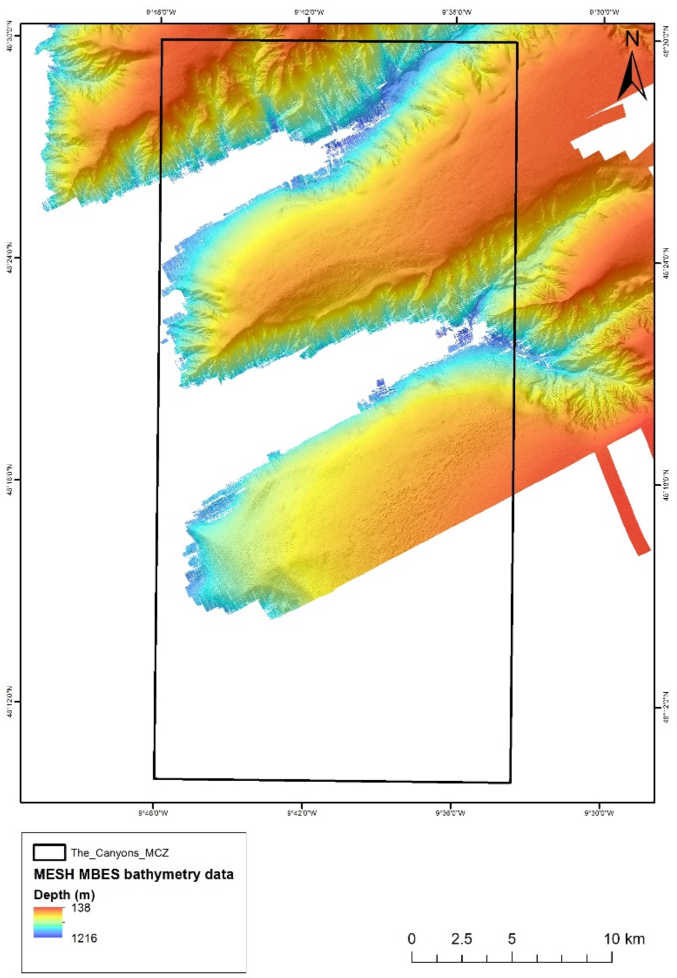


Fig. 13.1: Existing available MBES data at The Canyons MCZ

The MBES bathymetry data acquired (Fig. 13.2) covered the majority of the high priority area indicated by JNCC plus a small proportion of the medium priority area. Gaps in the high priority area were a result of unfavourable conditions impacting data quality. The remaining medium and low priority areas were not surveyed (Fig. 13.2). Following completion of the MBES survey, ROV *Isis* was deployed at the site of previously observed cold-water coral reef (Fig. 13.3).

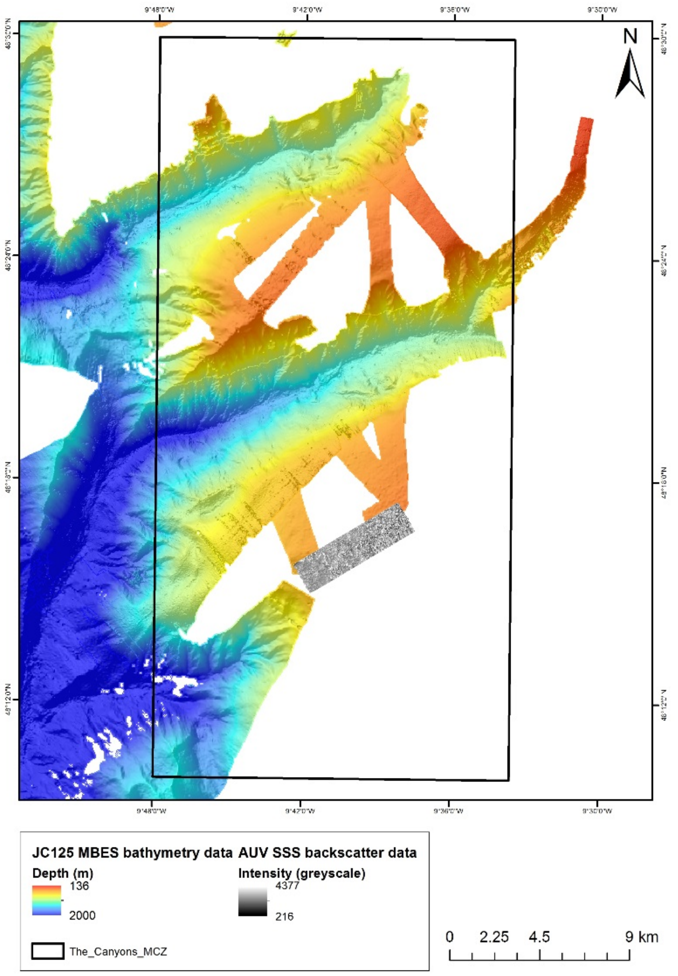


Fig. 13.2: New MBES bathymetry and backscatter data acquired from The Canyons MCZ

13.2. ROV video surveys

ROV *Isis* was equipped with three high-definition video cameras, two manipulator arms, a vacuum sampler, six push cores and various sample storage units. The primary data - video and photographs - were acquired from the Scorpio camera, which was mounted at a fixed angle and had still image capture capability. The zoom was nominally set to provide a field of view of approximately 1 m^2. Still images were automatically captured at 30 s intervals and were augmented with manually captured images of features of interest. Video data from the Pilot and Science cameras were also recorded. These cameras had pan and tilt capability and could provide imagery from outside of the field of view of the Scorpio camera or at a higher magnification to aid *in*- and *ex situ* identification of observed taxa. Live notation of the ROV transects was recorded using the Ocean Floor Observation Protocol (OFOP) software. This system records pre-set and user-entered observations and the associated ship and ROV positions.

ROV Isis dive 246

The first ROV dive within The Canyons MCZ (in Explorer Canyon) was *Isis* dive 246 on 17 Aug (Fig. 13.3). The dive was to begin at the canyon thalweg and approach the canyon wall, before ascending towards the location of previously observed corals. Once located, the extent of the coral reefs was to be explored by traversing areas until corals were absent.

The dive started in the thalweg at 14:29 (all times GMT) and proceeded to the canyon wall. At the base of the canyon wall exposed bedrock was observed, which was encrusted with barnacles, gorgonians (*Swiftia spp*.) and small colonies of cold-water coral (*Lophelia pertusa*). The wall comprised a variety of strata and morphologies, from gently sloping areas to steeper stepped walls with small-scale failures. Coral rubble was observed for large segments of the dive with isolated live colonies (Fig. 13.3). At a depth of circa 950 m, live coral became more prevalent and large colonies were observed until circa 750 m. Within this depth band, areas of very dense coral were observed and targeted for the cross-line to estimate the extent of the reefs (Fig. 13.3). Expanses of soft sediment were also observed, with associated epifauna, and litter was recorded in several places (Fig. 13.4). The cross-line revealed the same pattern of dense corals in the central region, and enabled a tentative delineation of the main coral extent as observed from the dive.

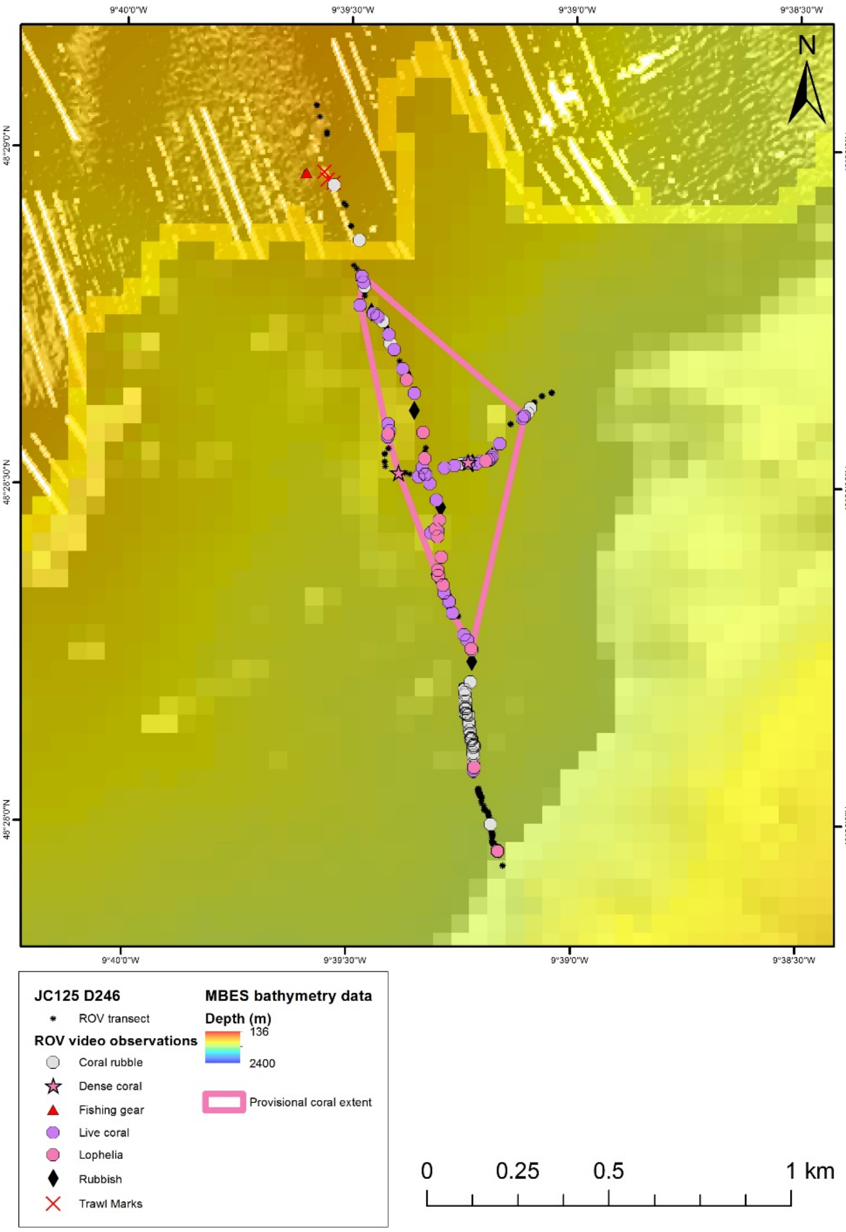


Fig. 13.3 Dive track and key observations from ROV Isis dive 246 as recorded in OFOP

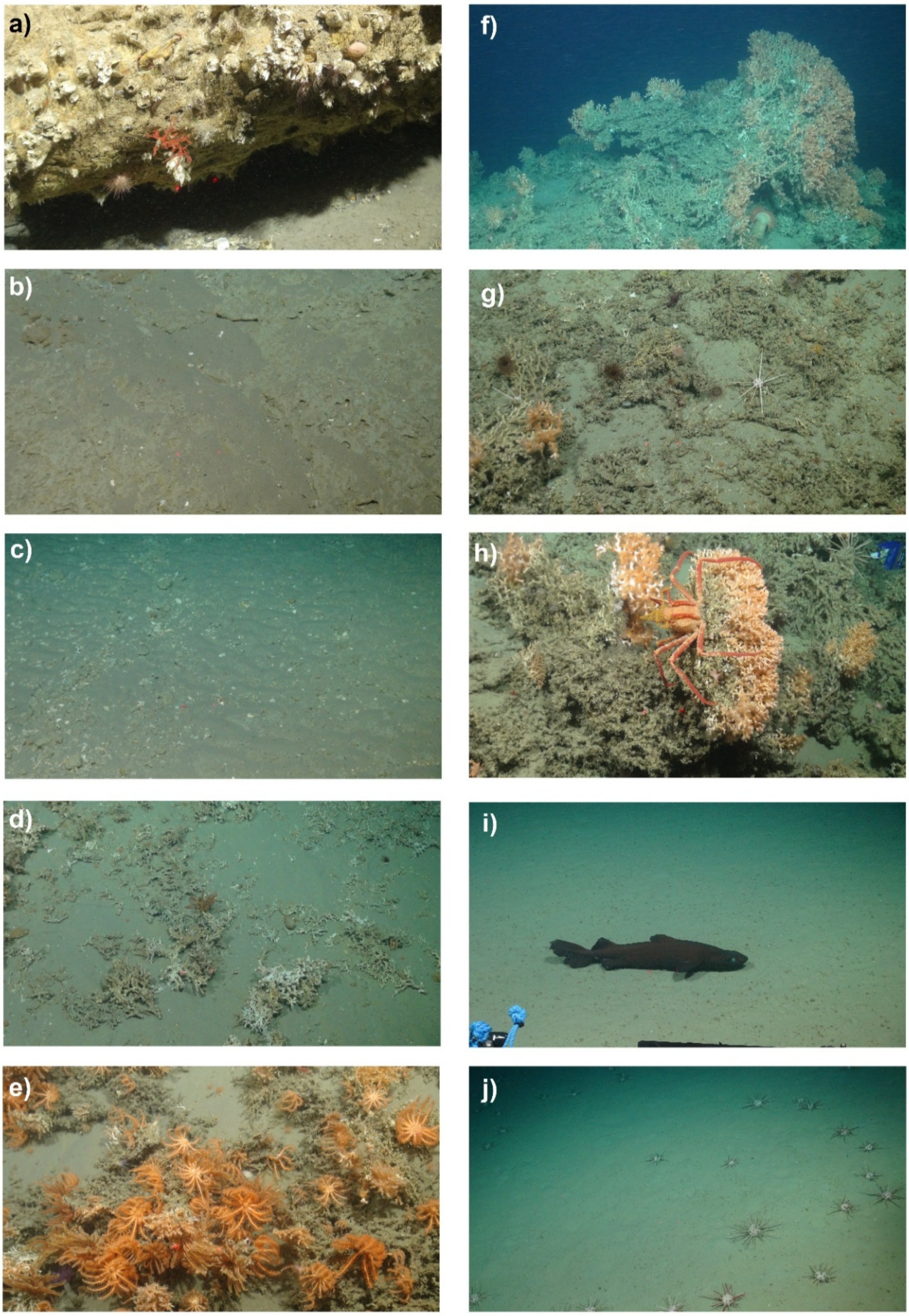


Fig. 13.4 Images captured by the Scorpio camera on ROV Isis dive 246; a) barnacles and gorgonian growing at canyon wall base, b) exposed sedimentary rocks, c) rippled sediment with coarse fraction, d) coral rubble, e) coral rubble, live coral and epifaunal Brisingid spp., f) large Lophelia pertusa colony, g) coral rubble and live coral matrix with associated anemone, black coral, sponge and urchin spp. community, h) coral with associated crab and litter, i) deep-sea sleeper shark, j) soft sediment with urchin aggregation.

ROV *Isis* left the seabed at 03:37 on 18 Aug, after collecting approximately 13 hrs of video data, 2048 photographs, four biological samples (a starfish, a purple anemone, two *Cidaris sp*. urchins) and two sediment 'push' cores.

During the dive lost/discarded fishing gear was encountered on the seabed and in mid-water, resulting in avoiding action being taken. The gear appeared to be attached to the canyon wall and was strung across a gully. This influenced the design of the next dive as efforts were made to avoid further gear encounters.

ROV Isis dive 247

Isis dive 247 took place in Explorer Canyon in the vicinity of transect 2, which was requested by JNCC. This transect was designed to assess coral presence, as predicted by a model created by Howell *et al*. (2010). However, the dive was modified to take into account observations of both coral and fishing gear during dive 246. The largest cold-water coral colonies in dive 246 were observed upon a projecting spur of the canyon wall. Thus, the plan for dive 247 was adjusted to intersect only the coral model cells of highest probability, before diverting to a spur to search for coral between 950 and 750 m water depth. The path to the spur was also adapted to try and reduce potential fishing gear encounters by avoiding gullies with a NW-SE orientation, across which gears could be draped in mid-water in a NE-SW direction.

The dive started in the thalweg of the canyon at 11:02 on 18 Aug, and rippled sands with cobbles and boulders were observed (Fig. 13.5). At the foot of the canyon wall, exposed sedimentary rocks were present and were draped with (recent) muddy sediments. The gradient of the canyon wall steadily increased upwards (Fig. 13.6). Sediment-covered areas were colonised by various sea pen, stalked sponge and anemone species, with demersal fish also present (Fig. 13.5). Isolated patches of coral rubble and occasional live coral were observed, with frequency of observations increasing as the ROV progressed upslope.

A large section of discarded fishing gear was encountered, anchored to a steep wall and suspended into mid-water (Fig. 13.6). The course of the dive was therefore changed to avoid this, adapting from a northeast course to a northwest course. Further discarded gear was encountered in mid-water and the dive was again altered to pick up a new section towards the southwest before heading in a northward direction (Fig. 13.5). The dive finished at 01:34 on 19 Aug due to a fishing vessel deploying gear ahead of the ROV. Approximately 14 hrs of video data were collected, with 1,996 associated photographs, 2 sediment 'push' cores, and five biological samples.

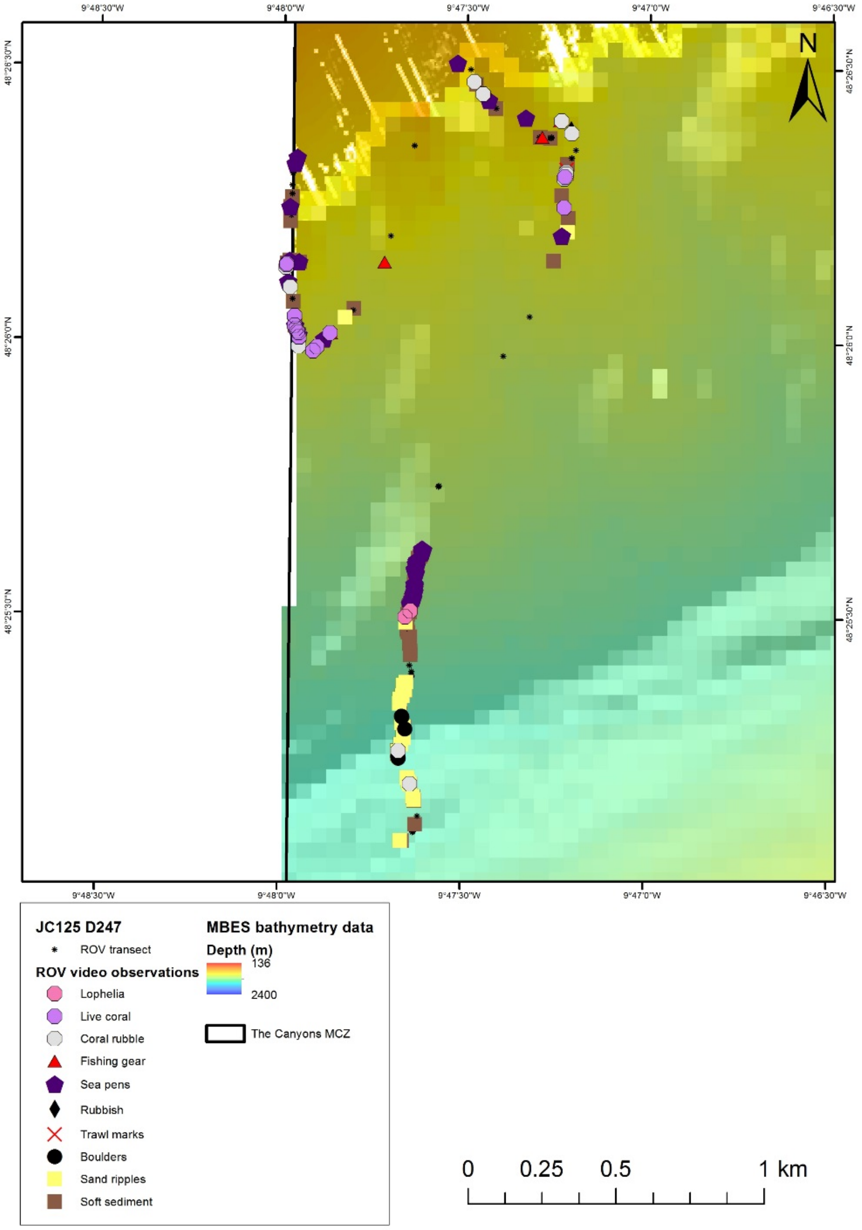


Fig. 13.5 Dive track and key observations from ROV Isis dive 247 as recorded in OFOP

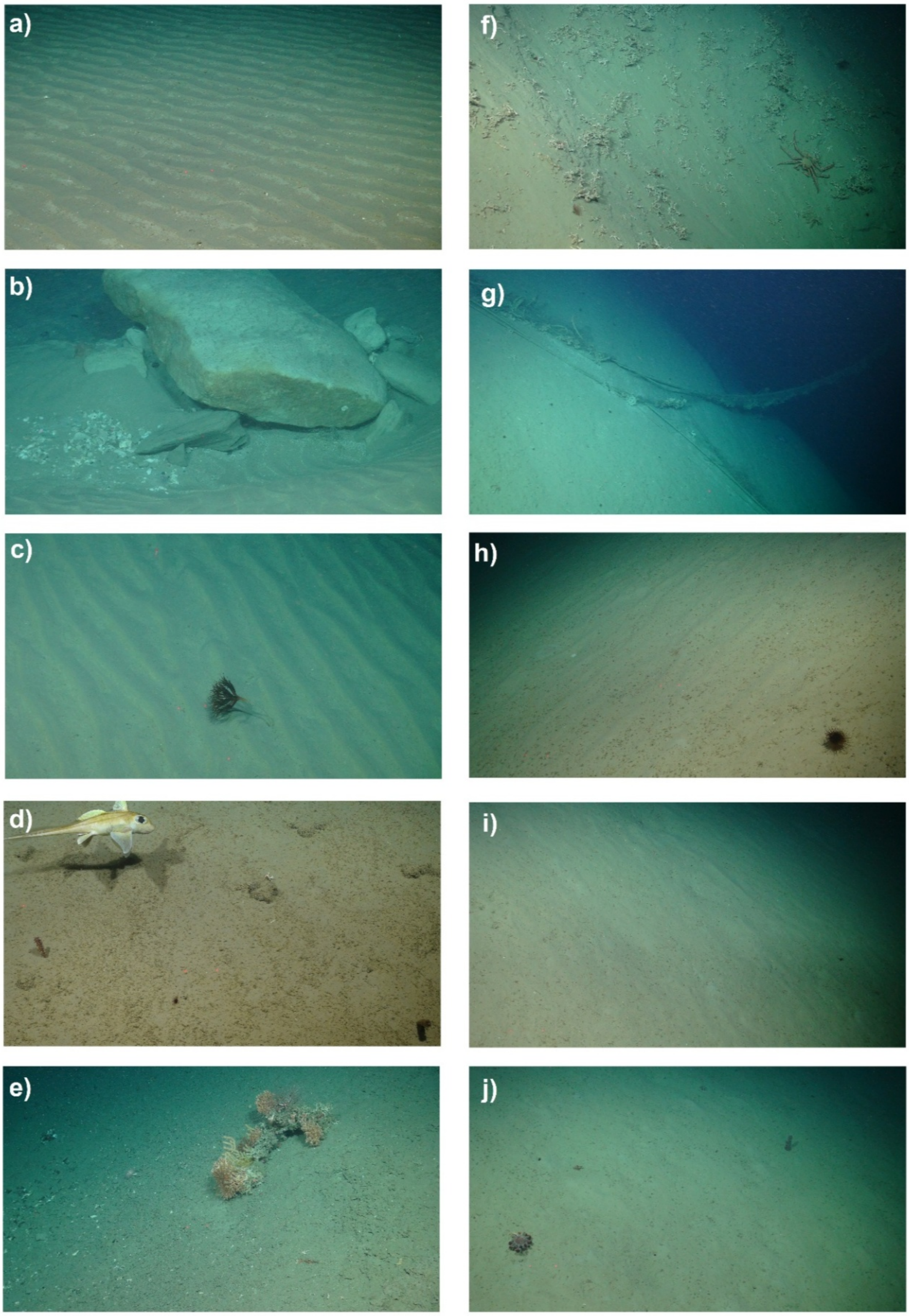


Fig. 13.6 Images captured by the Scorpio camera on ROV Isis dive 247; a) rippled sand in thalweg, b) boulders in canyon thalweg, c) Umbellula spp. sea pen, d) soft sediment with sea pens, Xenopyophores and Chimera spp., e) isolated coral rubble with live coral, gorgonian and Ophioroid spp., f) coral rubble, g) discarded fishing gear with entangled coral rubble, h) soft sediment with anemone, i) soft sediment, j) hermit crab with commensal anemone and sea pen.

ROV Isis Dive 254

Isis dive 254 also occurred in Explorer Canyon, with the first waypoint over the dense coral colonies observed during dive 246. The dive was then scheduled to progress across the canyon thalweg to the opposite wall of the canyon, and investigate this flank for evidence of features of interest (Fig. 13.7).

The ROV was on the seabed at 06:29 on 27 Aug and proceeded to further investigate the vibrant cold-water coral communities previously observed in 2007 and on dive 246. A series of panoramic scenes were recorded and close-up photographs were taken of various taxa for both library and taxonomic purposes (Fig. 13.8). Voucher specimens were also collected for further taxonomic analyses.

Following the completion of the targeted surveys, the ROV traversed the canyon thalweg, sampling sediment with push cores for geochemical analyses (Fig. 13.7). The opposite wall of the canyon comprised a vertical sedimentary rock face colonised by various sessile and vagile epifauna (Fig. 13.8). The rock exhibited bedding planes across strata of varying hardness, with sandstones forming discrete ledges. The wall was colonised by cold-water corals, gorgonians, barnacles and anemones. Occasionally, discarded fishing gear was observed, ranging from monofilament strands to more substantial ropes. At the top of the wall, soft sediment was evident, occurring in deposits thick enough for *Nephrops norvegicus* to colonise and maintain burrows (Fig. 13.7). The dive ended at 16:22 on 27 Aug. Approximately 10 hrs of video data were collected, with 1,173 associated photographs, three sediment 'push' cores and five cold-water coral samples.

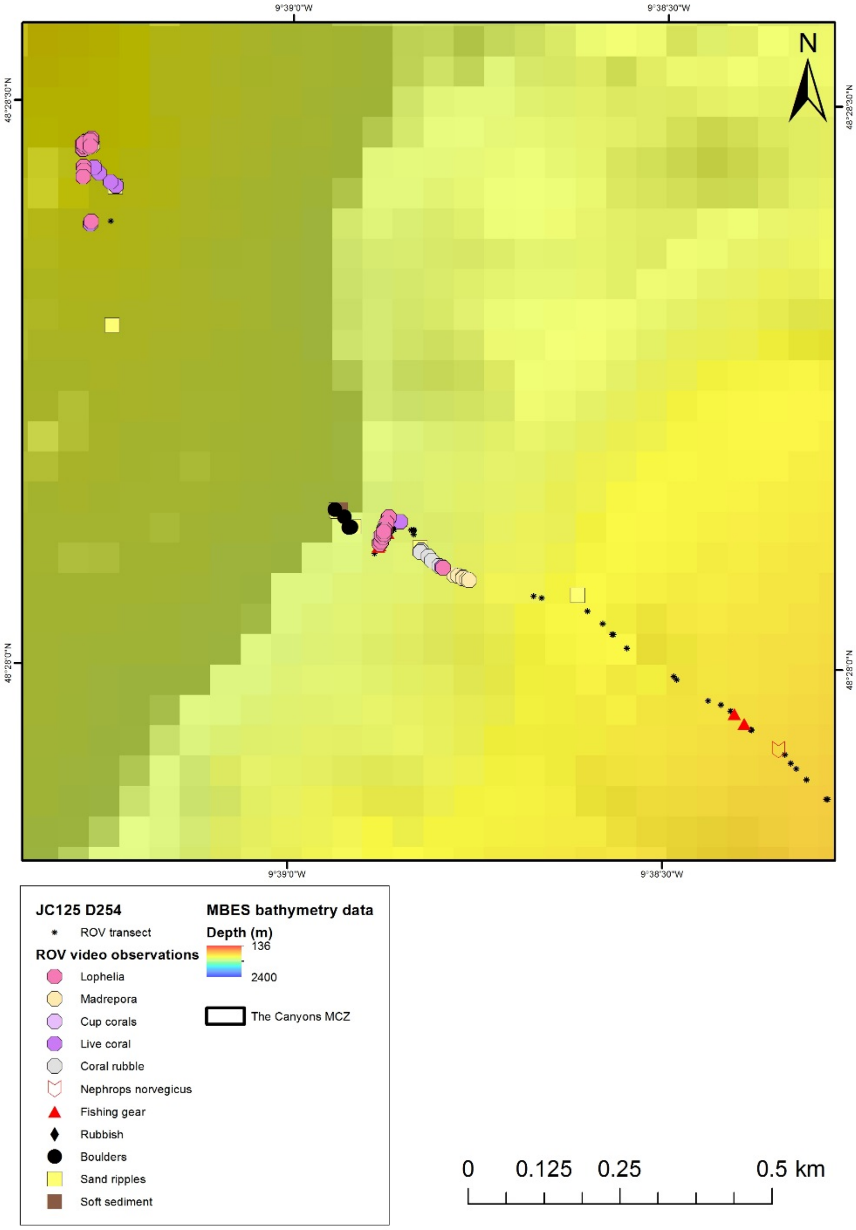


Fig. 13.7 Dive track and key observations from ROV Isis dive 254 as recorded in OFOP

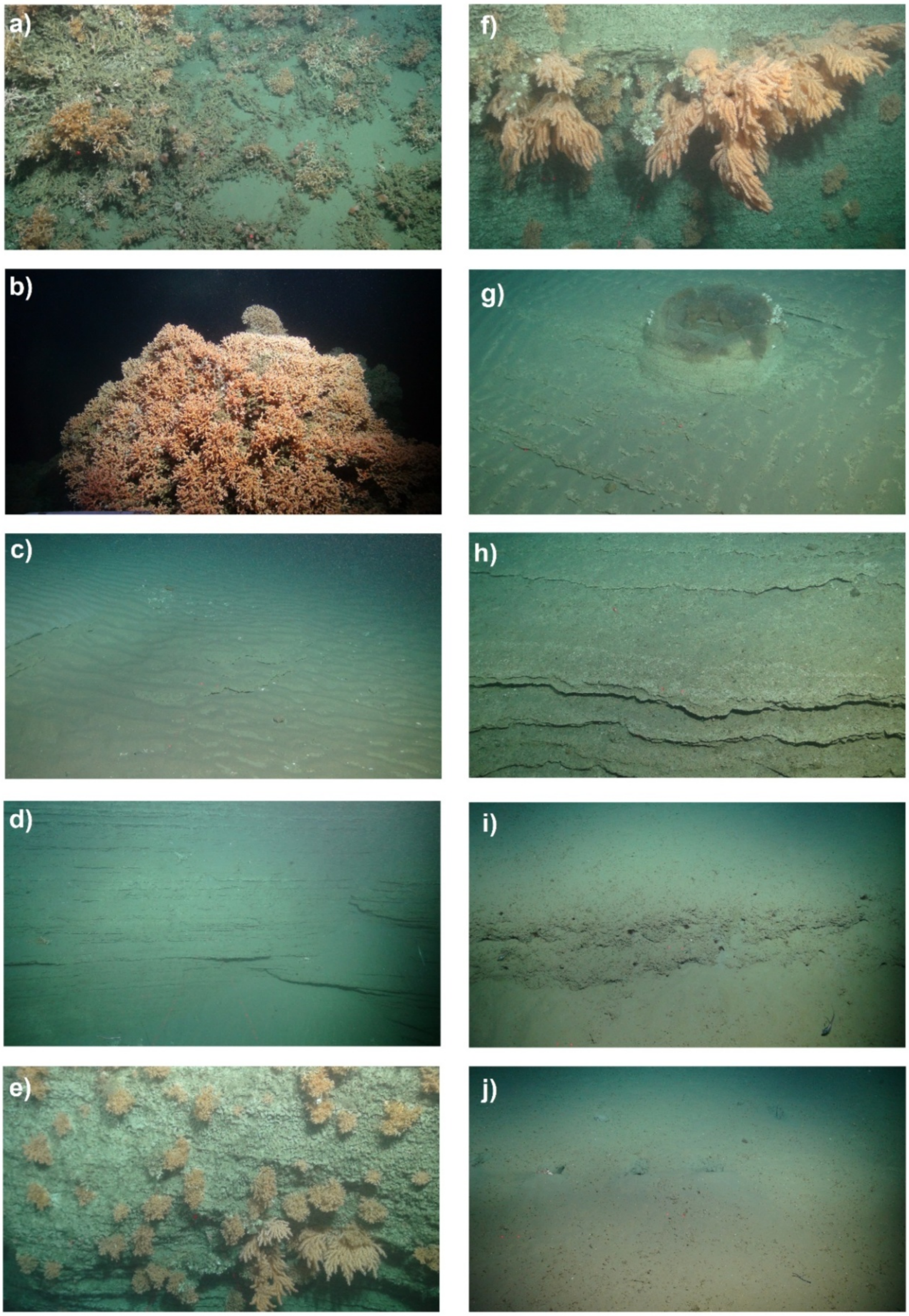


Fig. 13.8 Images captured by the Scorpio camera on ROV Isis dive 254; a) cold-water coral patches in northwest Explorer Canyon, b) cold-water coral mound, c) exposed bedrock ledges with overlying sediment, d) base of vertical wall on southeast canyon flank, e) epifaunal community on vertical wall, f) Gorgonian spp., g) isolated rock formation, h) bedded sedimentary rock, i) exposed and burrowed mudstone, j) Nephrops norvegicus burrows.

13.3. Autosub6000 missions

Autosub mission 89

Autosub6000 was deployed on an interfluve to the south of Dangeard Canyon, to investigate the presence of cold-water coral 'mini-mounds' observed in MESH MBES bathymetry data. The survey was originally planned to occur in a NW-SE orientation but this was revised to ENE-WSW due to the presence of a disused cable and increased fishing activity on the NW downslope. *Autosub6000* was deployed at 06:09 18th Aug and was recovered at 04:48 19th Aug. Upon recovery it was noted that the camera unit had failed, meaning that only SSS data were acquired (Fig. 13.9).

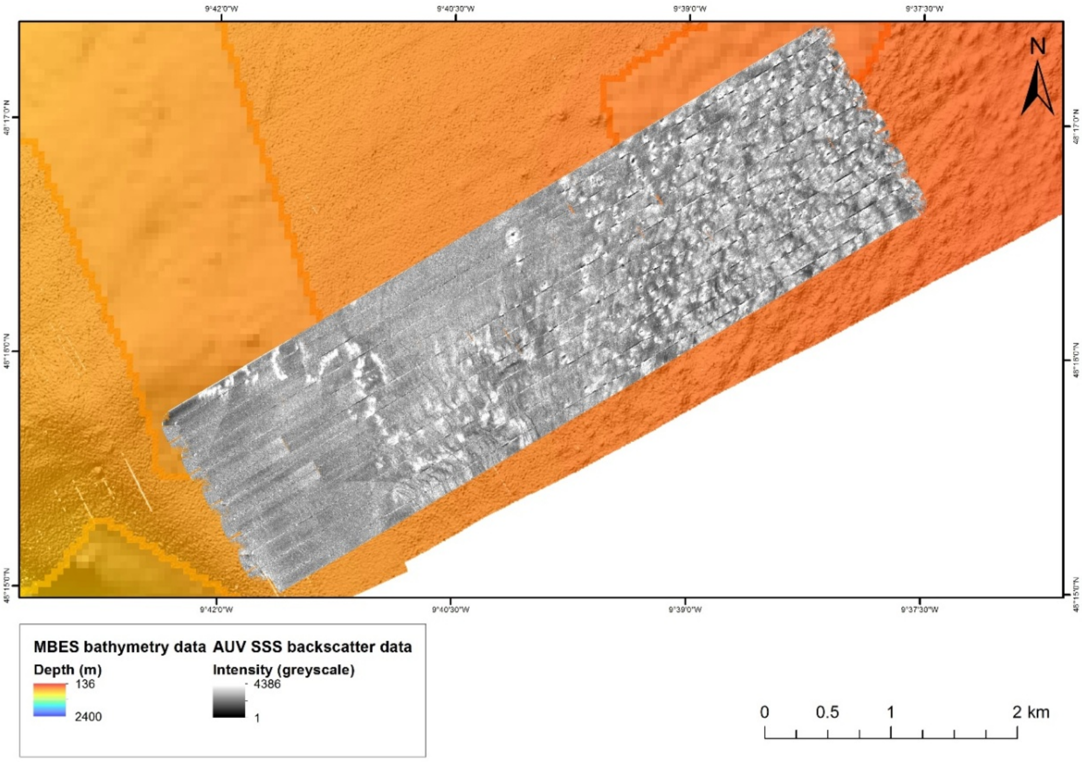


Fig. 13.9 Sidescan sonar data acquired during Autosub6000 mission 89

SSS backscatter data illustrate the presence of cold-water coral signatures, particularly in the eastern section of the data - this corresponds well with MESH MBES bathymetry data from 2007 (Fig. 13.9). However, the signatures do not appear to correspond to those of live coral structures as the acoustic shadows are less pronounced than would be expected in association with erect live coral structures. (Fig. 13.10). Evidence of fishing activity was also observed, in the form of trawl scars visible in the backscatter data (Fig. 13. 10).

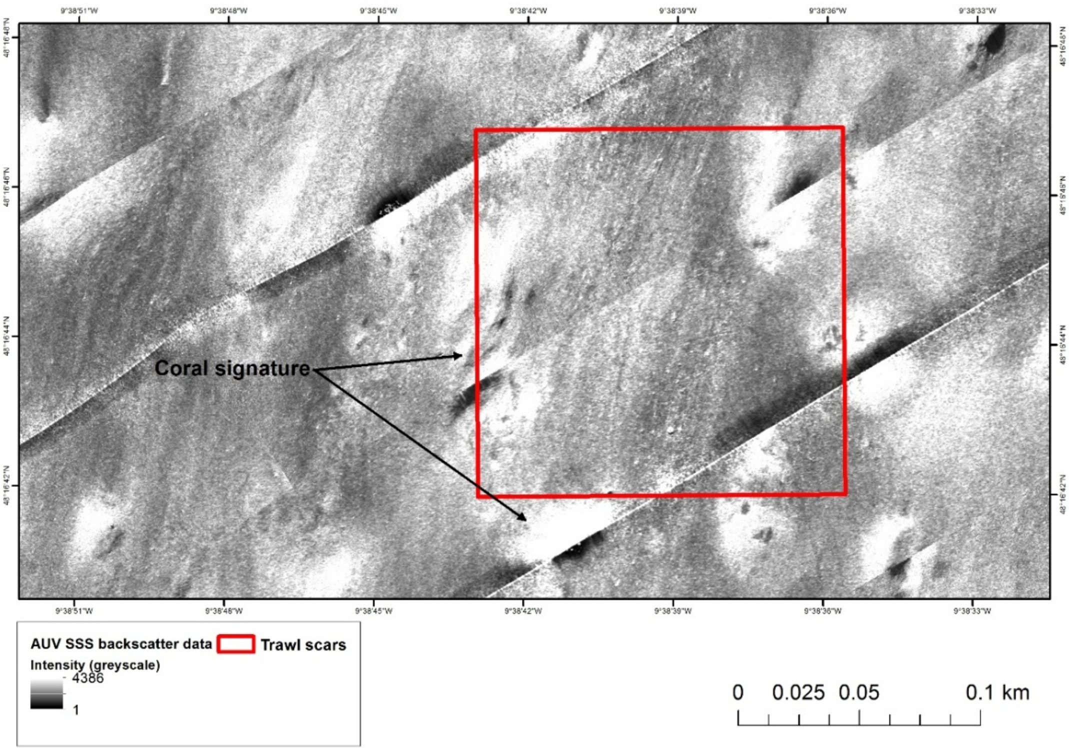


Fig. 13.10 Cold-water coral signatures and trawl scars (running NNE-SSW) observed during Autosub6000 mission 89

Autosub6000 mission 89

Autosub 6000 was deployed to acquire high resolution MBES data from within Explorer Canyon in the vicinity of the cold-water coral observed in ROV *Isis* dives 246 and 254. The AUV was programmed to survey at an altitude of 120 m above seabed and at a line spacing of 450 m. Mission 96 was underway at 12:35 1st Sep and *Autosub 6000* was recovered at 12:55 2nd Sep. Upon reviewing the data gap were evident from insufficient line spacing so a second mission, 98, was planned to complete data coverage in the area. *Autosub 6000* mission 98 occurred between 07:38 5th Sep and 04:24 6th Sep. These data were gridded at 3 m to give a high resolution bathymetric image of the area (Fig. 13.11). For a detailed discussion of the data processing and *Autosub 6000* missions please see sections 1 and 3.

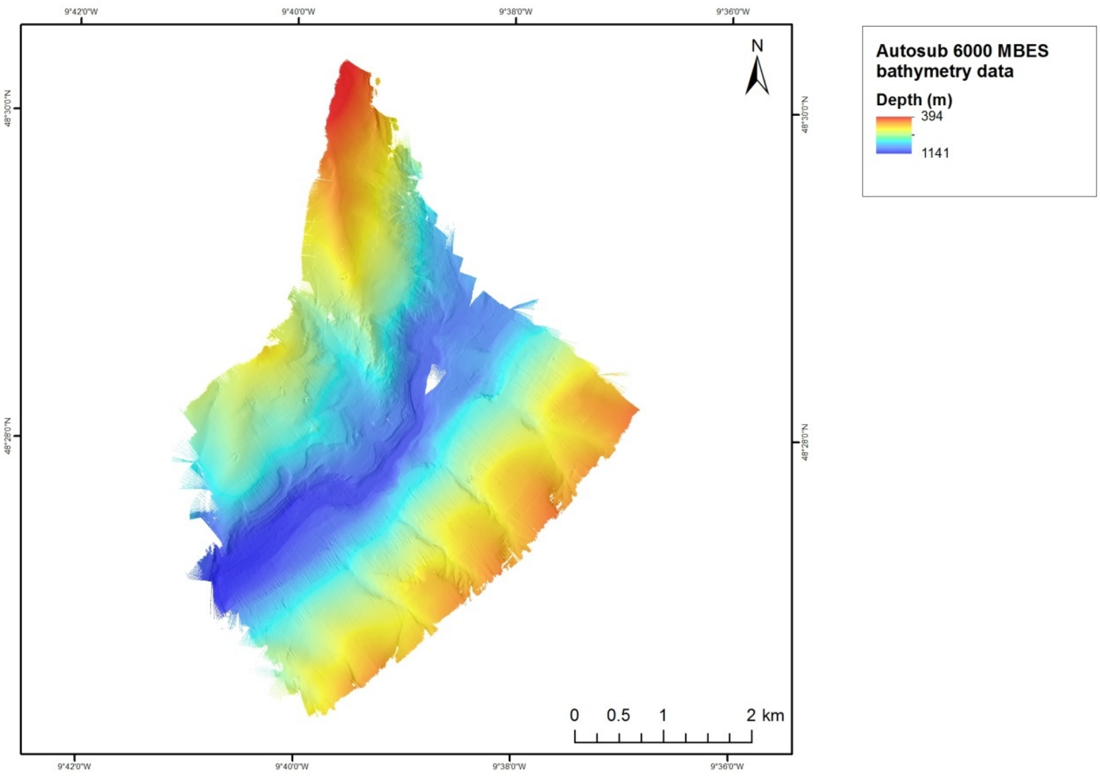


Fig. 13.11 High resolution MBES bathymetry data acquired during Autosub6000 missions 96 & 98.

13.4. ROV ISIS multibeam

ROV Isis dive 261

Isis dive 261 acquired high resolution MBES bathymetry data from within Explorer Canyon, specifically targeting the spur upon which dense cold-water coral colonies were observed during dive 246. ROV Isis was equipped with a downward looking MBES and surveyed at an altitude of 40 m. Survey lines were spaced at 160 m. The data acquired were gridded at 30 cm to produce a very high resolution MBES bathymetry image (Fig. 13.12). For a detailed discussion of the data processing please see section 3.

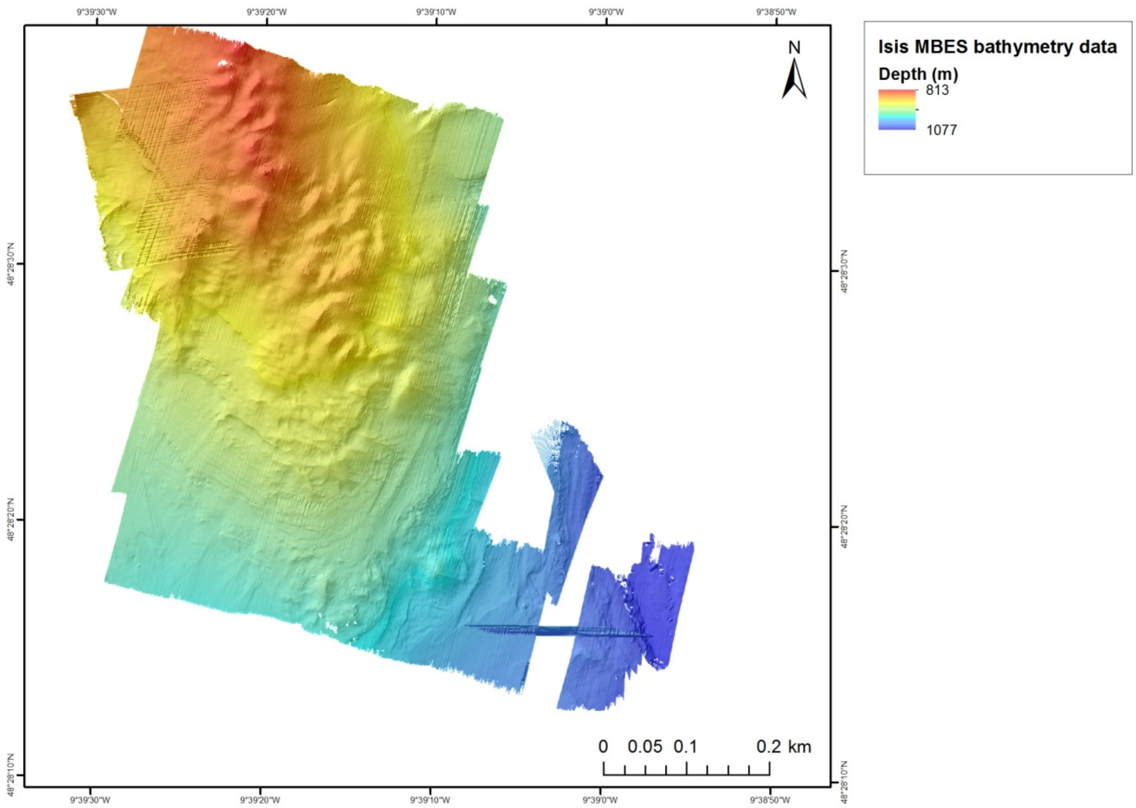


Fig. 13.12 High resolution MBES bathymetry data acquired during Isis dive 261.

14. Wildlife observations (Russell Wynn)

14.1. Summary

A total of 51 hours of marine life observations were carried out on 33 dates between 09 Aug and 12 Sept 2015 during RRS *James Cook* expedition 124/125/126. Apart from five dates at the start and end of the expedition, when the ship was in shelf waters off southwest UK, all observations were carried out in the vicinity of Whittard Canyon (within both UK and Irish waters). A full species list for the cruise is attached in Appendix F.

Fig. 14.1 Great Shearwater and Autosub6000

A total of five cetacean species were recorded, with the highlight being the first Blue Whale to be photographed in English (and possibly UK) waters, at a depth of 3270 m in southern Whittard Canyon. At least 20, and possibly as many as 40 Fin Whales were seen, in loose aggregations of up to seven animals. Common Dolphin was the most frequently encountered cetacean with several hundred observed, typically in loose aggregations of tens of animals. Smaller numbers of Long-finned Pilot Whales and Bottlenose Dolphins were also noted. There was clear evidence for habitat partitioning of cetacean species, with Fin Whales restricted to deep waters (>1-2 km) in the west and southwest of the canyon, Common Dolphins mostly seen in shelf edge and upper slope environments in the north and northeast of the canyon, and Pilot Whales at intermediate depths on the upper slope.

The seabird assemblage in the Whittard Canyon study area typically comprised Fulmar, Great Shearwater, Cory's Shearwater, European Storm Petrel, Gannet and Lesser Black-backed Gull, with 100+ of each recorded. Great Shearwaters were particularly abundant, with a regular flock around the ship peaking at 270 on 25 Aug. Smaller numbers of Sooty

Shearwater, Manx Shearwater, Grey Phalarope, Great Skua, Pomarine Skua, Arctic Skua, Long-tailed Skua, Sabine's Gull, Black-headed Gull, Yellow-legged Gull and Arctic Tern were also recorded. Of particular note was a single Balearic Shearwater on the outward passage through the English Channel, a juvenile Shag that arrived on board ~400 km off southwest UK, and up to eight Wilson's Storm Petrels over the upper reaches of Whittard Canyon.

Land bird migrants seen on or around the ship included Ringed Plover, Whimbrel, Turnstone, Feral (Racing) Pigeon, Pied/White Wagtail, Redstart, Robin, Wheatear, Reed Warbler, Chiffchaff and Willow Warbler. Southeast winds on 8-9 Sept produced an influx of migrant insects, including a Convolvulus Hawk-moth and several Rush Veneer and Green Lacewing.

An Ocean Sunfish was observed in the Haig Fras work area, and up to 12 Blue Sharks were regularly seen around the ship in the upper reaches of Whittard Canyon (often harassing loafing Great Shearwaters). Finally, a rare Broad-billed Swordfish was imaged using ROV *Isis* in deep waters of southern Whittard Canyon, within the English part of the UK EEZ.

14.2. Methods

In order to characterise the cetacean and seabird assemblage in different areas of Whittard Canyon, marine life observations were carried out daily (usually 1-2 hours). The observation point was typically just aft of the bridge, in a relatively sheltered location ~20m above sea level. Observations were always carried out with an 180^{o} field of view, and comprised one continuous scan with 12x50 binoculars every ~5 minutes, and regular binocular/visual scanning of specific targets to confirm identifications. In many cases, photos and/or video were also obtained to aid identification.

Whenever possible, counts were undertaken in one-hour blocks. Due to the nature of the work being undertaken, the ship was often stationary. At these times, counts of birds loafing around the ship should be treated as minima, i.e. the number counted in a single scan. Meteorological and ship data relevant to the observations were recorded when available. Sea surface temperature in the work area ranged from 16-18^{o}C, and water depth from 100-4000 m. The horizon was deemed to be at 15 km range, and visibility was classified into distance bands on this basis.

14.3. Weekly summary of observations

<u>Week one (9-15 Aug) 19.5 hrs of observations</u>

Our initial passage out of Southampton and through the western English Channel on 9 Aug was unexceptional, with the only notable sightings being a Balearic Shearwater associating with 130 Manx Shearwaters in the southwest part of Lyme Bay (a known shearwater hotspot), and single juvenile Mediterranean and Yellow-legged Gulls.

Our work area for the next three days (10-12 Aug) was Haig Fras, an isolated rocky reef on the continental shelf off southwest UK at 100 m water depth. The commonest seabirds were Fulmars, European Storm Petrels, Gannets and Lesser Black-backed Gulls, often aggregating around the stationary ship. Other seabirds included small numbers of Great Shearwaters, Cory's Shearwaters, Arctic Skuas and Great Skuas. Land bird migrants alighting on the ship included Wheatear and Willow Warbler, while a Turnstone briefly circled. The only cetaceans noted were a pod of at least 25 Common Dolphins, closely tracked by 60 Gannets. A single Ocean Sunfish was also recorded.

Fig. 14.2 Juvenile Yellow-legged Gull

We then transferred to our main work area on 13 Aug at Whittard Canyon, which is located beyond the shelf edge in the northern Bay of Biscay. Our first foray into the deeper waters of the canyon quickly produced one of our main target species, the Fin Whale. Up to six animals were seen in Irish waters on 14-15 Aug at depths of 2500-3200m, including four in a loose aggregation.

Fig. 14.3 Fin Whale – note the vertical blow, prominent dorsal fin and smooth dark grey back

Seabirds were relatively scarce in these deep waters, but Cory's Shearwaters were seen in small numbers and flocks of Arctic Terns trickled south. Things got much busier whenever we visited the shallower waters around the shelf edge, where a similar seabird assemblage to Haig Fras was observed. Highlights included the first Sooty Shearwaters of the trip and an immature Pomarine Skua, as well as regular encounters with bow-riding Common Dolphins.

Fig. 14.4 Immature Pomarine Skua

<u>Week two (16-22 Aug) 11.5 hrs of observations</u>

The second week of the expedition saw us mostly working in and around the upper part of Whittard Canyon. Much of this work involved long periods on station, which would often lead to large aggregations of loafing seabirds around the ship. Peak counts included 145 Fulmars, 78 Great Shearwaters and 60 European Storm Petrels, while up to six Wilson's Storm Petrels were recorded (including two in UK waters). Five pristine juvenile Long-tailed Skuas were seen briefly, as well as a single dark phase Pomarine Skua.

Some of the most interesting sightings came at night, when birds were attracted to the ship's lights. Small numbers of Grey Phalaropes and flocks of migrating Arctic Terns were regularly noted, and snorkelling Great Shearwaters could be seen chasing fish at the surface.

Fig. 14.5 Great and Sooty Shearwaters loafing around the ship

Migrant land birds on board included Redstart and Reed Warbler (the latter found hopping around inside the forward hold!), with Ringed Plover, Whimbrel and Turnstone seen overhead. More surprising was a tatty juvenile Shag that arrived on board on 19 Aug at >4 km water depth, several hundred kilometres from land!

Fig. 14.6 Juvenile Long-tailed Skuas

Fig. 14.7 Juvenile Shag on the aft deck

Fig. 14.8 Immature male Redstart perched on the aft deck crane (left) and Reed Warbler on the foredeck

As well as seabirds, the stationary ship also attracted small numbers of Blue Sharks. In addition, to seeing one from the ship (in the same field of view as a pod of Common Dolphins and a Wilson's Storm Petrel), we were lucky to capture video and images of several individuals from ROV *Isis* when it passed through surface waters on its way to and from the seabed.

Fig. 14.9 Blue Sharks photographed using ROV Isis

Cetacean sightings included regular encounters with pods of 20-80 Common Dolphins and 3-15 Long-finned Pilot Whales; a single pod of 40+ offshore Bottlenose Dolphins was also seen. However, the most remarkable cetacean sighting was of a lone juvenile Pilot Whale, seen continually surfacing alongside the ship for most of the day on 18 June. This apparently orphaned animal was evidently in some distress, which became even more apparent when it reappeared alongside the vessel two days later some 50km to the southwest!

Fig. 14.10 Immature Pilot Whale surfacing alongside the ship

Week three (23-29 Aug) 14.5 hrs of observations

The third week of the trip saw the weather become more unsettled, with a dominance of westerly winds that at times exceeded 30 mph. This led to an influx of seabirds into the Whittard Canyon work area, including a regular flock of Great Shearwaters loitering around the ship that peaked at 270 on 25 Aug.

Fig. 14.11 Flock of Great Shearwaters resting on the water

Fig. 14.12 Great Shearwaters loafing around the ship

Other notable seabirds included 53 Grey Phalaropes, four Pomarine Skuas, three Long-tailed Skuas, three Sabine's Gulls, two Wilson's Storm Petrels (one in UK waters), and a juvenile Yellow-legged Gull.

Fig. 14.13 Wilson's Storm Petrel – note the pale upperwing bar, legs projecting beyond the tail tip, and the straight rear edge to the wing

During calmer interludes up to 12 Blue Sharks could be seen circling the stationary ship, often harassing loafing Great Shearwaters and Lesser Black-backed Gulls settled on the water. Blue Sharks were also regularly seen from ROV *Isis* during ascent/descent, with up to six in the camera at any one time. However, the two highlights of the week came on 24 Aug, and involved iconic animals that have rarely, if ever, been photographed alive in UK waters. The first was a Broad-billed Swordfish, captured on ROV video at several hundred metres water depth as it flashed by.

Fig. 14.14 Left: Blue Shark (foreground) swimming amongst Great Shearwaters alongside the ship. Right: Broad-billed Swordfish captured on video by ROV Isis

The second was altogether on a larger scale: a Blue Whale seen and photographed as it surfaced several times alongside the stationary ship. Both of these animals were within the English portion of the UK EEZ in water depths >3 km, and the Blue Whale would appear to be the first photographed individual of this species in English waters.

Fig. 14.15 Blue Whale – note the mottled blue-grey colouration, small stubby dorsal fin, and large prominent splashguard

Fig. 12. 16 Blue Whale – note the mottled blue-grey colouration, small stubby dorsal fin, and large prominent splashguard

Fin Whales were also regularly encountered in deep waters (>1 km depth), with a minimum of seven being positively identified and a maximum of 22 seen (if all tall distant blows were attributed to this species). Other cetaceans included three Pilot Whales, a pod of 25 Bottlenose Dolphins and at least 100 Common Dolphins.

The westerly winds meant that migrating land birds were scarce, with just single Chiffchaff and Wheatear seen on board.

<u>Week four (30 Aug to 5 Sept) 10.5 hrs of observations</u>

A quieter week with light to moderate north and northeast winds dominating, and most work undertaken in the upper part of NE Whittard Canyon at depths of 200-1000m.

Great Shearwaters continued to be the commonest seabird, with the regular loafing flock around the ship peaking at 120 birds on 4 Sept (and sporadically being terrorised by Great Skuas!). Small numbers of Sooty Shearwater, Pomarine Skua, Long-tailed Skua and Grey Phalarope were also seen, with one of the latter being chased by a juvenile Long-tailed Skua on 30 Aug. Cory's Shearwaters were most often encountered associating with Common Dolphins, with at least 30 seen on 1 Sept.

Fig. 14.17 Great Skua attacking Great Shearwaters

Common Dolphins were recorded on most days, both during dedicated watches and at night when they were seen chasing fish attracted to the ship's lights. Numbers were usually small, with counts typically numbering a few tens of animals. A pod of four Pilot Whales was seen on 4 Sept, and large Tuna (possibly Bluefin Tuna) were seen feeding at the surface on two occasions.

Land birds were again scarce, with single Pied/White Wagtail, Wheatear and Chiffchaff recorded.

Fig. 14.18 Sooty and Great Shearwaters

Fig. 14.19 Long-finned Pilot Whale

Week five (6-12 Sept) 5.5 hrs of observations

A continuation of the mild east/southeast airflow saw an influx of insects and land birds on the ship, including a Convolvulus Hawk-moth and good numbers of Rush Veneer and Green Lacewing. These provided sustenance for a Robin and Reed Warbler that arrived on deck.

Fig. 14.20 Convolvulus Hawk-moth (left) and Rush Veneer (right)

Observations in the northeast sector of Whittard Canyon included small numbers of Great, Manx, Cory’s and Sooty Shearwaters, and singles of Grey Phalarope and Sabine’s Gull. Common Dolphins were again seen regularly, and another Blue Shark was observed at the surface.

Fig. 14.21 Common Dolphin

15. Outreach (Leigh Marsh, Tahmeena Aslam, Raissa Hogan)

Prior to the cruise, a blog (http://codemap2015.wordpress.com; Fig. 13.1) and a Twitter account (www.twitter.com/codemap2015) were set up so that information about the cruise could be communicated to a wider audience.

15.1. Blog

Almost all members of the scientific party had some part in writing a blog post, leading to posts covering a wide variety of subjects and disciplines from all participating institutes. This also meant that not just one person was relied upon to create content and as a result, there were regular posts throughout the duration of the cruise. The constant updating and variety of subjects covered may have played a role in the success of the blog (Figs.13.2, 13.3).

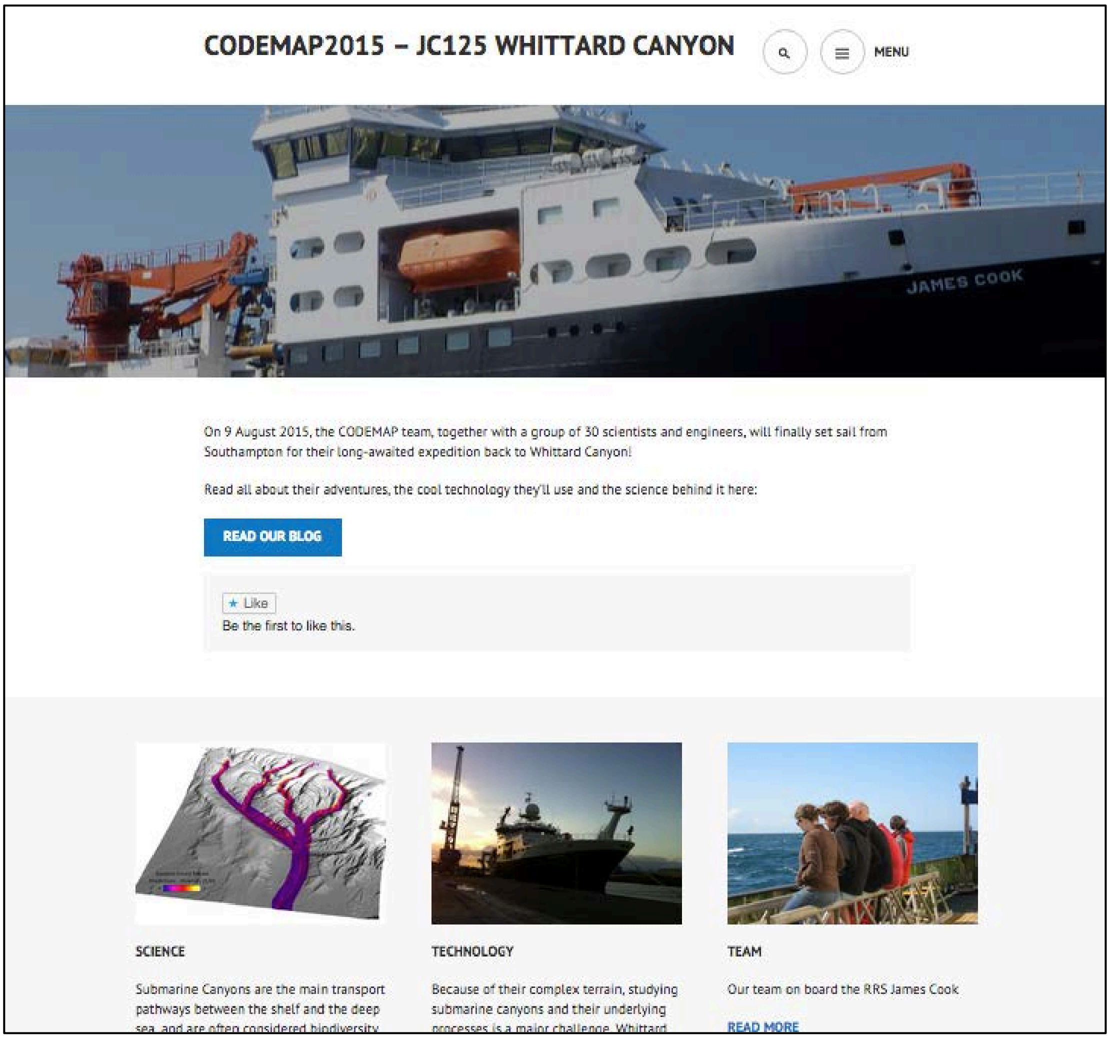


Fig. 15.1 Screen-shot of the CODEMAP2015 cruise website

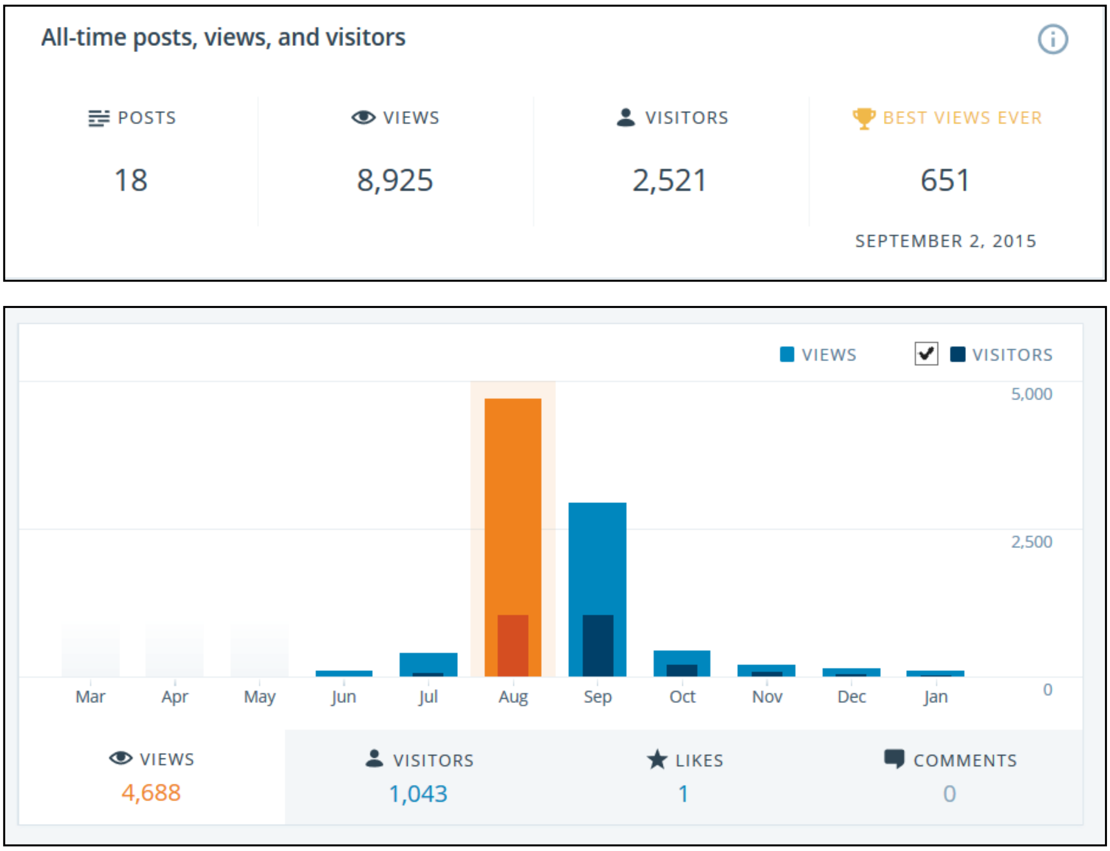


Fig. 15.2 Overall statistics of CODEMAP2015 blog popularity (as recorded on 8 Jan 2016)

15.2. Twitter

By the end of the cruise, the Twitter account had gained 209 followers and can be considered a success (Fig. 13.4). The use of the Twitter allowed two-way interaction: we were asked questions by both colleagues and members of the public. In addition, we received many positive responses to when trying to determine the species of animals that the ROV had recorded on previous dives.

Hosting a Twitter account is a less time consuming way of sharing information than hosting a blog. As a result, the Twitter account was updated more regularly. It was noted that when the NOC twitter account, @NOC_news, retweeted content from the @codemap2015 feed, a larger audience was reached. Therefore in future, greater support must be given by institutional communications teams to the content created by scientists, so as to enable the greatest outreach impact.

Fig. 15.3 Background of visitors to the CODEMAP2015 website in the month of August 2015

15.3. Media

Two specific press releases were prepared in relation to the CODEMAP2015 expedition: one to communicate about the sighting of the blue whale (see Section 12), and one at the end of the cruise. With some strategic approaching of specific contacts in the media by R.Wynn, the blue whale story was picked up quickly and appeared on the front page of numerous newspapers the next day (including The Guardian, Fig. 13.5). There were also radio interviews and a phone interview with Sky News.

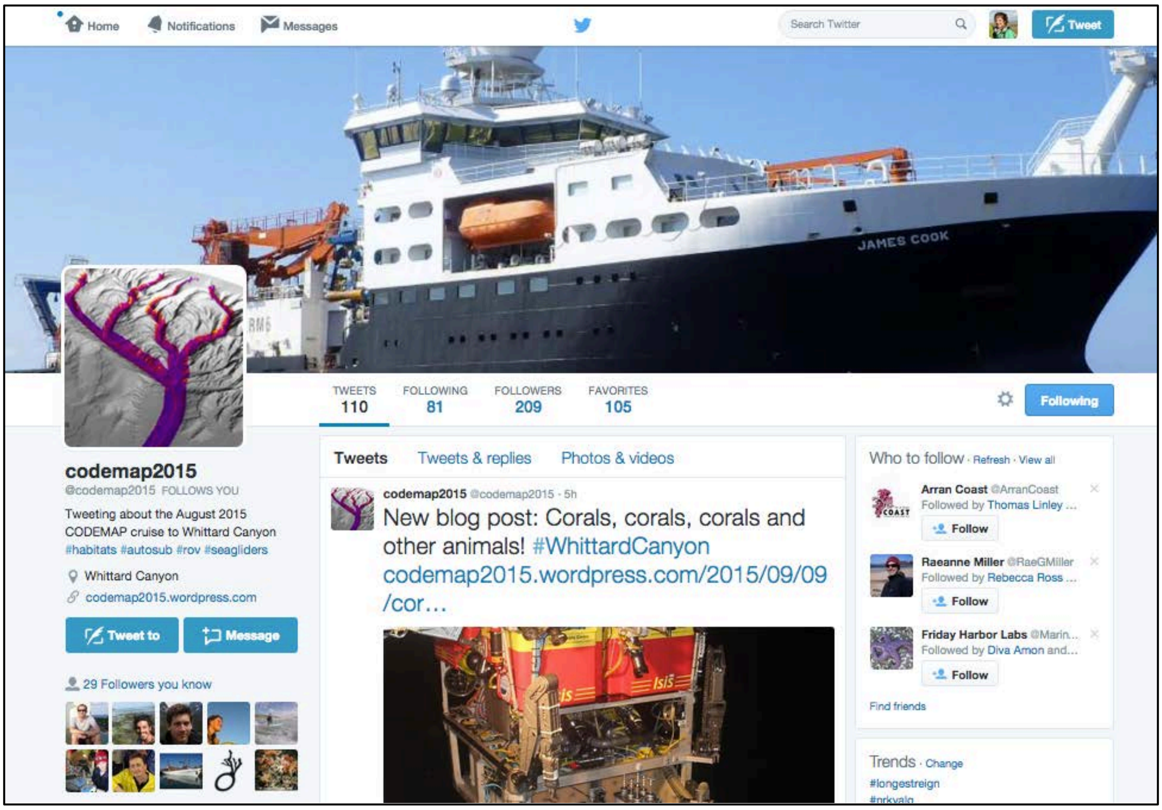


Fig. 15.3 Screen-shot of CODEMAP2015 Twitter front page

Fig. 15.5 Screen-shot of the Guardian newspaper with the Blue Whale story

The press release about the entire cruise somehow created less impact, even though video footage and photographs of the corals were released with it. However, this time it was simply relased via the NOC and ERC Comms channels, rather than being sent to specific contacts in the media, which may have been a less effective way of spreading the information.

15.4. Other Outreach

On the 7th September 2015, the CODEMAP project streamed ROV footage live to the British Science Festival in Bradford. Colleagues from University of Southampton, Plymouth University and the Natural History Museum were hosting a session entitled the "Deep-sea ecosystems of the UK" (Fig. 13.6). Initially, the audience was shown a prepared highlights video created from recent footage acquired during JC125. After this brief introduction, the ship was able to contact the session and footage from the ROV Isis was streamed live to the audience and a Skype call was used to narrate the ROV dive in progress. This was a first for a UK NERC research vessel and was a complete success. Support from IT and Sea Systems Tech Martin Bridger (NMFSS) was invaluable to achieve this milestone.

Initial feedback from evaluation forms at the event were unanimously positive (comments including "wow!", "fantastic", "fascinating!"). And also: 71% of the surveyed audience did not previously know that the UK has research ships and a deep-sea ROV, operated by NERC (but now they do!). Again, this illustrates the importance of the outreach activities.

Fig. 15.6 Twitter feeds from Jon Copley and Adrian Glover illustrating the session at the Bradford Science Festival that was featuring live CODEMAP2015 ROV video.

REFERENCES

Allen, S.E., Hickey, B.M., 2010. Dynamics of advection-driven upwelling over a shelf break submarine canyon. Journal of Geophysical Research 115, C08018.

Amaro, T., de Stigter, H., Lavaleye, M., Duineveld, G., 2015. Organic matter enrichment in the Whittard Channel; its origin and possible effects on benthic megafauna. Deep-Sea Research I 102, 90-100.

Chase, J.M., Leibold, M.A., 2003. Ecological niches: linking classical and contemporary approaches. University of Chicago Press, Chicago.

Cunningham, M.J., Hodgson, S., Masson, D.G., Parson, L.M., 2005. An evaluation of along- and down-slope sediment transport processes between Goban Spur and Brenot Spur on the Celtic Margin of the Bay of Biscay. Sediment. Geol. 179, 99-116.

Danovaro, R., Gambi, C., Dell'Anno, A., Corinaldesi, C., Fraschetti, S., Vanreusel, A., Vincx, M., Gooday, A.J., 2008. Exponential decline of deep-sea ecosystem functioning linked to benthic biodiversity loss. Current Biology 18, 1-8.

Duros, P., Fontanier, C., Metzger, E., Pusceddu, A., Cesbron, F., de Stigter, H.C., Bianchelli, S., Danovaro, R., Jorissen, F.J., 2011. Live (stained) benthic foraminifera in the Whittard Canyon, Celtic margin (NE Atlantic. Deep-Sea Research I 58, 128-146.

Gunton, L.M., Gooday, A.J., Glover, A.G., Bett, B.J., 2015. Macrofaunal abundance and community composition at lower bathyal depths in different branches of the Whittard Canyon and on the adjacent slope (3500m; NE Atlantic). Deep-Sea Research I 97, 23-39.

Huvenne, V.A.I., Georgiopoulou, A., Chaumillon, L., Lo Iacono, C., Wynn, R.B., 2015. Novel method to map the morphology of submarine landslide headwall scarps using Remotely Operated Vehicles, in: Lamarche, G., Mountjoy, J., Bull, S., Hubble, T., Krastel, S., Lane, E., Micallef, A., Moscardelli, L., Mueller, C., Pecher, I., Woeltz, S. (Eds.), Submarine mass movements and their consequences. 7th International Symposium. Springer, Heidelberg, pp. 135-144.

Huvenne, V.A.I., McPhail, S.D., Wynn, R.B., Furlong, M., Stevenson, P., 2009. Mapping giant scours in the deep ocean. EOS 90, 274-275.

Huvenne, V.A.I., Tyler, P.A., Masson, D.G., Fisher, E.H., Hauton, C., Hühnerbach, V., Le Bas, T.P., Wolff, G.A., 2011. A picture on the wall: innovative mapping reveals cold-water coral refuge in submarine canyon. PLoS One 6, e28755.

Ingels, J., Tchesunov, A.V., Vanreusel, A., 2011. Meiofauna in the Gollum Channels and the Whittard Canyon, Celtic Margin - how local environmental conditions shape Nematode structure and function. PLoS One 6, e20094.

Ismail, K., 2015. Marine landscape mapping in submarine canyons, Ocean and Earth Science. University of Southampton, Southampton, p. 151.

Ismail, K., Huvenne, V.A.I., Masson, D.G., 2015. Objective automated classification technique for marine landscape mapping in submarine canyons. Marine Geology 362, 17-32.

Johnson, M.P., White, M., Wilson, A., Würzberg, L., Schwabe, E., Folch, H., Allcock, L., 2013. A vertical wall dominated by Acesta excavata and Neopycnodonte zibrowii, part of an undersampled group of deep-sea habitats. PLoS One 8, e79917.

Morris, K.J., Tyler, P.A., Masson, D.G., Huvenne, V.A.I., Rogers, A.D., 2013. Distribution of cold-water corals in the Whittard Canyon, NE Atlantic Ocean. Deep-Sea Research II 92, 136-144.

Robert, K., 2014. Evaluation of local- and medium-scale habitat heterogeneity as proxy for biodiversity in deep-sea habitats, Ocean and Earth Science. University of Southampton, Southampton, p. 240.

Robert, K., Jones, D.A.B., Huvenne, V.A.I., 2014. Megafaunal distribution and biodiversity in a heterogeneous landscape: the iceberg-scoured Rockall Bank, NE Atlantic. Marine Ecology Progress Series, 67-88.

Robert, K., Jones, D.O.B., Tyler, P.A., Van Rooij, D., Huvenne, V.A.I., 2015. Finding the hotspots within a biodiversity hotspot: fine-scale biological predictions within a submarine canyon using high-resolution acoustic mapping techniques. Marine Ecology 36, 1256-1276.

Ryan, J.P., Chavez, F.P., Bellingham, J.G., 2005. Physical-biological coupling in Monterey Bay, California: topographic influences on phytoplankton ecology. Marine Ecology Progress Series 287, 23-32.

Stewart, H.A., Davies, J.S., Guinan, J.C., Howell, K.L., 2014. The Dangeard and Explorer Canyons, South-West Approaches, UK: Geology, sedimentology and newly discovered cold-water coral mini-mounds. Deep-Sea Research II 104, 230-244.

Toucanne, S., Zaragosi, S., Bourillet, J.F., Dennielou, B., Jorry, S.J., Jouet, G., Cremer, M., 2012. External controls on turbidite sedimentation on the glacially-influenced Armorican margin (Bay of Biscay, western European margin. Marine Geology 303-306, 137-153.

Toucanne, S., Zaragosi, S., Bourillet, J.-F., Naughton, F., Cremer, M., Eynaud, F., Dennielou, B., 2008. Activity of the turbidite levees of the Celtic-Armorican margin (Bay of Biscay) during the last 30,000 years: imprints of the last European deglaciation and Heinrich events. Marine Geology 247, 84-103.

Van Rooij, D., De Mol, L., Le Guilloux, E., Wisshak, M., Huvenne, V.A.I., Moeremans, R., Henriet, J.P., 2010. Environmental setting of deep-water oysters in the Bay of Biscay. Deep-Sea Research I 57, 1561-1572.

Wynn, R.B., Bett, B.J., Evans, A.J., Griffiths, G., Huvenne, V.A.I., Jones, A.R., Palmer, M.R., Dove, D., Howe, J.A., Boyd, T.J., partners, M., 2012. Investigating the feasibility of utilizing AUV and Glider technology for mapping and monitoring of the UK MPA network. Final report for Defra project MB0118. National Oceanography Centre, Southampton, p. 244.

Wynn, R.B., Huvenne, V.A.I., Le Bas, T.P., Murton, B.J., Connelly, D.P., Bett, B.J., Ruhl, H.A., Morris, K.J., Peakall, J., Parsons, D.R., Sumner, E.J., Darby, S.E., Dorrell, R.M., Hunt, J.E., 2014. Autonomous Underwater Vehicles (AUVs): Their past, presence and future contributions to the advancement of marine geoscience. Marine Geology 352, 451-468.

APPENDIX A – JC124-125-126 Station List

Crui	Site	Final sample number	Event N	JDay (Start	Start Date	Start Time GMT	Start Lat Degr S	Start Lat Min S	Start Long Degr W	Start Long Min W	Start Water depth meter	Equipment depth	JDay	End Date	End Time GMT	End Lat Deg	End Lat Min	End Long Deg	End Long Min	End waterdepth meter	Comments	Recipient
JC125	Haig Fras	JC125-001-CTD01/P01	1	222	10/08/2015	10:58:00	50	23.8280	7	42.7400	110.0		222	10/08/2015	11:37:00	50	23.8300	7	42.7390	110.0	CTD stayed longer at the bottom to check the comms with the beacons (AUV and ROV) deployed. AUV deployed not working. A second CTD will be deployed with a spare beacon. No data recorded on deck at the end of the survey.	
JC125	Haig Fras	JC125-001-CTD01/SVP01	2	222	10/08/2015	10:58:00	50	23.8280	7	42.7400	110.0		222	10/08/2015	11:37:00	50	23.8300	7	42.7390	110.0	CTD stayed longer at the bottom to check the comms with the beacons (AUV and ROV) deployed. AUV deployed not working. A second CTD will be deployed with a spare beacon. No data recorded on deck at the end of the survey.	
JC125	Haig Fras	JC125-002-CTD02/P01	1	222	10/08/2015	11:56:00	50	23.8294	7	42.7398	109.0		222	10/08/2015	12:12:00	50	23.8307	7	42.7451	112.0		
JC125	Haig Fras	JC125-003-MBES01/EM120	1	222	10/08/2015	12:59:00	50	23.8100	7	42.7580	110.0		222	10/08/2015	17:59:00	50	21.2450	7	43.3550	107.0	HF1/HF2/HF3/HF3ext/HF2ext/HF1ext/HF4/HF5. CARIS import EM3000 position 3.	
JC125	Haig Fras	JC125-003-MBES01/SBP120	2	222	10/08/2015	12:59:00	50	23.8100	7	42.7580	110.0		222	10/08/2015	17:59:00	50	21.2450	7	43.3550	107.0	HF1/HF2/HF3/HF3ext/HF2ext/HF1ext/HF4/HF5. CARIS import EM3000 position 3.	
JC125	Haig Fras	JC125-003-MBES01/EM710	3	222	10/08/2015	12:59:00	50	23.8100	7	42.7580	110.0		222	10/08/2015	17:59:00	50	21.2450	7	43.3550	107.0	HF1/HF2/HF3/HF3ext/HF2ext/HF1ext/HF4/HF5. CARIS import EM3000 position 3.	
JC125	Haig Fras	JC125-004-AUV86/ASUBM86	1	222	10/08/2015	18:47:00	50	21.3996	7	43.5440	108.0		223	11/08/2015	12:48:00	50	23.8520	7	43.3650	111.0	AUV rdv indicated MBES data OK. Downward camera only firing every 15 sec.	
JC125	Haig Fras	JC125-005-MBES02/EM120	1	222	10/08/2015	20:58:00	50	22.1600	7	43.1610	106.0		223	11/08/2015	07:17:00	50	23.9143	7	41.2569	107.0	Survey paused for AUV rdv. Survey continued to end of AUV rdv point. HF3cal/HF6/HF7/HF8/HF9/HF10/HF11/HF12/HF13/HF14/HF15/HF16/HF17	
JC125	Haig Fras	JC125-005-MBES02/SBP120	2	222	10/08/2015	20:58:00	50	22.1600	7	43.1610	106.0		223	11/08/2015	07:17:00	50	23.9143	7	41.2569	107.0	Survey paused for AUV rdv. Survey continued to end of AUV rdv point. HF3cal/HF6/HF7/HF8/HF9/HF10/HF11/HF12/HF13/HF14/HF15/HF16/HF17	
JC125	Haig Fras	JC125-005-MBES02/EM710	3	222	10/08/2015	20:58:00	50	22.1600	7	43.1610	106.0		223	11/08/2015	07:17:00	50	23.9143	7	41.2569	107.0	Survey paused for AUV rdv. Survey continued to end of AUV rdv point. HF3cal/HF6/HF7/HF8/HF9/HF10/HF11/HF12/HF13/HF14/HF15/HF16/HF17	
JC125	Haig Fras	JC125-006-ISIS242/ISIS242	0	223	11/08/2015	08:56:00	50	21.5000	7	36.1885	101.0		223	11/08/2015	11:31:00	50	21.6000	7	36.3847	74.5		
JC125	Haig Fras	JC125-007-MBES03/EM120	1	223	11/08/2015	13:06:00	50	23.8800	7	40.9860	107.0		223	11/08/2015	17:41:00	50	20.1060	7	40.5970	103.0	HF18/HF19/HF20. MBES survey paused at 14:20 for (aborted) ROV dive. Survey resumed at 17:17. Transit to ROV site at 17:41.	
JC125	Haig Fras	JC125-007-MBES03/SBP120	2	223	11/08/2015	13:06:00	50	23.8800	7	40.9860	107.0		223	11/08/2015	17:41:00	50	20.1060	7	40.5970	103.0	HF18/HF19/HF20. MBES survey paused at 14:20 for (aborted) ROV dive. Survey resumed at 17:17. Transit to ROV site at 17:41.	
JC125	Haig Fras	JC125-007-MBES03/EM710	3	223	11/08/2015	13:06:00	50	23.8800	7	40.9860	107.0		223	11/08/2015	17:41:00	50	20.1060	7	40.5970	103.0	HF18/HF19/HF20. MBES survey paused at 14:20 for (aborted) ROV dive. Survey resumed at 17:17. Transit to ROV site at 17:41.	
JC125	Haig Fras	JC125-008-ISIS243/ISIS243	0	223	11/08/2015	19:03:00	50	21.4700	7	36.2119	101.0		223	11/08/2015	23:47:00	50	21.5640	7	36.4068	101.0		
JC125	Haig Fras	JC125-008-ISIS243/TBE01	1	223	11/08/2015	20:59:53	50	21.5400	7	36.3000	99.3										Branching gorgonian *Swiftia*	Alex
JC125	Haig Fras	JC125-008-ISIS243/TBE02	2	223	11/08/2015	21:46:06	50	21.5400	7	36.2982	99.4										Branching gorgonian *Swiftia*	Alex
JC125	Haig Fras	JC125-009-MBES04/EM120	1	224	12/08/2015	00:30:00	50	20.1510	7	40.3330	103.0		224	12/08/2015	07:33:00	50	21.3908	7	38.0283	97.0	HF21/HF22/HF22/HF23/HF24/HF25/HF26/HF27/HF28/HF29/HF30/HF31/HF32	
JC125	Haig Fras	JC125-009-MBES04/SBP120	2	224	12/08/2015	00:30:00	50	20.1510	7	40.3330	103.0		224	12/08/2015	07:33:00	50	21.3908	7	38.0283	97.0	HF21/HF22/HF22/HF23/HF24/HF25/HF26/HF27/HF28/HF29/HF30/HF31/HF32	
JC125	Haig Fras	JC125-009-MBES04/EM710	3	224	12/08/2015	00:30:00	50	20.1510	7	40.3330	103.0		224	12/08/2015	07:33:00	50	21.3908	7	38.0283	97.0	HF21/HF22/HF22/HF23/HF24/HF25/HF26/HF27/HF28/HF29/HF30/HF31/HF32	
JC125	Haig Fras	JC125-010-AUV87/ASUBM87	1	224	12/08/2015	08:45:00	50	23.8966	7	42.6063	108.0		224	12/08/2015	21:52:00	50	23.4440	7	44.0800	108.0	AUV recovery delayed (affected by strong tide/current?!)	
JC125	Haig Fras	JC125-011-ISIS244/ISIS244	0	224	12/08/2015	11:46:00	50	14.3806	7	55.3064	107.0		224	12/08/2015	16:04:00	50	14.1429	7	55.4583	90.7		
JC125	Haig Fras	JC125-011-ISIS244/PSH01	1	224	12/08/2015	12:46:00	50	14.3806	7	33.2052	108.6										Coarse gravel; limited amount	Claudio
JC125	Haig Fras	JC125-011-ISIS244/TBE01	2	224	12/08/2015	12:50:00	50	14.1429	7	33.2064	108.8										Coarse gravel	Claudio
JC125	Haig Fras	JC125-012-MBES05/EM120	1	224	12/08/2015	22:01:00	50	23.4490	7	44.3830	108.0		225	13/08/2015	15:24:00	47	57.5730	10	13.0180	3967.0	Transit from HF to WC	
JC125	Haig Fras	JC125-012-MBES05/SBP120	2	224	12/08/2015	22:01:00	50	23.4490	7	44.3830	108.0		225	13/08/2015	15:24:00	47	57.5730	10	13.0180	3967.0	Transit from HF to WC	
JC125	Haig Fras	JC125-012-MBES05/EM710	3	224	12/08/2015	22:01:00	50	23.4490	7	44.3830	108.0		225	13/08/2015	15:24:00	47	57.5730	10	13.0180	3967.0	Transit from HF to WC	
JC125	Whittard Canyon	JC125-013-CTD03/P01	1	225	13/08/2015	21:29:00	47	57.5740	10	13.0200	3956.0		226	14/08/2015	00:21:00	47	57.5740	10	13.0200	3956.0	Deep CTD in central axis of WC. Coms failed during upcast at 3667 m.	
JC125	Whittard Canyon	JC125-013-CTD03/SVP01	2	225	13/08/2015	21:29:00	47	57.5740	10	13.0200	3956.0		226	14/08/2015	00:21:00	47	57.5740	10	13.0200	3956.0	Deep CTD in central axis of WC. Coms failed during upcast at 3667 m.	

JC125	Whittard Canyon	JC125-014-MBES06/EM120	1	226	14/08/2015	01:23:00	47	57.8610	10	13.2500	3778.0		226	14/08/2015	05:35:00	48	26.2780	10	47.8850	3235.0	New SVP file entenred into EM120 before start of transit. Not the best data on the SBP / EM120.	
JC125	Whittard Canyon	JC125-014-MBES06/SBP120	2	226	14/08/2015	01:23:00	47	57.8610	10	13.2500	3778.0		226	14/08/2015	05:35:00	48	26.2780	10	47.8850	3235.0	New SVP file entenred into EM120 before start of transit. Not the best data on the SBP / EM120.	
JC125	Whittard Canyon	JC125-015-PC01/PC01	1	226	14/08/2015	07:38:00	48	26.2831	10	47.8752	3234.0	3237.0									FAIL. 07:44: holding ship position; tension at 9 between 7 + 8. Waiting for tension to drop before hauling. Corer stacked in the seafloor; lost piston core.	
JC125	Whittard Canyon	JC125-016-MBES07/EM120	1	226	14/08/2015	13:54:00	48	25.9410	10	47.6790	3148.0		227	15/08/2015	02:05:00	48	42.9160	9	55.6450	238.0	Recurrent problems with EM120; continually losing bottom.	
JC125	Whittard Canyon	JC125-016-MBES07/SBP120	2	226	14/08/2015	13:54:00	48	25.9410	10	47.6790	3148.0		227	15/08/2015	02:05:00	48	42.9160	9	55.6450	238.0	Recurrent problems with EM120; continually losing bottom.	
JC125	Whittard Canyon	JC125-017-MBES08/EM120	1	227	15/08/2015	02:05:00	48	42.9400	9	55.7050	238.0		227	15/08/2015	09:42:00	48	42.6911	9	55.4034	239.0		
JC125	Whittard Canyon	JC125-017-MBES08/SBP120	2	227	15/08/2015	02:05:00	48	42.9400	9	55.7050	238.0		227	15/08/2015	09:42:00	48	42.6911	9	55.4034	239.0		
JC125	Whittard Canyon	JC125-017-MBES08/EM710	3	227	15/08/2015	02:05:00	48	42.9400	9	55.7050	238.0		227	15/08/2015	09:42:00	48	42.6911	9	55.4034	239.0		
JC125	Whittard Canyon	JC125-018-AUV88/ASUBM88	1	227	15/08/2015	10:21:00	48	43.0210	9	56.1240	241.0		228	16/08/2015	10:35:00	48	42.0040	9	55.1480	240.0	End waterdepth meter not pinging	
JC125	Whittard Canyon	JC125-019-MBES09/EM120	1	227	15/08/2015	11:57:00	48	42.6568	9	55.4947	241.0		227	15/08/2015	13:56:00	48	24.0080	9	57.7041	3029.0		
JC125	Whittard Canyon	JC125-019-MBES09/SBP120	2	227	15/08/2015	11:57:00	48	42.6568	9	55.4947	241.0		227	15/08/2015	13:56:00	48	24.0080	9	57.7041	3029.0		
JC125	Whittard Canyon	JC125-020-GLIDER01/Glider	1	227	15/08/2015	14:27:00	48	23.6730	9	59.7620	2998.0000		249	06/09/2015	11:54:00	48	29.1690	10	2.9450	1660.0		
JC125	Whittard Canyon	JC125-021-CTD04/P01	1	227	15/08/2015	15:53:00	48	23.3690	9	59.7680	2985.0		227	15/08/2015	17:53:00	48	23.3690	9	59.7700	2984.0		
JC125	Whittard Canyon	JC125-022-MBES10/EM120	1	227	15/08/2015	18:09:00	48	23.9800	9	59.7020	3000.0		228	16/08/2015	04:40:00	48	21.4856	9	37.1074	1038.0		
JC125	Whittard Canyon	JC125-022-MBES10/SBP120	2	227	15/08/2015	18:09:00	48	23.9800	9	59.7020	3000.0		228	16/08/2015	04:40:00	48	21.4856	9	37.1074	1038.0		
JC125	Whittard Canyon	JC125-023-MBES11/EM120	1	228	16/08/2015	04:45:00	48	21.7387	9	37.3335	1157.0		228	16/08/2015	05:32:00	48	21.8688	9	42.2870	900.0		
JC125	Whittard Canyon	JC125-023-MBES11/SBP120	2	228	16/08/2015	04:45:00	48	21.7387	9	37.3335	1157.0		228	16/08/2015	05:32:00	48	21.8688	9	42.2870	900.0		
JC125	Whittard Canyon	JC125-024-ISIS245/ISIS245	0	228	16/08/2015	12:06:00	48	39.2630	10	1.8130	1336.0		228	16/08/2015	16:27:00	48	65.4820	10	3.4305	1309.0	NO SUCCESS. Poor visibility + navigation issues with ROV software led to cancellation of dive.	
JC125	Whittard Canyon	JC125-025-CTD05/P01	1	228	16/08/2015	17:11:00	48	39.3070	10	2.0670	1369.0		228	16/08/2015	19:01:00	48	39.3070	10	2.0670	1368.0	SAPS pumping for 30 min at 1752 m, 20 m above bed. Slight tear in filter edge. 'O ring' (??!) droppred on filter.	
JC125	Whittard Canyon	JC125-025-CTD05/SAPS01	2	228	16/08/2015	17:11:00	48	39.3070	10	2.0670	1369.0		228	16/08/2015	19:01:00	48	39.3070	10	2.0670	1368.0	SAPS pumping for 30 min at 1752 m, 20 m above bed. Slight tear in filter edge. 'O ring' (??!) droppred on filter.	
JC125	Whittard Canyon	JC125-026-MBES12/EM120	1	228	16/08/2015	19:20:00	48	39.1800	10	2.1590	1301.0		228	16/08/2015	22:37:00	48	6.4820	10	13.8570	3721.0		
JC125	Whittard Canyon	JC125-026-MBES12/SBP120	2	228	16/08/2015	19:20:00	48	39.1800	10	2.1590	1301.0		228	16/08/2015	22:37:00	48	6.4820	10	13.8570	3721.0		
JC125	Whittard Canyon	JC125-027-PC02/PC01	1	229	17/08/2015	00:54:00	48	6.3286	10	13.8204	3722.0	3722.0										
JC125	Whittard Canyon	JC125-028-MC01/T01	1	229	17/08/2015	05:29:00	48	6.3241	10	13.8330	3723.0	3758.0									0 cm. 4.61 T	
JC125	Whittard Canyon	JC125-028-MC01/X01	1	229	17/08/2015	05:29:00	48	6.3241	10	13.8330	3723.0	3758.0									Bio. 36 cm. 4.61 T	
JC125	Whittard Canyon	JC125-028-MC01/D01	1	229	17/08/2015	05:29:00	48	6.3241	10	13.8330	3723.0	3758.0									33.5 cm 4.61 T	
JC125	Whittard Canyon	JC125-028-MC01/M01	1	229	17/08/2015	05:29:00	48	6.3241	10	13.8330	3723.0	3758.0									Geo. 45 cm. 4.61 T	
JC125	Whittard Canyon	JC125-028-MC01/E01	1	229	17/08/2015	05:29:00	48	6.3241	10	13.8330	3723.0	3758.0									Bio. 44 cm. 4.61 T	
JC125	Whittard Canyon	JC125-028-MC01/P01	1	229	17/08/2015	05:29:00	48	6.3241	10	13.8330	3723.0	3758.0									44 cm. Fractured. 4.61 T	
JC125	Whittard Canyon	JC125-028-MC01/J01	1	229	17/08/2015	05:29:00	48	6.3241	10	13.8330	3723.0	3758.0									Geo. 44 cm. 4.61 T	
JC125	Whittard Canyon	JC125-028-MC01/A01	1	229	17/08/2015	05:29:00	48	6.3241	10	13.8330	3723.0	3758.0									44 cm. 4.61 T	
JC125	Whittard Canyon	JC125-029-MBES13/EM120	1	229	17/08/2015	08:32:00	48	10.4370	10	0.1370	2906.0		229	17/08/2015	10:11:00	48	17.1400	9	38.7377	351.0		
JC125	Whittard Canyon	JC125-029-MBES13/SBP120	2	229	17/08/2015	08:32:00	48	10.4370	10	0.1370	2906.0		229	17/08/2015	10:11:00	48	17.1400	9	38.7377	351.0		
JC125	Whittard Canyon	JC125-030-MBES14/EM120	1	229	17/08/2015	12:02:00	48	17.3546	9	38.2128	684.0		229	17/08/2015	13:07:00	48	27.8730	9	39.0147	999.0	MBES14 instead of AUV MISSION (ABORTED 11:47)	
JC125	Whittard Canyon	JC125-030-MBES14/EM120	1	229	17/08/2015	12:02:00	48	17.3546	9	38.2128	684.0		229	17/08/2015	13:07:00	48	27.8730	9	39.0147	999.0	MBES14 instead of AUV MISSION (ABORTED 11:47)	
JC125	Whittard Canyon	JC125-031-ISIS246/ISIS246	0	229	17/08/2015	13:39:00	48	27.9350	9	39.1940	1054.3		230	18/08/2015	04:33:00	48	29.2020	9	39.4020	730.6	Fishing line bearing 238 (near WP206), 48 28.967/9 39.551	
JC125	Whittard Canyon	JC125-031-ISIS246/BIOB01	1	229	17/08/2015	18:58:00	48	28.8000	9	39.4800	753.0										Seastar (*Nymphaster*?)	Inge
JC125	Whittard Canyon	JC125-031-ISIS246/PSH01	2	229	17/08/2015	20:15:00	48	28.8000	9	39.4800	753.0										Sediment push core #01 10cm	
JC125	Whittard Canyon	JC125-031-ISIS246/PSH02	3	229	17/08/2015	21:23:00	48	29.0960	9	39.5910	635.0										Sediment push core #02 26cm	
JC125	Whittard Canyon	JC125-031-ISIS246/BIOB02	4	229	17/08/2015	21:32:00	48	29.0988	9	39.5922	635.0										Purple anemone (soft sediment)	Inge / Kat
JC125	Whittard Canyon	JC125-031-ISIS246/BIOB03	5	229	17/08/2015	22:15:00	48	29.0988	9	39.5922	635.0										*Cidaris* urchin #01	Leigh
JC125	Whittard Canyon	JC125-031-ISIS246/BIOB04	6	229	17/08/2015	22:21:00	48	29.1012	9	39.5928	635.0										*Cidaris* urchin #02	Leigh
JC125	Canyons MCZ	JC125-032-MBES15/EM120	1	230	18/08/2015	04:52:00	48	28.5720	9	39.0930	948.0		230	18/08/2015	06:10:00	48	17.3740	9	28.1851	341.0		
JC125	Canyons MCZ	JC125-032-MBES15/SBP120	2	230	18/08/2015	04:52:00	48	28.5720	9	39.0930	948.0		230	18/08/2015	06:10:00	48	17.3740	9	28.1851	341.0		
JC125	Canyons MCZ	JC125-033-AUV89/ASUBM89	2	230	18/08/2015	06:37:00	48	17.3242	9	38.1375	338.0		231	19/08/2015	04:48:00	48	15.1710	9	42.0960	542.0		
JC125	Canyons MCZ	JC125-034-MBES16/EM120	1	230	18/08/2015	08:27:00	48	17.5910	9	38.2780	342.0		230	18/08/2015	09:40:00	48	25.1010	9	47.7600	1472.0		
JC125	Canyons MCZ	JC125-034-MBES16/SBP120	2	230	18/08/2015	08:27:00	48	17.5910	9	38.2780	342.0		230	18/08/2015	09:40:00	48	25.1010	9	47.7600	1472.0		
JC125	Canyons MCZ	JC125-035-ISIS247/ISIS247	0	230	18/08/2015	10:01:00	48	25.0950	9	47.7800	1452.0		231	19/08/2015	02:33:00	48	26.5570	9	48.0690	602.0	Large fishing net observed. Discarded against wall-lines into mid-water.	

JC125	Canyons MCZ	JC125-035-ISIS247/BIOB01	1	230	18/08/2015	13:40:00	48	25.5590	9	47.6230	1246.0											Sea pen	Raissa
JC125	Canyons MCZ	JC125-035-ISIS247/BIOB02	2	230	18/08/2015	14:28:00	48	25.6870	9	47.5790	1203.0											Sea pen (long) *Halipteris sp.*	Raissa
JC125	Canyons MCZ	JC125-035-ISIS247/BIOB03	3	230	18/08/2015	14:53:00	48	25.7060	9	47.5730	1192.0											*Pennatula sp.* #01	Raissa
JC125	Canyons MCZ	JC125-035-ISIS247/BIOB04	4	230	18/08/2015	17:04:00	48	26.2090	9	47.2140	946.0											LOST. *Pennatula sp.* #02 (?aculeata)	Raissa
JC125	Canyons MCZ	JC125-035-ISIS247/SLP01	5	230	18/08/2015	17:20:00	48	26.2260	9	47.2060	937.0											*Pennatula sp.* #03 (?aculeata)	Raissa
JC125	Canyons MCZ	JC125-035-ISIS247/SLP02	6	231	19/08/2015	00:32:00	48	26.2540	9	47.9720	764.4											*Kophobolemnon sp.*	Raissa
JC125	Canyons MCZ	JC125-035-ISIS247/PSH01	7	231	19/08/2015	00:38:00	48	26.2540	9	47.9720	764.4											Push core; half of it fell off	Alex
JC125	Canyons MCZ	JC125-035-ISIS247/PSH02	8	231	19/08/2015	00:41:00	48	26.2540	9	47.9720	764.4											Push core	Alex
JC125	Whittard Canyon	JC125-036-MBES17/EM120	1	231	19/08/2015	02:50:00	48	26.3350	9	47.7090	231.0		231	19/08/2015	04:00:00	48	15.5240	9	44.6550	533.0		Transit to AUV recovery site	
JC125	Whittard Canyon	JC125-036-MBES17/SBP120	2	231	19/08/2015	02:50:00	48	26.3350	9	47.7090	231.0		231	19/08/2015	04:00:00	48	15.5240	9	44.6550	533.0		Transit to AUV recovery site	
JC125	Canyons MCZ	JC125-037-MBES18/EM120	1	231	19/08/2015	05:03:00	48	14.8960	9	42.1860	613.0		231	19/08/2015	08:31:00	47	47.5045	10	7.6849	4158.0			
JC125	Canyons MCZ	JC125-037-MBES18/SBP120	2	231	19/08/2015	05:03:00	48	14.8960	9	42.1860	613.0		231	19/08/2015	08:31:00	47	47.5045	10	7.6849	4158.0			
JC125	Whittard Canyon	JC125-038-ISIS248/ISIS248	0	231	19/08/2015	09:59:00	47	46.8900	10	9.6270	4146.0		231	19/08/2015	21:50:00	47	48.2100	10	9.1500	4173.0		Vehicle lost power between 17:48:00 and 18:40:00 due to blown fuse shipside. ROV then lost powered again so recovered.	
JC125	Whittard Canyon	JC125-038-ISIS248/PSH01	1	231	19/08/2015	12:51:00	47	47.1640	10	9.6390	4163.0											Push core half full on recovery	Jenny
JC125	Whittard Canyon	JC125-038-ISIS248/PSH02	2	231	19/08/2015	13:52:00	47	47.3000	10	9.3160	4169.2											FAIL. Very soft and loss of most of sample leading to 2nd attempt	Jenny
JC125	Whittard Canyon	JC125-038-ISIS248/PSH03	3	231	19/08/2015	14:32:00	47	47.3630	10	9.1700	4171.4											FAIL. Very fine sediment.	Jenny
JC125	Whittard Canyon	JC125-038-ISIS248/PSH04	4	231	19/08/2015	15:18:00	47	47.2860	10	8.9400	4147.0											FAIL. Very fine sediment with dark horizon at base (cohesive?)	Jenny
JC125	Whittard Canyon	JC125-038-ISIS248/PSH05	5	231	19/08/2015	16:54:00	47	47.1940	10	8.4620	4177.0											Very fine sediment.	Jenny
JC125	Whittard Canyon	JC125-038-ISIS248/SLP01	6	231	19/08/2015	17:23:00	47	47.1940	10	8.2420	4173.0											*Umbellula sp.*	Raissa
JC125	Whittard Canyon	JC125-039-MBES19/EM120	1	231	19/08/2015	22:05:00	47	48.2295	10	9.2426	4165.0		232	20/08/2015	03:07:00	48	39.2627	10	1.6960	1330.0			
JC125	Whittard Canyon	JC125-039-MBES19/SBP120	2	231	19/08/2015	22:05:00	47	48.2295	10	9.2426	4165.0		232	20/08/2015	03:07:00	48	39.2627	10	1.6960	1330.0			
JC125	Whittard Canyon	JC125-040-CTD06/P01	1	232	20/08/2015	03:54:00	48	39.2090	10	2.0030	1371.0		232	20/08/2015	06:03:00	48	39.2080	10	2.0040	1372.0			
JC125	Whittard Canyon	JC125-040-CTD06/SAPS01	2	232	20/08/2015	03:54:00	48	39.2090	10	2.0030	1371.0		232	20/08/2015	06:03:00	48	39.2080	10	2.0040	1372.0			
JC125	Whittard Canyon	JC125-041-MBES20/EM120	1	232	20/08/2015	07:54:00	48	38.5877	10	4.6703	934.0		232	20/08/2015	09:59:00	48	45.6380	10	27.5587	758.0		It went crazy many times because of the weather.	
JC125	Whittard Canyon	JC125-041-MBES20/SBP120	2	232	20/08/2015	07:54:00	48	38.5877	10	4.6703	934.0		232	20/08/2015	09:59:00	48	45.6380	10	27.5587	758.0		It went crazy many times because of the weather.	
JC125	Whittard Canyon	JC125-042-CTD07/P01	1	232	20/08/2015	10:30:00	48	45.6604	10	27.6558	760.0		232	20/08/2015	12:55:00	48	45.6607	10	27.6556	758.0		One of the filter was a little bit broken after opening the SAP.	
JC125	Whittard Canyon	JC125-042-CTD07/SAPS01	2	232	20/08/2015	10:30:00	48	45.6604	10	27.6558	760.0		232	20/08/2015	12:55:00	48	45.6607	10	27.6556	758.0		One of the filter was a little bit broken after opening the SAP.	
JC125	Whittard Canyon	JC125-043-MBES21/EM120	1	232	20/08/2015	14:11:00	48	45.0700	10	27.4800	411.0		232	20/08/2015	18:28:00	48	6.9050	10	11.9510	3700.0			
JC125	Whittard Canyon	JC125-043-MBES21/SBP120	2	232	20/08/2015	14:11:00	48	45.0700	10	27.4800	411.0		232	20/08/2015	18:28:00	48	6.9050	10	11.9510	3700.0			
JC125	Whittard Canyon	JC125-044-PC03/PC01	1	232	20/08/2015	20:22:00	48	6.8940	10	11.9630	3699.0	3692.0										12m RIG. Pullout=6.1T	
JC125	Whittard Canyon	JC125-045-MC02/C01	1	233	21/08/2015	01:24:00	48	6.8940	10	11.9640	3697.0	3723.0										4/8 cores. 365 mm.	
JC125	Whittard Canyon	JC125-045-MC02/M01	1	233	21/08/2015	01:24:00	48	6.8940	10	11.9640	3697.0	3723.0										4/8 cores. 325 mm.	
JC125	Whittard Canyon	JC125-045-MC02/J01	1	233	21/08/2015	01:24:00	48	6.8940	10	11.9640	3697.0	3723.0										4/8 cores. 380 mm.	
JC125	Whittard Canyon	JC125-045-MC02/P01	1	233	21/08/2015	01:24:00	48	6.8940	10	11.9640	3697.0	3723.0										4/8 cores. 362 mm.	
JC125	Whittard Canyon	JC125-045-MC02/xx01	1	233	21/08/2015	01:24:00	48	6.8940	10	11.9640	3697.0	3723.0										4/8 cores. Not fired (#04). No letter on the tube; labelled 'xx'.	
JC125	Whittard Canyon	JC125-045-MC02/D01	1	233	21/08/2015	01:24:00	48	6.8940	10	11.9640	3697.0	3723.0										4/8 cores. Not fired (#02).	
JC125	Whittard Canyon	JC125-045-MC02/B01	1	233	21/08/2015	01:24:00	48	6.8940	10	11.9640	3697.0	3723.0										4/8 cores. Small sample (#05).	
JC125	Whittard Canyon	JC125-045-MC02/A01	1	233	21/08/2015	01:24:00	48	6.8940	10	11.9640	3697.0	3723.0										4/8 cores. Small sample (#12).	
JC125	Whittard Canyon	JC125-046-MBES22/EM120	1	233	21/08/2015	03:59:00	48	7.3110	10	11.7250	3678.0		233	21/08/2015	07:14:00	48	39.2953	10	1.6447	1329.0		Transit to ROV deployment site.	
JC125	Whittard Canyon	JC125-046-MBES22/SBP120	2	233	21/08/2015	03:59:00	48	7.3110	10	11.7250	3678.0		233	21/08/2015	07:14:00	48	39.2953	10	1.6447	1329.0		Transit to ROV deployment site.	
JC125	Whittard Canyon	JC125-047-ISIS249/ISIS249	0	233	21/08/2015	07:49:00	48	39.2590	10	1.8150	1333.0		233	21/08/2015	19:18:00	48	39.2410	10	2.1210	1299.0			
JC125	Whittard Canyon	JC125-047-ISIS249/TBE01	1	233	21/08/2015	13:44:00	48	39.1260	10	2.1260	1309.2											2 *Acesta*	Laura
JC125	Whittard Canyon	JC125-047-ISIS249/BIOB01	2	233	21/08/2015	13:53:00	48	39.1270	10	2.1290	1307.3											1 *Acesta*	Laura
JC125	Whittard Canyon	JC125-047-ISIS249/BIOB02	2	233	21/08/2015	13:59:00	48	39.1270	10	2.1310	1308.7											1 *Acesta*	Laura
JC125	Whittard Canyon	JC125-047-ISIS249/BIOB03	2	233	21/08/2015	14:00:00	48	39.1250	10	2.1290	1308.9											1 *Acesta*	Laura
JC125	Whittard Canyon	JC125-047-ISIS249/BIOB04	2	233	21/08/2015	14:04:00	48	39.1260	10	2.1290	1308.9											1 *Acesta*	Laura
JC125	Whittard Canyon	JC125-047-ISIS249/BIOB05	2	233	21/08/2015	14:08:00	48	39.1250	10	2.1290	1308.5											2 *Acesta*	Laura
JC125	Whittard Canyon	JC125-047-ISIS249/BIOB06	2	233	21/08/2015	14:10:00	48	39.1240	10	2.1290	1308.5											2 *Acesta*	Laura
JC125	Whittard Canyon	JC125-047-ISIS249/BIOB07	2	233	21/08/2015	14:12:00	48	39.1240	10	2.1290	1308.5											1 *Acesta*	Laura
JC125	Whittard Canyon	JC125-047-ISIS249/BIOB08	2	233	21/08/2015	14:29:00	48	39.1240	10	2.1270	1316.3											5 *Acesta*	Laura
JC125	Whittard Canyon	JC125-047-ISIS249/TBE02	3	233	21/08/2015	15:57:00	48	39.1280	10	2.1270	1310.4											*Solensmilia* ?	Kat
JC125	Whittard Canyon	JC125-047-ISIS249/TBE03	4	233	21/08/2015	16:39:00	48	39.1340	10	2.1360	1289.0											*Lophelia* ?	Kat
JC125	Whittard Canyon	JC125-047-ISIS249/AcestaTrap01	5	233	21/08/2015	12:05:15	48	39.1464	10	2.1484	1290.0												
JC125	Whittard Canyon	JC125-047-ISIS249/AcestaTrap02	6	233	21/08/2015	12:53:47	48	39.1208	10	2.1238	1292.0												
JC125	Whittard Canyon	JC125-047-ISIS249/AcestaTrap03	7	233	21/08/2015	13:10:39	48	39.1163	10	2.1213	1290.0												
JC125	Whittard Canyon	JC125-048-MBES23/EM120	1	233	21/08/2015	19:29:00	48	39.0880	10	2.2800	1292.0		233	21/08/2015	19:45:00	48	38.5042	10	4.3763	485.0			
JC125	Whittard Canyon	JC125-048-MBES23/SBP120	2	233	21/08/2015	19:29:00	48	39.0880	10	2.2800	1292.0		233	21/08/2015	19:45:00	48	38.5042	10	4.3763	485.0			
JC125	Whittard Canyon	JC125-049-AUV90/ASUB90	1	233	21/08/2015	20:17:00	48	38.5651	10	4.9244	485.0		234	22/08/2015	08:18:00	48	38.0080	10	0.1380	1257.0			

JC125	Whittard Canyon	JC125-050-ISIS250/ISIS250	0	233	21/08/2015	23:53:00	48	43.7640	10	5.9100	894.0		234	22/08/2015	06:34:00	48	26.4918	10	3.3540	890.0		
JC125	Whittard Canyon	JC125-050-ISIS250/ISIS250	1	234	22/08/2015	03:35:00	48	43.9954	10	5.7255	798.0										Black coral	Raissa
JC125	Whittard Canyon	JC125-050-ISIS250/ISIS250	2	234	22/08/2015	05:32:00	48	44.0710	10	5.6130	667.0										*Paranthipathes*	Raissa
JC125	Whittard Canyon	JC125-051-MBES24/EM120	1	234	22/08/2015	08:28:00	48	38.0463	10	0.0247	1302.0		234	22/08/2015	10:02:00	48	42.8243	10	19.5678		End date & positions correspond to failed line 183 (no bottom could be found)	
JC125	Whittard Canyon	JC125-051-MBES24/SBP120	2	234	22/08/2015	08:28:00	48	38.0463	10	0.0247	1302.0		234	22/08/2015	10:02:00	48	42.8243	10	19.5678		End date & positions correspond to failed line 183 (no bottom could be found)	
JC125	Whittard Canyon	JC125-052-ISIS251/ISIS251	0	234	22/08/2015	11:14:00	48	45.6960	10	27.6040	753.6		234	22/08/2015	22:06:00	48	45.8278	10	27.5970	683.0		
JC125	Whittard Canyon	JC125-052-ISIS251/PSH01	1	234	22/08/2015	13:02:00	48	45.6340	10	27.5840	757.0										Fine sand, possibly some biogenic material	Kostas
JC125	Whittard Canyon	JC125-052-ISIS251/PSH02	2	234	22/08/2015	13:05:00	48	45.6330	10	27.5880	757.0										Fine sand, possibly some biogenic material	Kostas
JC125	Whittard Canyon	JC125-052-ISIS251/PSH03	3	234	22/08/2015	13:22:00	48	45.6835	10	27.5972	757.0										Fine sand, possibly some biogenic material	Kostas
JC125	Whittard Canyon	JC125-052-ISIS251/RCK01	4	234	22/08/2015	14:00:00	48	45.5960	10	27.5070	736.3										2 rocks	Claudio
JC125	Whittard Canyon	JC125-052-ISIS251/RCK02	5	234	22/08/2015	14:51:00	48	45.6220	10	27.6610	760.3										1 rock	Claudio
JC125	Whittard Canyon	JC125-052-ISIS251/SLP01	6	234	22/08/2015	19:22:00	48	45.8820	10	27.6750	551.0										1 *Acesta* + *Lophelia* fragments	Kat / Kostas
JC125	Whittard Canyon	JC125-052-ISIS251/SLP02	7	234	22/08/2015	20:00:00	48	45.8820	10	27.6850	541.0		234	22/08/2015	20:29:00	48	45.8810	10	27.6830	547.0	Cup corals + 7 *Acesta*	Laura / Kostas
JC125	Whittard Canyon	JC125-052-ISIS251/AcestaTrap01	8	234	22/08/2015	17:01:07	48	45.7863	10	27.7581	581.0											
JC125	Whittard Canyon	JC125-052-ISIS251/AcestaTrap02	9	234	22/08/2015	20:13:04	48	45.8805	10	27.6855	542.0											
JC125	Whittard Canyon	JC125-052-ISIS251/AcestaTrap03	10	234	22/08/2015	21:25:18	48	45.8954	10	27.6920	524.0											
JC125	Whittard Canyon	JC125-053-AUV91/ASUB91	1	234	22/08/2015	23:09:00	48	45.1330	10	26.7980	313.0		235	23/08/2015	07:53:00	48	45.9223	10	27.3310	541.0		
JC125	Whittard Canyon	JC125-054-ISIS252/ISIS252	0	235	23/08/2015	01:25:00	48	42.2790	10	23.7580	840.0		235	23/08/2015	06:53:00	48	42.0904	10	23.2098	560.1		
JC125	Whittard Canyon	JC125-055-MBES25/EM120	1	235	23/08/2015	08:20:00	48	44.8212	10	27.3046	538.0		235	23/08/2015	12:19:00	48	6.2300	10	13.7770	3724.0	Coordinates taken after logging on.	
JC125	Whittard Canyon	JC125-055-MBES25/SBP120	2	235	23/08/2015	08:20:00	48	44.8212	10	27.3046	538.0		235	23/08/2015	12:19:00	48	6.2300	10	13.7770	3724.0	Coordinates taken after logging on.	
JC125	Whittard Canyon	JC125-056-PC04/PC01	1	235	23/08/2015	14:27:00	48	6.2710	10	13.7800	3714.0	3716.0									6.31 T. ~7 m. USBL lat/long.	
JC125	Whittard Canyon	JC125-057-PC05/PC01	1	235	23/08/2015	19:42:00	48	6.6140	10	12.8810	3758.0	3756.0									5.4 T. Core barrels jammed on lead. Nails stoned upon attempted removal. 1.5 m core recovered/6 m PC. Suction collapse of liner.	
JC125	Whittard Canyon	JC125-058-MC03/A01	1	236	24/08/2015	00:09:00	48	6.6140	10	12.8820	3757.0	3794.0									Geo. 35 cm. 4.4 T.	
JC125	Whittard Canyon	JC125-058-MC03/B01	1	236	24/08/2015	00:09:00	48	6.6140	10	12.8820	3757.0	3794.0									Bio. 17.5 cm. 4.4 T.	
JC125	Whittard Canyon	JC125-058-MC03/J01	1	236	24/08/2015	00:09:00	48	6.6140	10	12.8820	3757.0	3794.0									Geo. 35.5 cm. 4.4 T.	
JC125	Whittard Canyon	JC125-058-MC03/O01	1	236	24/08/2015	00:09:00	48	6.6140	10	12.8820	3757.0	3794.0									NA. 4.4 T.	
JC125	Whittard Canyon	JC125-058-MC03/Y01	1	236	24/08/2015	00:09:00	48	6.6140	10	12.8820	3757.0	3794.0									Bio. 21 cm. 4.4 T.	
JC125	Whittard Canyon	JC125-058-MC03/K01	1	236	24/08/2015	00:09:00	48	6.6140	10	12.8820	3757.0	3794.0									19.9 cm. 4.4 T.	
JC125	Whittard Canyon	JC125-058-MC03/M01	1	236	24/08/2015	00:09:00	48	6.6140	10	12.8820	3757.0	3794.0									23 cm. 4.4 T.	
JC125	Whittard Canyon	JC125-058-MC03/D01	1	236	24/08/2015	00:09:00	48	6.6140	10	12.8820	3757.0	3794.0									NA. 4.4 T.	
JC125	Whittard Canyon	JC125-059-MBES26/EM120	1	236	24/08/2015	02:46:00	48	6.7823	10	12.3920	3711.0		236	24/08/2015	06:43:00	48	4.9013	10	22.5484	3853.0		
JC125	Whittard Canyon	JC125-059-MBES26/SBP120	2	236	24/08/2015	02:46:00	48	6.7823	10	12.3920	3711.0		236	24/08/2015	06:43:00	48	4.9013	10	22.5484	3853.0		
JC125	Whittard Canyon	JC125-060-ISIS253/ISIS253	0	236	24/08/2015	07:42:00	48	5.1570	10	23.0600	3808.7		236	24/08/2015	19:26:00	48	5.9340	10	21.7980	3478.0		
JC125	Whittard Canyon	JC125-060-ISIS253/RCK01	1	236	24/08/2015	10:37:00	48	4.9360	10	22.5910	3845.0										Weak mudstone?	Claudio
JC125	Whittard Canyon	JC125-060-ISIS253/PSH01	2	236	24/08/2015	10:54:00	48	4.9530	10	22.5820	3827.7										50% recovery	Claudio
JC125	Whittard Canyon	JC125-060-ISIS253/PSH02	3	236	24/08/2015	11:26:00	48	5.0490	10	22.4770	3819.0										75% recovery. Medium-dense sands and stiff mud	Claudio
JC125	Whittard Canyon	JC125-060-ISIS253/PSH03	4	236	24/08/2015	12:57:00	48	5.1180	10	22.4060	3560.0										50% recovery. Well consolidated.	Claudio
JC125	Whittard Canyon	JC125-060-ISIS253/SLP01	5	236	24/08/2015	16:35:00	48	5.8370	10	21.9900	3148.0										Seapen and coral	Inge / Raissa
JC125	Whittard Canyon	JC125-061-MBES27/EM120	1	236	24/08/2015	19:39:00	48	5.7630	10	21.7410	3327.0		236	24/08/2015	21:15:00	47	57.4160	10	13.3180	3988.0		
JC125	Whittard Canyon	JC125-061-MBES27/SBP120	2	236	24/08/2015	19:39:00	48	5.7630	10	21.7410	3327.0		236	24/08/2015	21:15:00	47	57.4160	10	13.3180	3988.0		
JC125	Whittard Canyon	JC125-062-PC06/PC01	1	236	24/08/2015	23:18:00	47	57.3810	10	13.4300	3984.0	3979.0									6 m PC. 5.7 T. Recovered length 3 m.	
JC125	Whittard Canyon	JC125-063-MC04/Q01	1	237	25/08/2015	03:19:00	47	57.3790	10	13.4360	3984.0	4010.0									33 cm. 4.65 T.	
JC125	Whittard Canyon	JC125-063-MC04/D01	1	237	25/08/2015	03:19:00	47	57.3790	10	13.4360	3984.0	4010.0									Bio. 33 cm. 4.65 T.	
JC125	Whittard Canyon	JC125-063-MC04/J01	1	237	25/08/2015	03:19:00	47	57.3790	10	13.4360	3984.0	4010.0									Geo. 35 cm. 4.65 T.	
JC125	Whittard Canyon	JC125-063-MC04/K01	1	237	25/08/2015	03:19:00	47	57.3790	10	13.4360	3984.0	4010.0									Geo. 36.5 cm. 4.65 T.	
JC125	Whittard Canyon	JC125-063-MC04/M01	1	237	25/08/2015	03:19:00	47	57.3790	10	13.4360	3984.0	4010.0									Failed. 33 cm. 4.65 T.	
JC125	Whittard Canyon	JC125-063-MC04/G01	1	237	25/08/2015	03:19:00	47	57.3790	10	13.4360	3984.0	4010.0									Bio. 35 cm. 4.65 T.	
JC125	Whittard Canyon	JC125-064-MBES28/EM120	1	237	25/08/2015	06:24:00	47	57.6985	10	13.2019	3983.0		237	25/08/2015	10:13:00	48	27.6989	9	37.8916	580.0		
JC125	Whittard Canyon	JC125-064-MBES28/SBP120	2	237	25/08/2015	06:24:00	47	57.6985	10	13.2019	3983.0		237	25/08/2015	10:13:00	48	27.6989	9	37.8916	580.0		
JC125	Canyons MCZ	JC125-065-CTD08/P01	1	237	25/08/2015	10:29:00	48	27.7065	9	38.0083	608.0		237	25/08/2015	11:35:00	48	27.7065	9	38.0083	595.0	1 bottle leaked/3 fired.	
JC125	Canyons MCZ	JC125-066-CTD09/P01	1	237	25/08/2015	12:15:00	48	27.9483	9	38.3165	755.0		237	25/08/2015	13:34:00	48	27.9502	9	38.3285	754.0	2 bottles leaked/3 fired.	
JC125	Canyons MCZ	JC125-067-CTD10/P01	1	237	25/08/2015	13:56:00	48	28.0932	9	38.6082	908.0		237	25/08/2015	15:23:00	48	28.0917	9	38.6041	902.0	1 bottle leaked/3 fired.	
JC125	Canyons MCZ	JC125-068-CTD11/P01	1	238	26/08/2015	10:01:00	48	28.4929	9	39.1917	878.1		238	26/08/2015	13:00:00	48	28.4938	9	39.1924	899.0	3 bottles fired.	
JC125	Canyons MCZ	JC125-068-CTD11/SAPS01	2	238	26/08/2015	10:01:00	48	28.4929	9	39.1917	878.1		238	26/08/2015	13:00:00	48	28.4938	9	39.1924	899.0	3 bottles fired.	
JC125	Canyons MCZ	JC125-069-CTD12/P01	1	238	26/08/2015	13:32:00	48	27.6992	9	38.0133	608.0		238	26/08/2015	14:34:00	48	27.6994	9	38.0128	595.0	3 bottles fired.	
JC125	Canyons MCZ	JC125-070-CTD13/P01	1	238	26/08/2015	15:02:00	48	27.9440	9	38.3131	750.0		238	26/08/2015	16:15:00	48	27.9450	9	38.3160	749.0	2 bottles fired.	
JC125	Canyons MCZ	JC125-071-CTD14/P01	1	238	26/08/2015	18:36:00	48	28.0910	9	38.6017	905.0		238	26/08/2015	19:36:00	48	28.0910	9	38.6010	903.0	1 bottle leaked/2 fired.	
JC125	Canyons MCZ	JC125-072-CTD15/P01	1	238	26/08/2015	20:03:00	48	28.3190	9	38.9300	1068.0		238	26/08/2015	21:20:00	48	28.3190	9	38.9300	1069.0	2 bottles fired.	
JC125	Canyons MCZ	JC125-073-CTD16/P01	1	238	26/08/2015	21:54:00	48	28.8631	9	39.6378	766.0		238	26/08/2015	22:59:00	48	28.8632	9	39.6369	769.0	3 bottles fired.	
JC125	Canyons MCZ	JC125-074-CTD17/P01	1	238	26/08/2015	23:31:00	48	29.4650	9	40.2573	596.0		239	27/08/2015	00:38:00	48	29.4646	9	40.5027	596.0	2 bottles leaked/3 fired.	
JC125	Canyons MCZ	JC125-075-MBES29/EM120	1	239	27/08/2015	00:44:00	48	29.4260	9	40.6280	558.0		239	27/08/2015	04:49:00	48	28.4362	9	39.2674	894.0		
JC125	Canyons MCZ	JC125-075-MBES29/SBP120	2	239	27/08/2015	00:44:00	48	29.4260	9	40.6280	558.0		239	27/08/2015	04:49:00	48	28.4362	9	39.2674	894.0		

JC125	Canyons MCZ	JC125-076-ISIS254/ISIS254	0	239	27/08/2015	05:39:00	48	28.4360	9	39.2770	865.0	239	27/08/2015	17:27:00	48	28.1400	9	39.0690	629.0		
JC125	Canyons MCZ	JC125-076-ISIS254/SLP01	1	239	27/08/2015	09:11:00	48	28.4320	9	39.2800	893.1									*Madrepora* (live)	Kostas / Veerle
JC125	Canyons MCZ	JC125-076-ISIS254/SLP02	2	239	27/08/2015	09:17:00	48	28.4320	9	39.2790	893.0									*Lophelia* (live). Half at -80°C, half in ethanol.	Kostas / Veerle
JC125	Canyons MCZ	JC125-076-ISIS254/SLP03	3	239	27/08/2015	09:24:00	48	28.4320	9	39.2800	893.2									*Lophelia* (dead from the same colony)	Claudio
JC125	Canyons MCZ	JC125-076-ISIS254/SLP04	4	239	27/08/2015	09:29:00	48	28.4320	9	39.2800	893.2									Dead coral from the bottom	Claudio
JC125	Canyons MCZ	JC125-076-ISIS254/SLP05	5	239	27/08/2015	09:36:00	48	28.4310	9	39.2790	893.3									*Lophelia* (different morphotype)	Kostas / Veerle
JC125	Canyons MCZ	JC125-076-ISIS254/PSH01	6	239	27/08/2015	11:09:00	48	28.1200	9	38.9060	1079.0									~50% recovery. Medium/coarse sands and occasional shell fragments	Claudio
JC125	Canyons MCZ	JC125-076-ISIS254/PSH02	7	239	27/08/2015	14:43:00	48	28.0190	9	38.5470	861.2									~75% recovery. Mostly stiff grey with a sand veneer.	Claudio (Bio)
JC125	Canyons MCZ	JC125-076-ISIS254/PSH03	8	239	27/08/2015	14:49:00	48	28.0190	9	38.5470	861.2									~80% recovery. Mostly grey plastic clays with black organic streaks and a thin layer of sand at surface.	Claudio (Geo)
JC125	Canyons MCZ	JC125-077-MBES30/EM120	1	239	27/08/2015	18:16:00	48	27.9180	9	38.5590	974.0	239	27/08/2015	22:10:00	48	45.5530	10	27.4890	540.0	FAIL. Logging stopped at 20:36 due to poor quality data.	
JC125	Canyons MCZ	JC125-077-MBES30/SBP120	2	239	27/08/2015	18:16:00	48	27.9180	9	38.5590	974.0	239	27/08/2015	22:10:00	48	45.5530	10	27.4890	540.0	FAIL. Logging stopped at 20:36 due to poor quality data.	
JC125	Whittard Canyon	JC125-078-ISIS255/ISIS255	0	239	27/08/2015	22:58:00	48	45.3820	10	27.8820	755.0	240	28/08/2015	07:45:00	48	75.8190	10	45.5090	412.0		
JC125	Whittard Canyon	JC125-078-ISIS255/PSH01	1	240	28/08/2015	00:06:00	48	45.7050	10	27.6020	755.0									Very sandy. Almost empty.	Claudio / Jenny
JC125	Whittard Canyon	JC125-078-ISIS255/SLP01	2	240	28/08/2015	01:27:00	48	45.6540	10	27.4070	692.0									Antipatharian	Raissa
JC125	Whittard Canyon	JC125-078-ISIS255/SLP02	3	240	28/08/2015	02:46:00	48	45.5640	10	27.5140	683.0									14 *Acesta* + pieces of coral	Laura / Kostas
JC125	Whittard Canyon	JC125-078-ISIS255/SLP03	4	240	28/08/2015	05:07:00	48	45.5160	10	27.5780	692.8									8 *Acesta*	Laura / Kostas
JC125	Whittard Canyon	JC125-078-ISIS255/PSH02	5	240	28/08/2015	06:50:00	48	45.4920	10	27.3460	498.8									60 m to WP367	Claudio / Jenny
JC125	Whittard Canyon	JC125-078-ISIS255/PSH03	6	240	28/08/2015	06:57:00	48	45.4920	10	27.3450	498.8									60 m to WP367	Kostas
JC125	Whittard Canyon	JC125-078-ISIS255/PSH04	7	240	28/08/2015	06:59:00	48	45.4920	10	27.3450	498.7									60 m to WP367	Kostas
JC125	Whittard Canyon	JC125-079-AUV92/ASUB92	1	240	28/08/2015	08:49:00	48	44.7910	10	29.0420	856.0	240	28/08/2015	14:50:00	48	46.2770	10	26.8720	841.0		
JC125	Whittard Canyon	JC125-080-ISIS256/ISIS256	0	240	28/08/2015	15:49:00	48	45.2350	10	28.2380	785.0	241	29/08/2015	06:53:00	48	45.1830	10	28.5770	672.2	Push cores 1-3 mixed success	
JC125	Whittard Canyon	JC125-080-ISIS256/SLP01	1	240	28/08/2015	17:26:00	48	45.2650	10	28.3270	820.0									cf. *Antipathes* (?). Broken in 2 pieces.	Raissa
JC125	Whittard Canyon	JC125-080-ISIS256/PSH01	2	240	28/08/2015	18:58:00	48	45.3460	10	28.4870	639.0									Geo	Claudio
JC125	Whittard Canyon	JC125-080-ISIS256/PSH02	3	240	28/08/2015	19:01:00	48	45.3460	10	28.4870	639.0									Bio #01	Kat
JC125	Whittard Canyon	JC125-080-ISIS256/PSH03	4	240	28/08/2015	19:03:00	48	45.3460	10	28.4870	639.0									Bio #02	Kat
JC125	Whittard Canyon	JC125-080-ISIS256/RCK01	5	240	28/08/2015	19:54:00	48	45.1990	10	28.3520	838.0									Rock sample #01 (small) taken at base of cliff section	Claudio
JC125	Whittard Canyon	JC125-080-ISIS256/RCK02	6	240	28/08/2015	19:56:00	48	45.1990	10	28.3520	838.0									Rock sample #02 (big) taken at base of cliff section	Claudio
JC125	Whittard Canyon	JC125-080-ISIS256/RCK03	7	240	28/08/2015	20:26:00	48	45.2160	10	28.4100	776.0									Large rock, tabular/angular + broken coral	Claudio / Kat
JC125	Whittard Canyon	JC125-080-ISIS256/SLP02	8	240	28/08/2015	20:44:00	48	45.2160	10	28.4100	776.0									Black coral	Raissa
JC125	Whittard Canyon	JC125-080-ISIS256/PSH04	9	241	29/08/2015	00:16:00	48	45.3528	10	28.3980	640.0									Bio. ~100% recovery.	Kostas
JC125	Whittard Canyon	JC125-080-ISIS256/PSH05	10	241	29/08/2015	00:19:00	48	45.3528	10	28.3980	640.0									~100% recovery.	Claudio
JC125	Whittard Canyon	JC125-080-ISIS256/SLP03	11	241	29/08/2015	03:42:00	48	45.2070	10	28.5640	698.0									8 *Acesta* + coral fragments	Laura
JC125	Whittard Canyon	JC125-080-ISIS256/SLP04	12	241	29/08/2015	04:17:00	48	45.2080	10	28.5650	698.7									3 *Acesta*	Laura
JC125	Whittard Canyon	JC125-081-AUV93/ASUB93	1	241	29/08/2015	09:46:00	48	44.8680	10	28.9980	789.0	241	29/08/2015	16:33:00	48	45.0170	10	28.4250	860.0		
JC125	Whittard Canyon	JC125-082-MBES31/EM120	1	241	29/08/2015	15:50:00	48	44.7750	10	30.5520	672.0	241	29/08/2015	18:38:00	48	36.4620	11	11.7160	2759.0	Restart EM120 at 16:17	
JC125	Whittard Canyon	JC125-082-MBES31/SBP120	2	241	29/08/2015	15:50:00	48	44.7750	10	30.5520	672.0	241	29/08/2015	18:38:00	48	36.4620	11	11.7160	2759.0		
JC125	Whittard Canyon	JC125-083-ISIS257/ISIS257	0	241	29/08/2015	19:14:00	48	36.4620	11	11.7384	2745.0	242	30/08/2015	07:53:00	48	36.4620	11	11.7060	2745.0		
JC125	Whittard Canyon	JC125-083-ISIS257/PSH01	1	241	29/08/2015	22:12:00	48	36.4681	11	11.8802	2740.0									Geo. Mud. Lots of holothurians / Morich (?)	Claudio
JC125	Whittard Canyon	JC125-083-ISIS257/PSH02	2	241	29/08/2015	22:13:00	48	36.4681	11	11.8802	2740.0									Bio. Mud. Lots of holothurians / Morich (?)	Kostas
JC125	Whittard Canyon	JC125-083-ISIS257/PSH03	3	241	29/08/2015	22:15:00	48	36.4681	11	11.8802	2740.0									Bio. Mud. Lots of holothurians / Morich (?)	Kostas
JC125	Whittard Canyon	JC125-083-ISIS257/SLP01	4	241	29/08/2015	22:18:00	48	36.4685	11	11.8852	2740.0									3 holothurians - Elpidiidae	Leigh / Kostas
JC125	Whittard Canyon	JC125-083-ISIS257/RCK01	5	241	29/08/2015	22:35:00	48	36.4680	11	11.9530	2697.0									2 pieces of rock at base of the wall	Russ
JC125	Whittard Canyon	JC125-083-ISIS257/SLP02	6	241	29/08/2015	22:53:00	48	36.4530	11	11.9660	2638.0									*Distichoptilum gracile*	Inge
JC125	Whittard Canyon	JC125-083-ISIS257/SLP03	7	242	30/08/2015	00:23:45	48	36.5890	11	11.8990	2735.0									11 *Peniagone sp.*	Leigh / Kostas
JC125	Whittard Canyon	JC125-083-ISIS257/SLP04	8	242	30/08/2015	05:40:00	48	37.4540	11	10.1430	2202.0									*Umbellula sp.*	Raissa
JC125	Whittard Canyon	JC125-083-ISIS257/PSH04	9	242	30/08/2015	05:42:00	48	37.4540	11	10.1420	2202.1									Geo	Claudio
JC125	Whittard Canyon	JC125-084-MBES32/EM120	1	242	30/08/2015	08:09:00	48	37.5830	11	9.2110	1905.0	242	30/08/2015	10:53:00	48	44.8674	10	28.7000	886.0		
JC125	Whittard Canyon	JC125-084-MBES32/SBP120	2	242	30/08/2015	08:09:00	48	37.5830	11	9.2110	1905.0	242	30/08/2015	10:53:00	48	44.8674	10	28.7000	886.0		
JC125	Whittard Canyon	JC125-085-AUV94/ASUB94	1	242	30/08/2015	11:25:00	48	44.9790	10	28.6900	853.0	242	30/08/2015	18:04:00	48	45.0580	10	25.5030	846.0		
JC125	Whittard Canyon	JC125-086-MBES33/EM120	1	242	30/08/2015	18:10:00	48	45.0020	10	28.2580	858.0	242	30/08/2015	20:03:00	48	38.0370	10	1.0850	1477.0		
JC125	Whittard Canyon	JC125-086-MBES33/SBP120	2	242	30/08/2015	18:10:00	48	45.0020	10	28.2580	858.0	242	30/08/2015	20:03:00	48	38.0370	10	1.0850	1477.0		
JC125	Whittard Canyon	JC125-087-ISIS258/ISIS258	0	242	30/08/2015	22:02:00	48	39.1360	10	1.0140	1455.0	243	31/08/2015	02:58:00	48	38.7580	10	33.7200	1176.0	Mission aborted due to strong currents.	
JC125	Whittard Canyon	JC125-088-MBES34/EM120	1	243	31/08/2015	03:12:00	48	38.9990	10	0.1990	980.0	243	31/08/2015	07:15:00	48	36.8490	9	58.8107	1604.0		
JC125	Whittard Canyon	JC125-088-MBES34/SBP120	2	243	31/08/2015	03:12:00	48	38.9990	10	0.1990	980.0	243	31/08/2015	07:15:00	48	36.8490	9	58.8107	1604.0		
JC125	Whittard Canyon	JC125-089-AUV95/ASUB95	1	243	31/08/2015	09:36:00	48	36.9244	9	58.7708	1592.0	243	31/08/2015	13:19:00	48	36.7630	9	59.3517	1640.0	FAIL; mecanic issues.	
JC125	Whittard Canyon	JC125-090-MBES35/EM120	1	243	31/08/2015	13:38:00	48	34.7520	9	59.3870	835.0	243	31/08/2015	14:41:00	48	23.9940	10	0.0060	2974.0		
JC125	Whittard Canyon	JC125-090-MBES35/SBP120	2	243	31/08/2015	13:38:00	48	34.7520	9	59.3870	835.0	243	31/08/2015	14:41:00	48	23.9940	10	0.0060	2974.0		

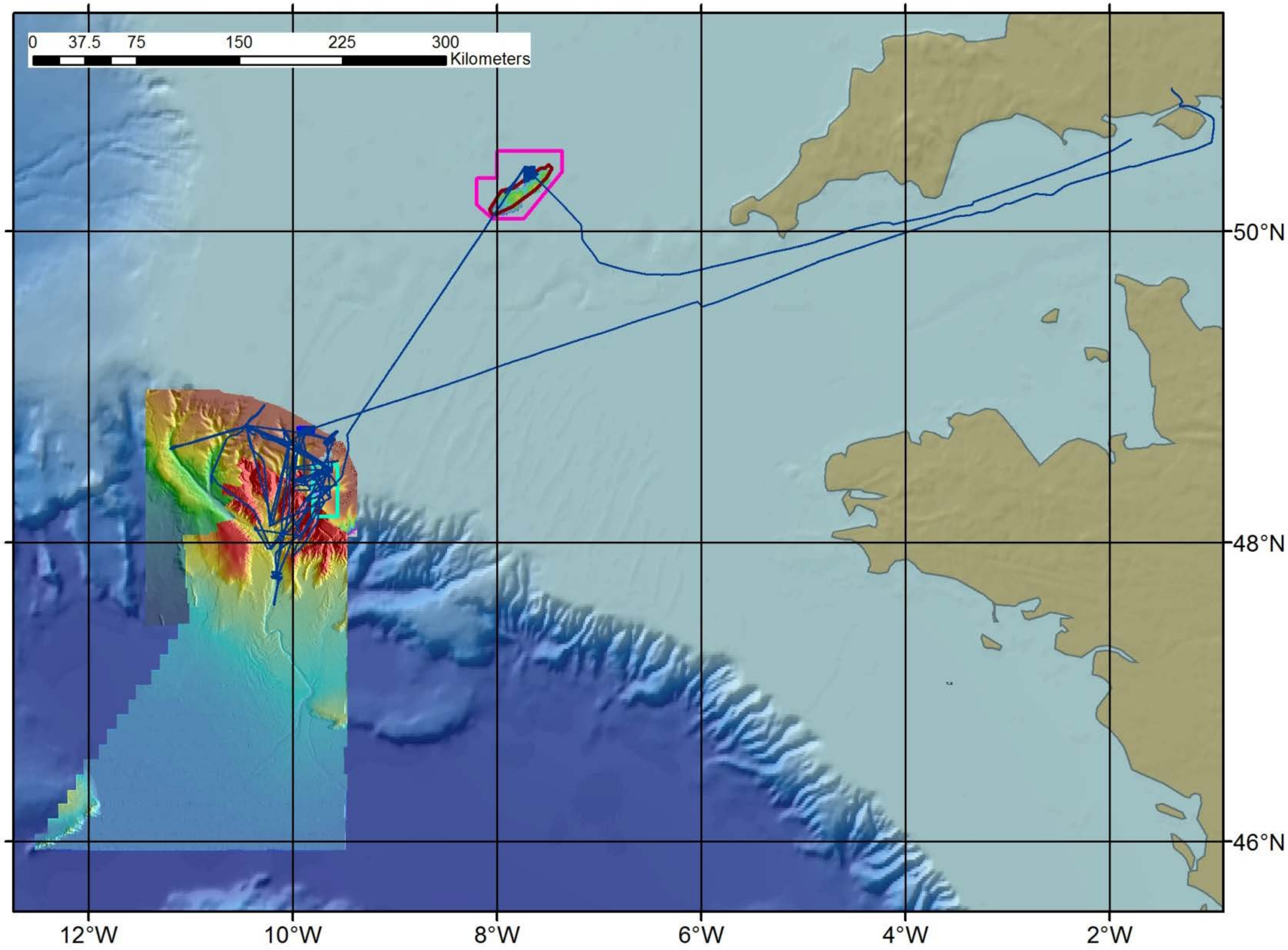
JC125	Whittard Canyon	JC125-091-ISIS259/ISIS259	0	243	31/08/2015	15:10:00	48	23.9170	9	59.7880	2973.1		244	01/09/2015	03:18:00	48	25.1310	10	1.6590	2242.0	ABORTED at 01:20 due to loss of telemetry on ROV. Common dolphins hunting fish at surface at 22:39, 48.40955/-10.006881.	
JC125	Whittard Canyon	JC125-091-ISIS259/PSH01	1	243	31/08/2015	17:56:00	48	23.9820	9	59.8390	2841.0										Geo. Sandy-mud/muddy-sand. Full recovery.	Jenny / Claudio
JC125	Whittard Canyon	JC125-091-ISIS259/PSH02	2	243	31/08/2015	17:57:00	48	23.9820	9	59.8390	2841.0										Bio. Sandy-mud. Full recovery.	Jenny / Claudio / Ko
JC125	Whittard Canyon	JC125-091-ISIS259/PSH03	3	243	31/08/2015	17:59:00	48	23.9820	9	59.8390	2841.0										Bio. Sandy-mud. Full recovery.	Jenny / Claudio / Ko
JC125	Whittard Canyon	JC125-091-ISIS259/PSH04	4	243	31/08/2015	18:45:00	48	24.0480	9	59.8860	2979.0										Geo. Sandy-mud. Full recovery.	Jenny / Claudio
JC125	Whittard Canyon	JC125-091-ISIS259/PSH05	5	243	31/08/2015	18:47:00	48	24.0480	9	59.8860	2979.0										Bio. Sandy-mud. Full recovery.	Jenny / Claudio
JC125	Whittard Canyon	JC125-091-ISIS259/PSH06	6	243	31/08/2015	18:49:00	48	24.0480	9	59.8860	2979.0										Bio. Sandy-mud. Full recovery.	Jenny / Claudio / Ko
JC125	Whittard Canyon	JC125-091-ISIS259/RCK01	7	243	31/08/2015	18:23:00	48	24.0247	9	59.7922	2969.0										Little piece of rock from ledge? (sandstone)	Gareth / Claudio
JC125	Whittard Canyon	JC125-091-ISIS259/RCK02	8	244	01/09/2015	00:55:00	48	25.0300	10	0.5667	1975.0										Glacial dropstone? With Fauna.	Russ
JC125	Whittard Canyon	JC125-092-MBES36/EM120	1	244	01/09/2015	03:29:00	48	24.6204	9	59.8971	2631.0		244	01/09/2015	07:18:00	48	28.5206	9	39.2382	875.0		
JC125	Whittard Canyon	JC125-092-MBES36/SBP120	2	244	01/09/2015	03:29:00	48	24.6204	9	59.8971	2631.0		244	01/09/2015	07:18:00	48	28.5206	9	39.2382	875.0		
JC125	Whittard Canyon	JC125-093-CTD18/P01	1	244	01/09/2015	08:36:00	48	28.4938	9	39.1933	897.0		244	01/09/2015	11:15:00	48	28.4936	9	39.1937	894.0	No bottle fired.	
JC125	Whittard Canyon	JC125-093-CTD18/SAPS01	2	244	01/09/2015	08:36:00	48	28.4938	9	39.1933	897.0		244	01/09/2015	11:15:00	48	28.4936	9	39.1937	894.0		
JC125	Whittard Canyon	JC125-094-AUV96/ASUB96	1	244	01/09/2015	12:35:00	48	28.8907	9	38.2023	1009.0		245	02/09/2015	12:55:00	48	28.5036	9	37.1544	635.0		
JC125	Whittard Canyon	JC125-095-MBES37/EM120	1	244	01/09/2015	14:59:00	48	28.6288	9	38.9098	1044.0		244	01/09/2015	16:35:00	48	24.1066	9	59.9883	2928.0		
JC125	Whittard Canyon	JC125-095-MBES37/SBP120	2	244	01/09/2015	14:59:00	48	28.6288	9	38.9098	1044.0		244	01/09/2015	16:35:00	48	24.1066	9	59.9883	2928.0		
JC125	Whittard Canyon	JC125-096-ISIS260/ISIS260	0	244	01/09/2015	17:23:00	48	24.0720	10	0.0180	2844.0		245	02/09/2015	10:40:00	48	24.3731	10	0.3424	2451.0	Multibeam dive.	
JC125	Whittard Canyon	JC125-097-MBES38/EM120	1	245	02/09/2015	10:55:00	48	24.4657	9	59.3638	2907.0		245	02/09/2015	12:31:00	48	28.4833	9	37.2521	1231.0		
JC125	Whittard Canyon	JC125-097-MBES38/SBP120	2	245	02/09/2015	10:55:00	48	24.4657	9	59.3638	2907.0		245	02/09/2015	12:31:00	48	28.4833	9	37.2521	1231.0		
JC125	Whittard Canyon	JC125-098-PC07/PC01	1	245	02/09/2015	18:09:00	48	27.7950	9	38.2340	662.0	663.0									Preliminary SBP PC survey. 4.7 m recovered. 3.8 T.	
JC125	Whittard Canyon	JC125-099-PC08/PC01	1	245	02/09/2015	20:32:00	48	27.6890	9	38.5460	739.0	704.0									Preliminary SBP PC survey. 12 m PC. 2.7 T. Trigger arm not fired when recovered to surface; possible failure of hydrostatic release.	
JC125	Whittard Canyon	JC125-100-PC09/PC01	1	245	02/09/2015	23:07:00	48	27.6710	9	38.5640	726.0	693.0									12 m PC. 2.4 T. Repeat of previous attempt. Trigger arm not fired. Potential failed core. X2 failed attempts at this location due to PC not triggering.	
JC125	Whittard Canyon	JC125-101-MC05/W01	1	246	03/09/2015	01:10:00	48	27.7960	9	38.2410	665.0	664.0									340 mm. 2.17 T. 8 tubes.	
JC125	Whittard Canyon	JC125-101-MC05/U01	1	246	03/09/2015	01:10:00	48	27.7960	9	38.2410	665.0	664.0									Bio. 280 mm. 2.17 T. 8 tubes.	
JC125	Whittard Canyon	JC125-101-MC05/Q01	1	246	03/09/2015	01:10:00	48	27.7960	9	38.2410	665.0	664.0									Bio. 300 mm. 2.17 T. 8 tubes.	
JC125	Whittard Canyon	JC125-101-MC05/M01	1	246	03/09/2015	01:10:00	48	27.7960	9	38.2410	665.0	664.0									Failed. 94 mm. 2.17 T. 8 tubes.	
JC125	Whittard Canyon	JC125-101-MC05/A01	1	246	03/09/2015	01:10:00	48	27.7960	9	38.2410	665.0	664.0									Geo. 326 mm. 2.17 T. 8 tubes.	
JC125	Whittard Canyon	JC125-101-MC05/xx01	1	246	03/09/2015	01:10:00	48	27.7960	9	38.2410	665.0	664.0									335 mm. 2.17 T. 8 tubes.	
JC125	Whittard Canyon	JC125-101-MC05/O01	1	246	03/09/2015	01:10:00	48	27.7960	9	38.2410	665.0	664.0									Geo. 350 mm. 2.17 T. 8 tubes.	
JC125	Whittard Canyon	JC125-101-MC05/J01	1	246	03/09/2015	01:10:00	48	27.7960	9	38.2410	665.0	664.0									294 mm. 2.17 T. 8 tubes.	
JC125	Whittard Canyon	JC125-102-MBES39/EM120	1	246	03/09/2015	01:57:00	48	27.7620	9	38.2550	666.0		246	03/09/2015	04:07:00	48	25.2100	9	47.9770	1485.0		
JC125	Whittard Canyon	JC125-102-MBES39/SBP120	2	246	03/09/2015	01:57:00	48	27.7620	9	38.2550	666.0		246	03/09/2015	04:07:00	48	25.2100	9	47.9770	1485.0		
JC125	Whittard Canyon	JC125-103-MC06/MC01	1	246	03/09/2015	05:12:00	48	25.1740	9	47.7210	1474.0	1496.0									FAILED. 5/8 triggered. No recovery at all.	
JC125	Whittard Canyon	JC125-104-MBES40/EM120	1	246	03/09/2015	06:17:00	48	25.2766	9	47.5746	1489.0		246	03/09/2015	07:06:00	48	28.2800	9	39.4324	978.0		
JC125	Whittard Canyon	JC125-104-MBES40/SBP120	2	246	03/09/2015	06:17:00	48	25.2766	9	47.5746	1489.0		246	03/09/2015	07:06:00	48	28.2800	9	39.4324	978.0		
JC125	Whittard Canyon	JC125-105-ISIS261/ISIS261	0	246	03/09/2015	07:33:00	48	25.2020	9	47.6790	977.9		246	03/09/2015	20:28:00	48	28.8480	9	40.2150	919.0	Multibeam dive.	
JC125	Whittard Canyon	JC125-106-MBES41/EM120	1	246	03/09/2015	20:42:00	48	28.4650	9	39.7990	888.0		246	03/09/2015	22:17:00	48	36.7790	9	58.7990	1648.0		
JC125	Whittard Canyon	JC125-106-MBES41/SBP120	2	246	03/09/2015	20:42:00	48	28.4650	9	39.7990	888.0		246	03/09/2015	22:17:00	48	36.7790	9	58.7990	1648.0		
JC125	Whittard Canyon	JC125-107-AUV97/ASUB97	1	246	03/09/2015	22:48:00	48	36.9350	9	58.8070	1607.0		247	04/09/2015	14:15:00	48	39.5000	10	1.5000	1306.0		
JC125	Whittard Canyon	JC125-108-MBES42/EM120	1	247	04/09/2015	01:39:00	48	37.6490	10	0.2120	1572.0		247	04/09/2015	02:30:00	48	44.1640	10	6.0270	869.0		
JC125	Whittard Canyon	JC125-108-MBES42/SBP120	2	247	04/09/2015	01:39:00	48	37.6490	10	0.2120	1572.0		247	04/09/2015	02:30:00	48	44.1640	10	6.0270	869.0		
JC125	Whittard Canyon	JC125-109-ISIS262/ISIS262	0	247	04/09/2015	03:07:00	48	44.0470	10	6.7570	832.0		247	04/09/2015	11:41:00	48	44.1666	10	5.5146	485.0		
JC125	Whittard Canyon	JC125-109-ISIS262/PSH01	1	247	04/09/2015	04:31:00	48	44.1490	10	5.9700	874.0										Bio. PC from the deepest part of the canyon.	Kostas
JC125	Whittard Canyon	JC125-109-ISIS262/PSH02	2	247	04/09/2015	04:35:00	48	44.1490	10	5.9700	874.0										Geo. PC from the deepest part of the canyon.	Claudio
JC125	Whittard Canyon	JC125-109-ISIS262/RCK01	3	247	04/09/2015	04:43:00	48	44.1500	10	5.9660	874.0										Good size (>10 cm) rock sample.	Claudio
JC125	Whittard Canyon	JC125-109-ISIS262/BIOB01	4	247	04/09/2015	05:50:00	48	44.1720	10	5.8370	803.0										Antipatharia *Parantipathes sp.*	Raissa
JC125	Whittard Canyon	JC125-109-ISIS262/PSH03	5	247	04/09/2015	07:29:00	48	44.2290	10	5.5860	570.5										Bio. PC on the next terrace.	Kostas
JC125	Whittard Canyon	JC125-109-ISIS262/PSH04	6	247	04/09/2015	07:31:00	48	44.2290	10	5.5860	570.5										Geo. PC on the next terrace.	Claudio
JC125	Whittard Canyon	JC125-109-ISIS262/PSH05	7	247	04/09/2015	07:34:00	48	44.2290	10	5.5860	570.5										Bio. PC on the next terrace.	Kostas
JC125	Whittard Canyon	JC125-109-ISIS262/BIOB02	8	247	04/09/2015	08:35:00	48	44.2550	10	5.4160	483.5										11 *Acesta*	Laura
JC125	Whittard Canyon	JC125-109-ISIS262/BIOB03	9	247	04/09/2015	08:35:00	48	44.2550	10	5.4160	483.5										Crinoids	Raissa
JC125	Whittard Canyon	JC125-109-ISIS262/RCK02	10	247	04/09/2015	10:59:00	48	44.2510	10	5.4160	491.5										Rock + coral + sponge	Veerle
JC125	Whittard Canyon	JC125-110-MBES43/EM120	1	247	04/09/2015	12:01:00	48	43.8610	10	5.2360	585.0		247	04/09/2015	12:30:00	48	39.4650	10	1.7810	1340.0		
JC125	Whittard Canyon	JC125-110-MBES43/SBP120	2	247	04/09/2015	12:01:00	48	43.8610	10	5.2360	585.0		247	04/09/2015	12:30:00	48	39.4650	10	1.7810	1340.0		
JC125	Whittard Canyon	JC125-111-ISIS263/ISIS263	0	247	04/09/2015	15:25:00	48	38.2180	10	0.9600	1454.0		248	05/09/2015	04:39:00	48	38.3460	10	0.0620	1127.0		
JC125	Whittard Canyon	JC125-111-ISIS263/PSH01	1	247	04/09/2015	17:49:00	48	38.2460	10	0.7690	1445.0										Rippled mud?	Russ / Claudio
JC125	Whittard Canyon	JC125-111-ISIS263/PSH02	2	247	04/09/2015	17:51:00	48	38.2470	10	0.7690	1445.0										Rippled mud?	Russ / Claudio
JC125	Whittard Canyon	JC125-111-ISIS263/PSH03	3	247	04/09/2015	17:53:00	48	38.2470	10	0.7690	1445.0										Rippled mud?	Russ / Claudio

JC125	Whittard Canyon	JC125-111-ISIS263/RCK01	4	247	04/09/2015	19:33:00	48	38.3250	10	0.5320	1272.0										Very tiny piece of loose rock at the base of the rock wall.	Russ
JC125	Whittard Canyon	JC125-111-ISIS263/BIOB01	5	247	04/09/2015	19:37:00	48	38.3250	10	0.5320	1272.0										Piece of corals, gorgonians, black corals, etc.	Kat / Inge / Kostas
JC125	Whittard Canyon	JC125-111-ISIS263/BIOB02	6	247	04/09/2015	20:25:00	48	38.3420	10	0.4850	1266.0										White coral ?*Stylaster*	Kat / Inge
JC125	Whittard Canyon	JC125-111-ISIS263/BIOB03	7	247	04/09/2015	23:12:00	48	38.2740	10	0.3390	1260.0										Pennatulacea	Raissa
JC125	Whittard Canyon	JC125-111-ISIS263/PSH04	8	248	05/09/2015	02:03:00	48	38.4400	10	0.2790	1233.0										Soft mud. Full recovery.	Russ / Claudio
JC125	Whittard Canyon	JC125-111-ISIS263/PSH05	9	248	05/09/2015	02:06:00	48	38.4400	10	0.2790	1233.0										Soft mud. Full recovery.	Russ / Claudio
JC125	Whittard Canyon	JC125-111-ISIS263/PSH06	10	248	05/09/2015	02:10:00	48	38.4400	10	0.2790	1233.0										Soft mud. Full recovery.	Russ / Claudio
JC125	Whittard Canyon	JC125-111-ISIS263/BIOB04	11	248	05/09/2015	02:38:00	48	38.5010	10	0.1380	1129.0										*Umbellula sp.* ♥	Raissa
JC125	Whittard Canyon	JC125-112-AUV98/ASUB98	1	248	05/09/2015	07:28:00	48	28.9330	9	38.7460	1306.0		249	06/09/2015	08:56:00	48	31.8321	9	33.6873	440.0		
JC125	Whittard Canyon	JC125-113-MBES44/EM120	1	248	05/09/2015	10:05:00	48	28.7150	9	38.7240	1040.0		248	05/09/2015	13:53:00	48	45.7059	10	27.5087	750.0		
JC125	Whittard Canyon	JC125-113-MBES44/SBP120	2	248	05/09/2015	10:05:00	48	28.7150	9	38.7240	1040.0		248	05/09/2015	13:53:00	48	45.7059	10	27.5087	750.0		
JC125	Whittard Canyon	JC125-114-ISIS264/ISIS264	0	248	05/09/2015	14:27:00	48	45.5610	10	27.6210	651.0		248	05/09/2015	23:36:00	48	45.4490	10	27.7020	597.0	Multibeam dive.	
JC125	Whittard Canyon	JC125-115-MBES45/EM120	1	248	05/09/2015	23:46:00	48	45.4310	10	27.6730	622.0		249	06/09/2015	01:48:00	48	39.2260	10	1.9998	1368.0		
JC125	Whittard Canyon	JC125-115-MBES45/SBP120	2	248	05/09/2015	23:46:00	48	45.4310	10	27.6730	622.0		249	06/09/2015	01:48:00	48	39.2260	10	1.9998	1368.0		
JC125	Whittard Canyon	JC125-116-CTD19/P01	1	249	06/09/2015	02:27:00	48	39.2210	10	2.0120	1370.0		249	06/09/2015	04:20:00	48	39.2222	10	2.0125	1371.0	No bottle fired.	
JC125	Whittard Canyon	JC125-116-CTD19/SAPS01	2	249	06/09/2015	02:27:00	48	39.2210	10	2.0120	1370.0		249	06/09/2015	04:20:00	48	39.2222	10	2.0125	1371.0		
JC125	Whittard Canyon	JC125-117-MBES46/EM120	1	249	06/09/2015	04:35:00	48	38.8190	10	0.8800	1286.0		249	06/09/2015	06:33:00	48	28.5962	9	37.0038	598.0		
JC125	Whittard Canyon	JC125-117-MBES46/SBP120	2	249	06/09/2015	04:35:00	48	38.8190	10	0.8800	1286.0		249	06/09/2015	06:33:00	48	28.5962	9	37.0038	598.0		
JC125	Whittard Canyon	JC125-118-MBES47/EM120	1	249	06/09/2015	09:03:00	48	31.8362	9	33.8510	425.0		249	06/09/2015	11:02:00	48	28.9868	10	3.4990	1679.0		
JC125	Whittard Canyon	JC125-118-MBES47/SBP120	2	249	06/09/2015	09:03:00	48	31.8362	9	33.8510	425.0		249	06/09/2015	11:02:00	48	28.9868	10	3.4990	1679.0		
JC125	Whittard Canyon	JC125-119-CTD20/P01	1	249	06/09/2015	12:35:00	48	29.1700	10	2.9450	1655.0		249	06/09/2015	14:00:00	48	29.1700	10	2.9450	1656.0	No bottle fired.	
JC125	Whittard Canyon	JC125-120-MBES48/EM120	1	249	06/09/2015	14:13:00	48	29.1506	10	1.9339	1450.0		249	06/09/2015	15:55:00	48	28.2837	9	39.4260	960.0		
JC125	Whittard Canyon	JC125-120-MBES48/SBP120	2	249	06/09/2015	14:13:00	48	29.1506	10	1.9339	1450.0		249	06/09/2015	15:55:00	48	28.2837	9	39.4260	960.0		
JC125	Canyons MCZ	JC125-121-MBES49/EM120	1	249	06/09/2015	16:00:00	48	28.3087	9	39.3636	960.0		249	06/09/2015	17:10:00	48	28.2450	9	38.7910	1063.0	SBP survey over Explorer Canyon coral mounds. Finished early as data quality not very good over coral mounds. Followed by a transit and short survey to identify PC site (station 122).	
JC125	Canyons MCZ	JC125-121-MBES49/SBP120	2	249	06/09/2015	16:00:00	48	28.3087	9	39.3636	960.0		249	06/09/2015	17:10:00	48	28.2450	9	38.7910	1063.0	SBP survey over Explorer Canyon coral mounds. Finished early as data quality not very good over coral mounds. Followed by a transit and short survey to identify PC site (station 122).	
JC125	Canyons MCZ	JC125-122-PC10/PC01	1	249	06/09/2015	18:54:00	48	27.5600	9	38.7820	729.0	712.0									FAIL. 2.34 T. Trigger were not fired.	
JC125	Canyons MCZ	JC125-123-MC07/J01	1	249	06/09/2015	20:49:00	48	27.5650	9	38.7730	726.0	747.0									106 mm. 2.16 T.	
JC125	Canyons MCZ	JC125-123-MC07/W01	1	249	06/09/2015	20:49:00	48	27.5650	9	38.7730	726.0	747.0									110 mm. 2.16 T.	
JC125	Canyons MCZ	JC125-123-MC07/M01	1	249	06/09/2015	20:49:00	48	27.5650	9	38.7730	726.0	747.0									Geo. 110 mm. 2.16 T.	
JC125	Canyons MCZ	JC125-123-MC07/L01	1	249	06/09/2015	20:49:00	48	27.5650	9	38.7730	726.0	747.0									FAIL. 2.16 T.	
JC125	Canyons MCZ	JC125-123-MC07/H01	1	249	06/09/2015	20:49:00	48	27.5650	9	38.7730	726.0	747.0									105 mm. 2.16 T.	
JC125	Canyons MCZ	JC125-123-MC07/xx01	1	249	06/09/2015	20:49:00	48	27.5650	9	38.7730	726.0	747.0									103 mm. 2.16 T.	
JC125	Canyons MCZ	JC125-123-MC07/O01	1	249	06/09/2015	20:49:00	48	27.5650	9	38.7730	726.0	747.0									107 mm. 2.16 T.	
JC125	Canyons MCZ	JC125-123-MC07/A01	1	249	06/09/2015	20:49:00	48	27.5650	9	38.7730	726.0	747.0									Geo. 118 mm. 2.16 T.	
JC125	Canyons MCZ	JC125-124-PC11/PC01	1	249	06/09/2015	22:53:00	48	27.5656	9	38.7744	732.0										3.58 T. 4.5/6 m recovery length.	
JC125	Whittard Canyon	JC125-125-MBES50/EM120	1	250	07/09/2015	00:10:00	48	27.7928	9	38.7154	826.0		250	07/09/2015	01:29:00	48	38.4090	9	38.8290	182.0		
JC125	Whittard Canyon	JC125-125-MBES50/SBP120	2	250	07/09/2015	00:10:00	48	27.7928	9	38.7154	826.0		250	07/09/2015	01:29:00	48	38.4090	9	38.8290	182.0		
JC125	Whittard Canyon	JC125-125-MBES50/EM710	3	250	07/09/2015	00:10:00	48	27.7928	9	38.7154	826.0		250	07/09/2015	01:29:00	48	38.4090	9	38.8290	182.0		
JC125	Whittard Canyon	JC125-126-MBES51/EM120	1	250	07/09/2015	01:29:00	48	38.4090	9	38.8240	182.0		250	07/09/2015	06:09:00	48	39.9042	9	38.3244	182.0	Survey over sand waves.	
JC125	Whittard Canyon	JC125-126-MBES51/SBP120	2	250	07/09/2015	01:29:00	48	38.4090	9	38.8240	182.0		250	07/09/2015	06:09:00	48	39.9042	9	38.3244	182.0	Survey over sand waves.	
JC125	Whittard Canyon	JC125-126-MBES51/EM710	3	250	07/09/2015	01:29:00	48	38.4090	9	38.8240	182.0		250	07/09/2015	06:09:00	48	39.9042	9	38.3244	182.0	Survey over sand waves.	
JC125	Whittard Canyon	JC125-127-AUV99/ASUB99	1	250	07/09/2015	06:28:00	48	40.0360	9	38.1052	176.0		250	07/09/2015	22:36:00	48	40.6500	9	38.2570	178.0		
JC125	Whittard Canyon	JC125-128-MBES52/EM120	1	250	07/09/2015	07:20:00	48	39.9820	9	38.1990	178.0		250	07/09/2015	08:46:00	48	43.0560	9	52.1150	218.0		
JC125	Whittard Canyon	JC125-128-MBES52/SBP120	2	250	07/09/2015	07:20:00	48	39.9820	9	38.1990	178.0		250	07/09/2015	08:46:00	48	43.0560	9	52.1150	218.0		
JC125	Whittard Canyon	JC125-128-MBES52/EM710	3	250	07/09/2015	07:20:00	48	39.9820	9	38.1990	178.0		250	07/09/2015	08:46:00	48	43.0560	9	52.1150	218.0		
JC125	Whittard Canyon	JC125-129-ISIS265/ISIS265	0	250	07/09/2015	09:15:00	48	43.0487	9	52.0534	218.3		250	07/09/2015	11:51:00	48	43.0420	9	52.0360	217.6	Vibrocore.	
JC125	Whittard Canyon	JC125-129-ISIS265/VBR01	1	250	07/09/2015	10:34:00	48	43.0450	9	52.0530	219.0										Empty.	Jenny
JC125	Whittard Canyon	JC125-129-ISIS265/VBR02	2	250	07/09/2015	11:01:00	48	43.0500	9	52.0440	218.0											Jenny
JC125	Whittard Canyon	JC125-130-MBES53/EM120	1	250	07/09/2015	12:01:00	48	43.0271	9	51.9360	232.0		250	07/09/2015	13:15:00	48	43.9517	9	50.5508	200.0		
JC125	Whittard Canyon	JC125-130-MBES53/SBP120	2	250	07/09/2015	12:01:00	48	43.0271	9	51.9360	232.0		250	07/09/2015	13:15:00	48	43.9517	9	50.5508	200.0		
JC125	Whittard Canyon	JC125-130-MBES53/EM710	3	250	07/09/2015	12:01:00	48	43.0271	9	51.9360	232.0		250	07/09/2015	13:15:00	48	43.9517	9	50.5508	200.0		
JC125	Whittard Canyon	JC125-131-ISIS266/ISIS266	0	250	07/09/2015	13:45:00	48	44.0010	9	50.5930	197.0		250	07/09/2015	16:17:00	48	43.9800	9	50.5920	196.0	Vibrocore.	
JC125	Whittard Canyon	JC125-131-ISIS266/VBR01	1	250	07/09/2015	14:30:00	48	43.9860	9	50.6090	202.0											Jenny / Claudio
JC125	Whittard Canyon	JC125-131-ISIS266/VBR02	2	250	07/09/2015	15:29:00	48	44.0390	9	50.5240	203.5											Jenny / Claudio
JC125	Whittard Canyon	JC125-132-MBES54/EM120	1	250	07/09/2015	16:33:00	48	43.9010	9	50.5570	207.0		250	07/09/2015	17:30:00	48	42.2140	9	51.2170		Short transit and MBES/SBP survey before ROV dive (station 133).	
JC125	Whittard Canyon	JC125-132-MBES54/SBP120	2	250	07/09/2015	16:33:00	48	43.9010	9	50.5570	207.0		250	07/09/2015	17:30:00	48	42.2140	9	51.2170		Short transit and MBES/SBP survey before ROV dive (station 133).	

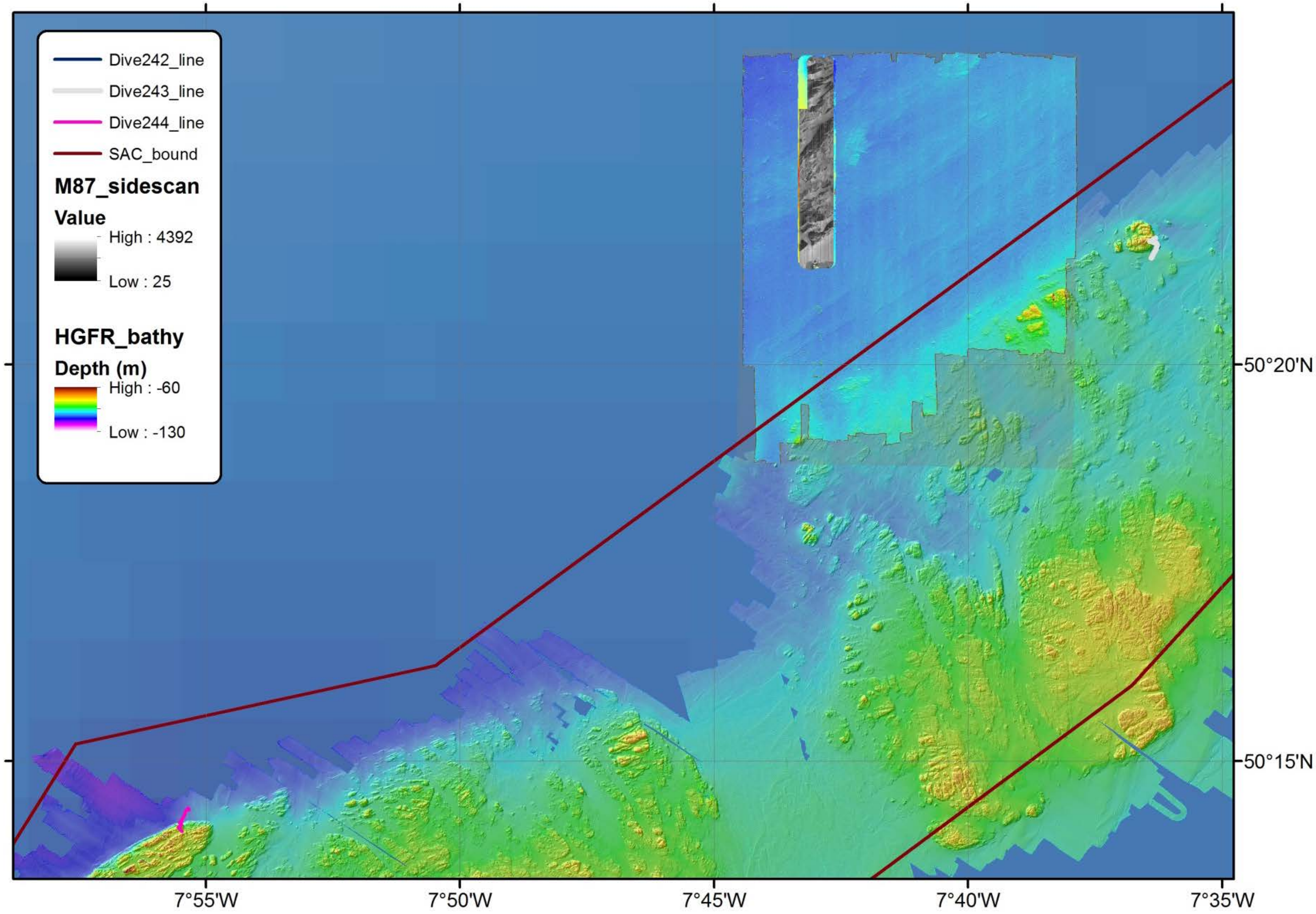
JC125	Whittard Canyon	JC125-132-MBES54/EM710	3	250	07/09/2015	16:33:00	48	43.9010	9	50.5570	207.0		250	07/09/2015	17:30:00	48	42.2140	9	51.2170		Short transit and MBES/SBP survey before ROV dive (station 133).
JC125	Whittard Canyon	JC125-133-ISIS267/ISIS267	0	250	07/09/2015	17:48:00	48	42.2160	9	51.2100	226.0		250	07/09/2015	20:07:00	48	42.2220	9	51.1860	227.0	Vibrocore.
JC125	Whittard Canyon	JC125-133-ISIS267/VBR01	1	250	07/09/2015	18:33:00	48	42.2140	9	51.1630	226.0										Jenny
JC125	Whittard Canyon	JC125-133-ISIS267/VBR02	2	250	07/09/2015	19:25:00	48	42.2540	9	51.1240	229.6										Jenny
JC125	Whittard Canyon	JC125-134-MBES55/EM120	1	250	07/09/2015	20:53:00	48	42.1850	9	50.9070	232.0		250	07/09/2015	21:52:00	48	40.2880	9	39.3340	185.0	
JC125	Whittard Canyon	JC125-134-MBES55/SBP120	2	250	07/09/2015	20:53:00	48	42.1850	9	50.9070	232.0		250	07/09/2015	21:52:00	48	40.2880	9	39.3340	185.0	
JC125	Whittard Canyon	JC125-134-MBES55/EM710	3	250	07/09/2015	20:53:00	48	42.1850	9	50.9070	232.0		250	07/09/2015	21:52:00	48	40.2880	9	39.3340	185.0	
JC125	Whittard Canyon	JC125-135-MBES56/EM120	1	250	07/09/2015	22:43:00	48	41.1960	9	38.4770	174.0		251	08/09/2015	00:49:00	48	40.9360	9	36.9820	172.0	
JC125	Whittard Canyon	JC125-135-MBES56/SBP120	2	250	07/09/2015	22:43:00	48	41.1960	9	38.4770	174.0		251	08/09/2015	00:49:00	48	40.9360	9	36.9820	172.0	
JC125	Whittard Canyon	JC125-135-MBES56/EM710	3	250	07/09/2015	22:43:00	48	41.1960	9	38.4770	174.0		251	08/09/2015	00:49:00	48	40.9360	9	36.9820	172.0	
JC125	Whittard Canyon	JC125-136-MBES57/EM120	1	251	08/09/2015	01:00:00	48	39.7890	9	35.9630	174.0		251	08/09/2015	08:31:00	47	46.6505	10	8.6019	4178.0	
JC125	Whittard Canyon	JC125-136-MBES57/SBP120	2	251	08/09/2015	01:00:00	48	39.7890	9	35.9630	174.0		251	08/09/2015	08:31:00	47	46.6505	10	8.6019	4178.0	
JC125	Whittard Canyon	JC125-136-MBES57/EM710	3	251	08/09/2015	01:00:00	48	39.7890	9	35.9630	174.0		251	08/09/2015	08:31:00	47	46.6505	10	8.6019	4178.0	EM710 switched off at 01:50 due to transit reaching deeper water.
JC125	Whittard Canyon	JC125-137-ISIS268/ISIS268	0	251	08/09/2015	09:14:00	47	46.5740	10	8.3050	4149.0		251	08/09/2015	15:53:00	47	46.7200	10	8.5420	4163.5	FAIL; vibrocore broke ☹
JC125	Whittard Canyon	JC125-138-MBES58/EM120	1	251	08/09/2015	16:21:00	47	46.6740	10	8.6950	4176.0		251	08/09/2015	19:38:00	47	46.2760	10	11.4300	4005.0	
JC125	Whittard Canyon	JC125-138-MBES58/SBP120	2	251	08/09/2015	16:21:00	47	46.6740	10	8.6950	4176.0		251	08/09/2015	19:38:00	47	46.2760	10	11.4300	4005.0	
JC125	Whittard Canyon	JC125-139-PC12/PC01	1	251	08/09/2015	22:04:00	47	46.1300	10	10.6720	4170.0	4170.0									6 m PC. Target: intra-canyon terrace ~25 m above canyon thalway/scour. 6.3 T.
JC125	Whittard Canyon	JC125-140-MBES59/SBP120	1	252	09/09/2015	00:36:00	47	45.7400	10	11.2320	4174.0		252	09/09/2015	02:52:00	47	48.1920	10	12.1650	3922.0	SBP survey over distal canyon. Lines 1 and 3 OK. Line 2 rubbish.
JC125	Whittard Canyon	JC125-141-MC08/K01	1	252	09/09/2015	05:12:00	47	46.1225	10	10.6707	4172.0	4210.0									6 cores. 38 cm. 06:42 - problems winching cable.
JC125	Whittard Canyon	JC125-141-MC08/H01	1	252	09/09/2015	05:12:00	47	46.1225	10	10.6707	4172.0	4210.0									6 cores. Bio. 39 cm. 06:42 - problems winching cable.
JC125	Whittard Canyon	JC125-141-MC08/A01	1	252	09/09/2015	05:12:00	47	46.1225	10	10.6707	4172.0	4210.0									6 cores. Bio. 41 cm. 06:42 - problems winching cable.
JC125	Whittard Canyon	JC125-141-MC08/J01	1	252	09/09/2015	05:12:00	47	46.1225	10	10.6707	4172.0	4210.0									6 cores. Geo. 41 cm. 06:42 - problems winching cable.
JC125	Whittard Canyon	JC125-141-MC08/P01	1	252	09/09/2015	05:12:00	47	46.1225	10	10.6707	4172.0	4210.0									6 cores. Geo. 42 cm. 06:42 - problems winching cable.
JC125	Whittard Canyon	JC125-141-MC08/W01	1	252	09/09/2015	05:12:00	47	46.1225	10	10.6707	4172.0	4210.0									6 cores. Geo. 41 cm. 06:42 - problems winching cable.
JC125	Whittard Canyon	JC125-142-AUV100/ASUB100	1	252	09/09/2015	08:32:00	47	46.7971	10	10.1610	4172.0		253	10/09/2015	02:45:00	47	47.5160	10	10.1370	4156.0	FAIL. Difficult recovery due to large swell. No MBES or SSS data. ☹
JC125	Whittard Canyon	JC125-143-MC09/W01	1	252	09/09/2015	15:06:00	47	46.7865	10	8.2929	4178.0	4220.0									Geo. 376 mm.5/8 successful cores.
JC125	Whittard Canyon	JC125-143-MC09/M01	1	252	09/09/2015	15:06:00	47	46.7865	10	8.2929	4178.0	4220.0									Fail.5/8 successful cores.
JC125	Whittard Canyon	JC125-143-MC09/F01	1	252	09/09/2015	15:06:00	47	46.7865	10	8.2929	4178.0	4220.0									Geo. 340 mm.5/8 successful cores.
JC125	Whittard Canyon	JC125-143-MC09/O01	1	252	09/09/2015	15:06:00	47	46.7865	10	8.2929	4178.0	4220.0									Fail.5/8 successful cores.
JC125	Whittard Canyon	JC125-143-MC09/K01	1	252	09/09/2015	15:06:00	47	46.7865	10	8.2929	4178.0	4220.0									380 mm.5/8 successful cores.
JC125	Whittard Canyon	JC125-143-MC09/J01	1	252	09/09/2015	15:06:00	47	46.7865	10	8.2929	4178.0	4220.0									Geo. 390 mm.5/8 successful cores.
JC125	Whittard Canyon	JC125-143-MC09/L01	1	252	09/09/2015	15:06:00	47	46.7865	10	8.2929	4178.0	4220.0									Geo. 375 mm.5/8 successful cores.
JC125	Whittard Canyon	JC125-143-MC09/R01	1	252	09/09/2015	15:06:00	47	46.7865	10	8.2929	4178.0	4220.0									Fail.5/8 successful cores.
JC125	Whittard Canyon	JC125-144-PC13/PC01	1	252	09/09/2015	20:06:00	47	47.1579	10	9.6343	4160.0	4166.0									6m PC. Core barrel bent from impact. 1.4 m of heavily disturbed sediment; not retained.
JC125	Whittard Canyon	JC125-145-MBES60/EM120	1	253	10/09/2015	02:46:00	47	47.7580	10	10.0800	4146.0		253	10/09/2015	08:52:00	48	42.2390	9	51.1640		
JC125	Whittard Canyon	JC125-145-MBES60/SBP120	2	253	10/09/2015	02:46:00	47	47.7580	10	10.0800	4146.0		253	10/09/2015	08:52:00	48	42.2390	9	51.1640		
JC125	Whittard Canyon	JC125-146-PC14/PC01	1	253	10/09/2015	09:38:00	48	42.2390	9	51.1663	244.0										Loose sands, lot of water. 1.5 m recovered.
JC125	Whittard Canyon	JC125-147-BC01/BC01	1	253	10/09/2015	11:36:00	48	44.0260	9	50.5682	198.0										No USBL. Classed sand (no organisms).
JC125	Whittard Canyon	JC125-148-BC02/BC01	1	253	10/09/2015	12:41:00	48	44.0390	9	50.5180	204.0										No USBL. Sands with muddy component. Lots of burrows, worms, bioclasts: cup corals, oysters, bivalves.
JC125	Whittard Canyon	JC125-149-MBES61/EM120	1	253	10/09/2015	13:51:00	48	46.2090	9	40.4180	178.0		254	11/09/2015	08:16:00	49	48.0120	4	52.3380	165.0	
JC125	Whittard Canyon	JC125-149-MBES61/SBP120	2	253	10/09/2015	13:51:00	48	46.2090	9	40.4180	178.0		254	11/09/2015	08:16:00	49	48.0120	4	52.3380	165.0	

APPENDIX B – CODEMAP2015 Maps

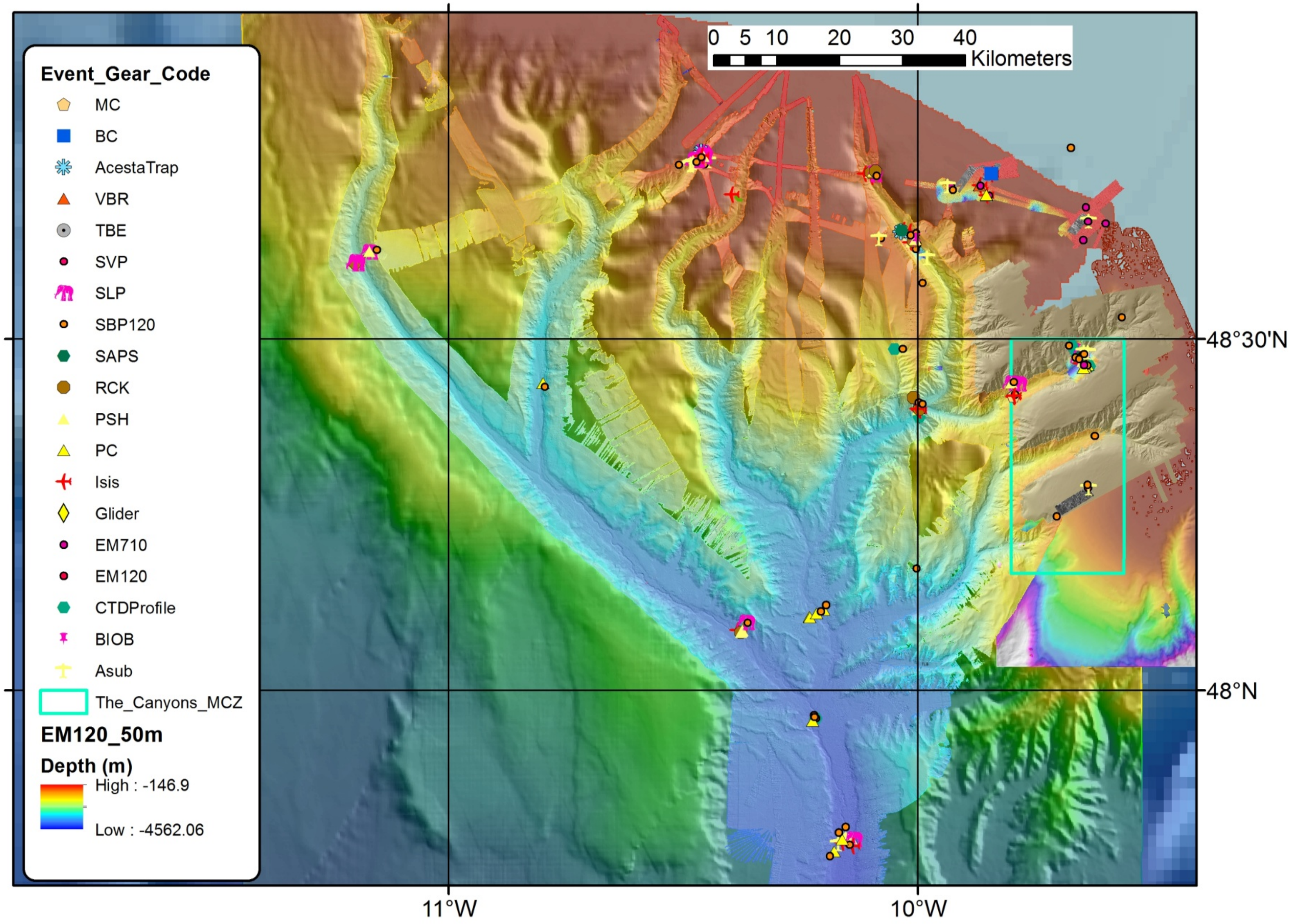
General cruise track:



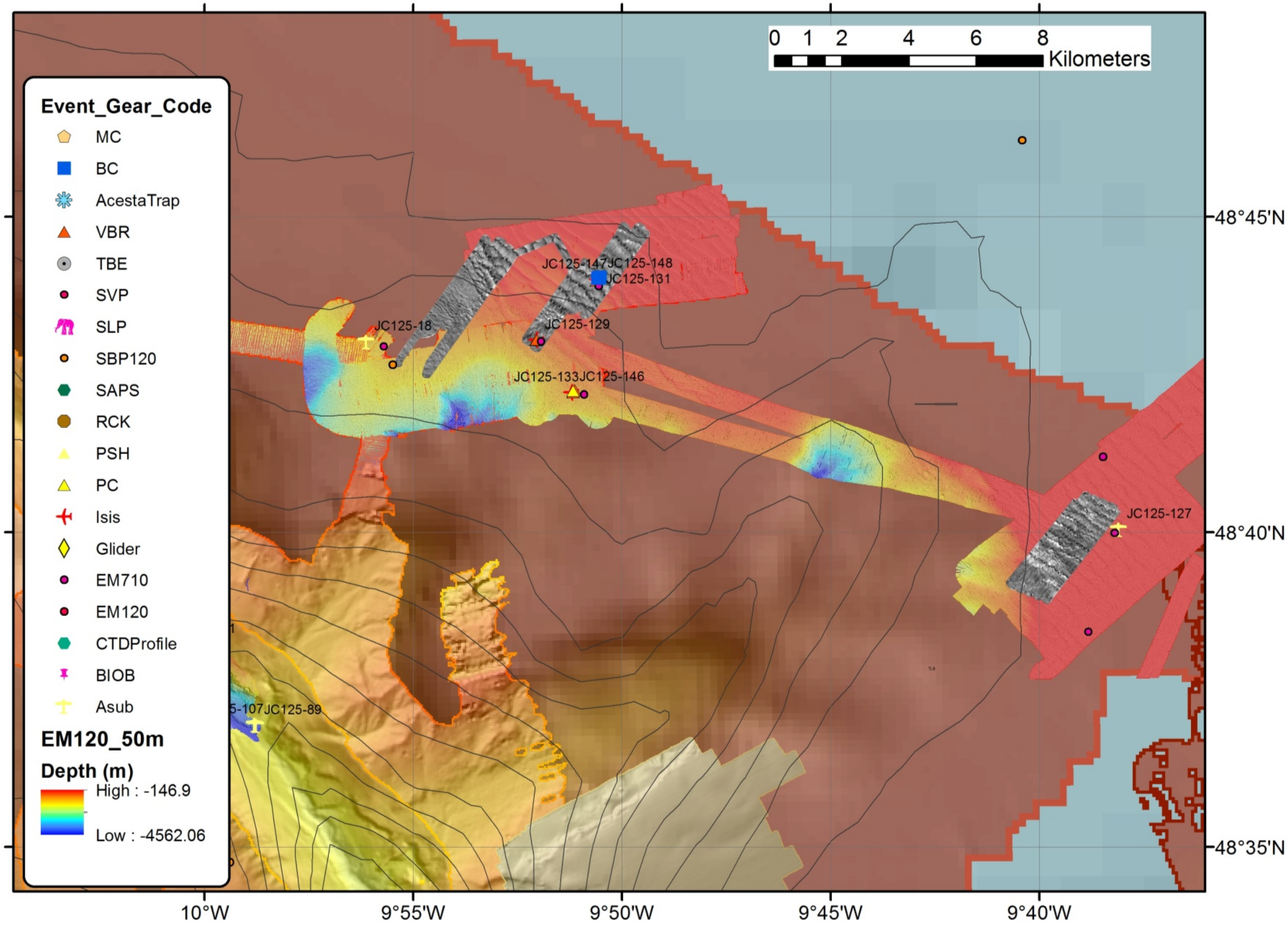
Haig Fras surveys:



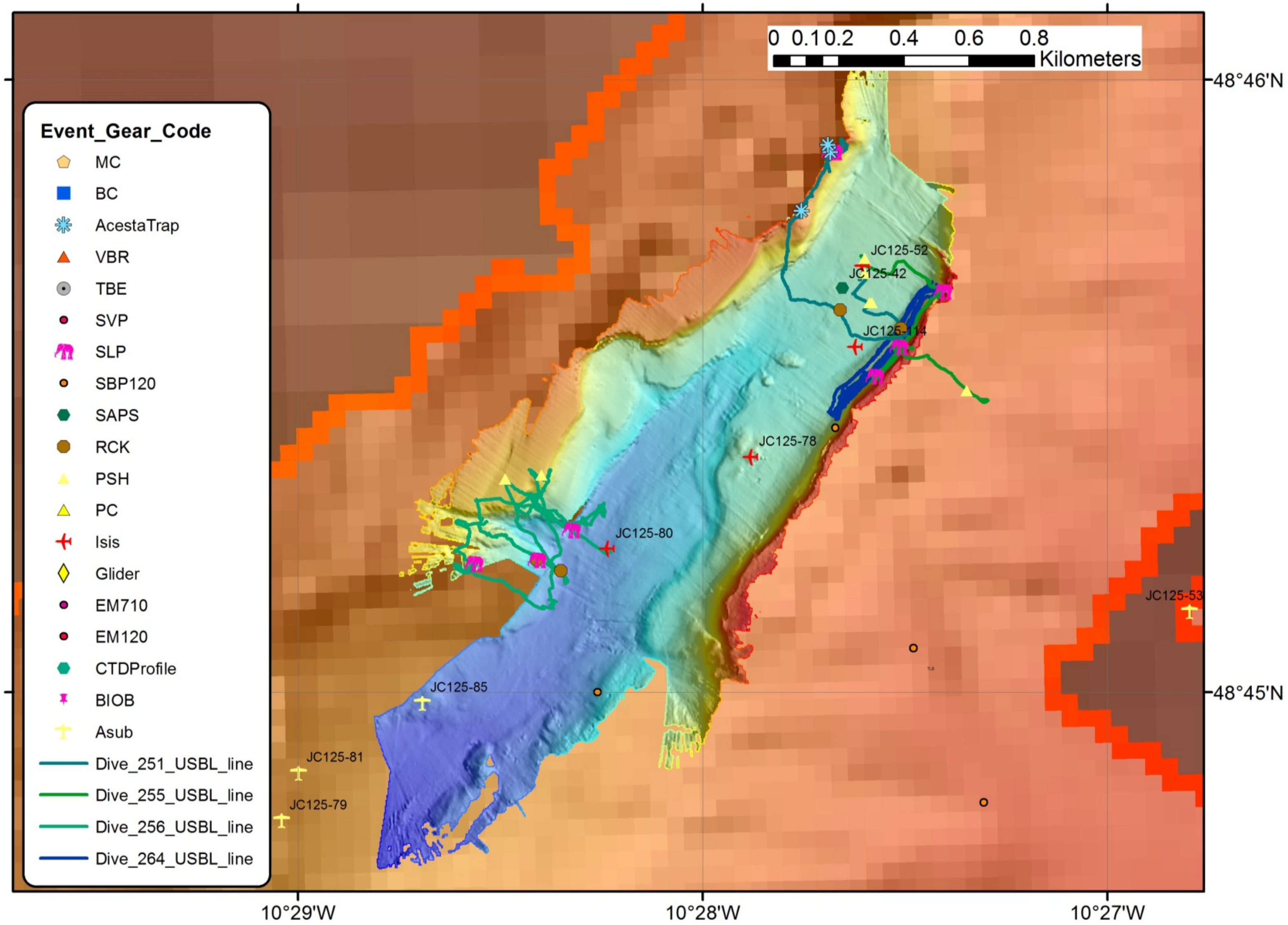
Whittard Canyon working areas:



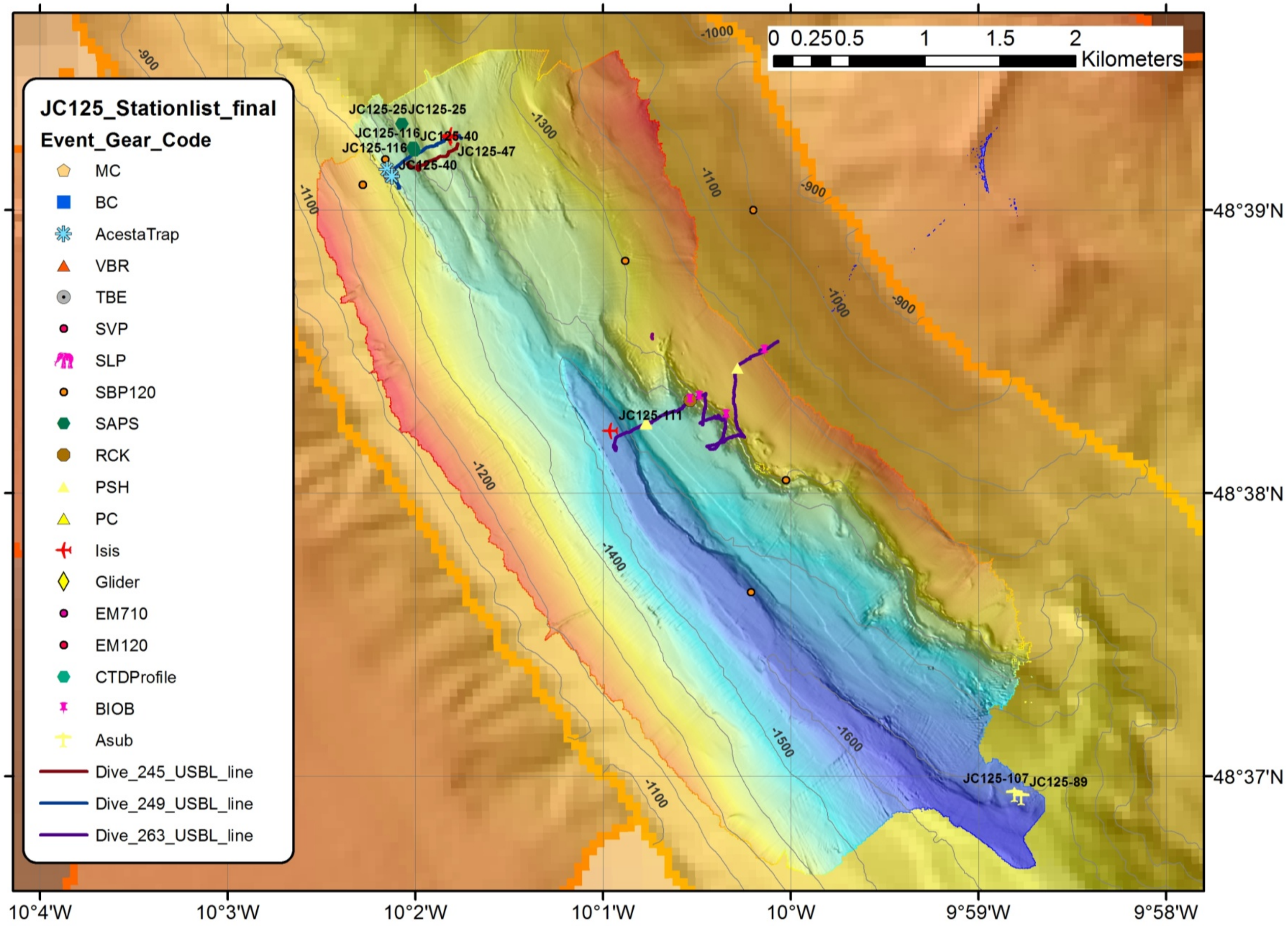
Sandwave study area:



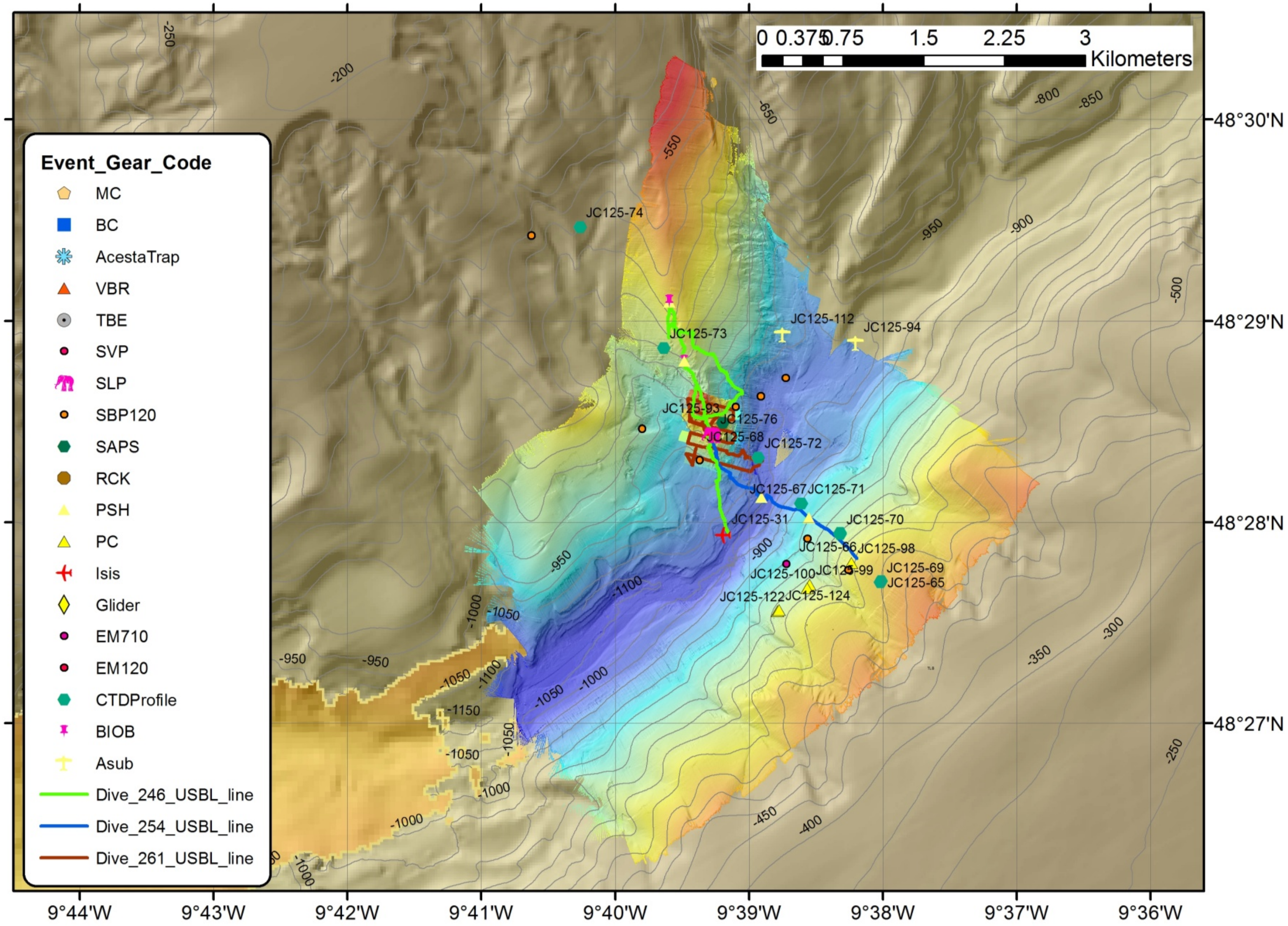
Acesta wall site:



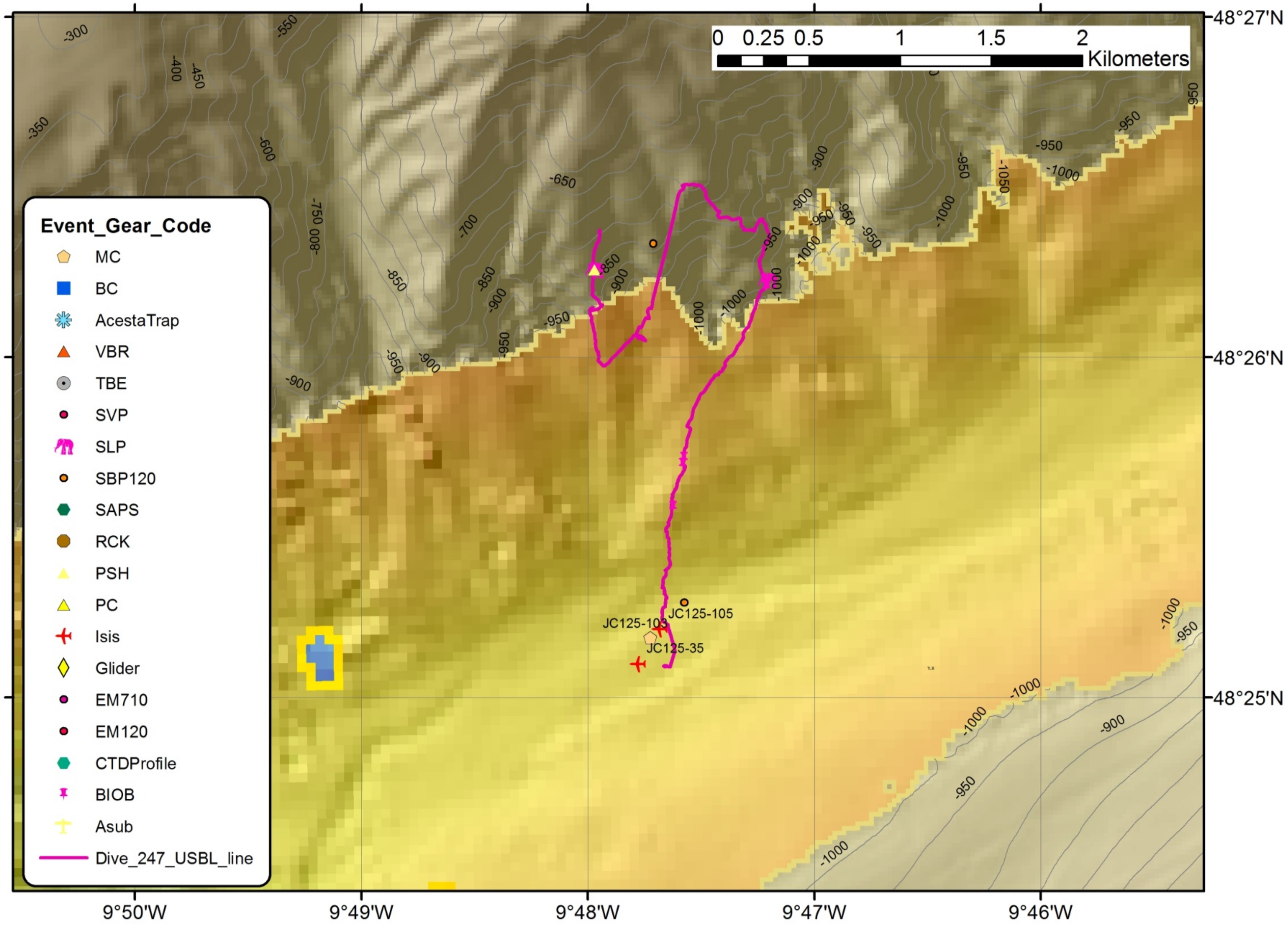
Coral Wall site:



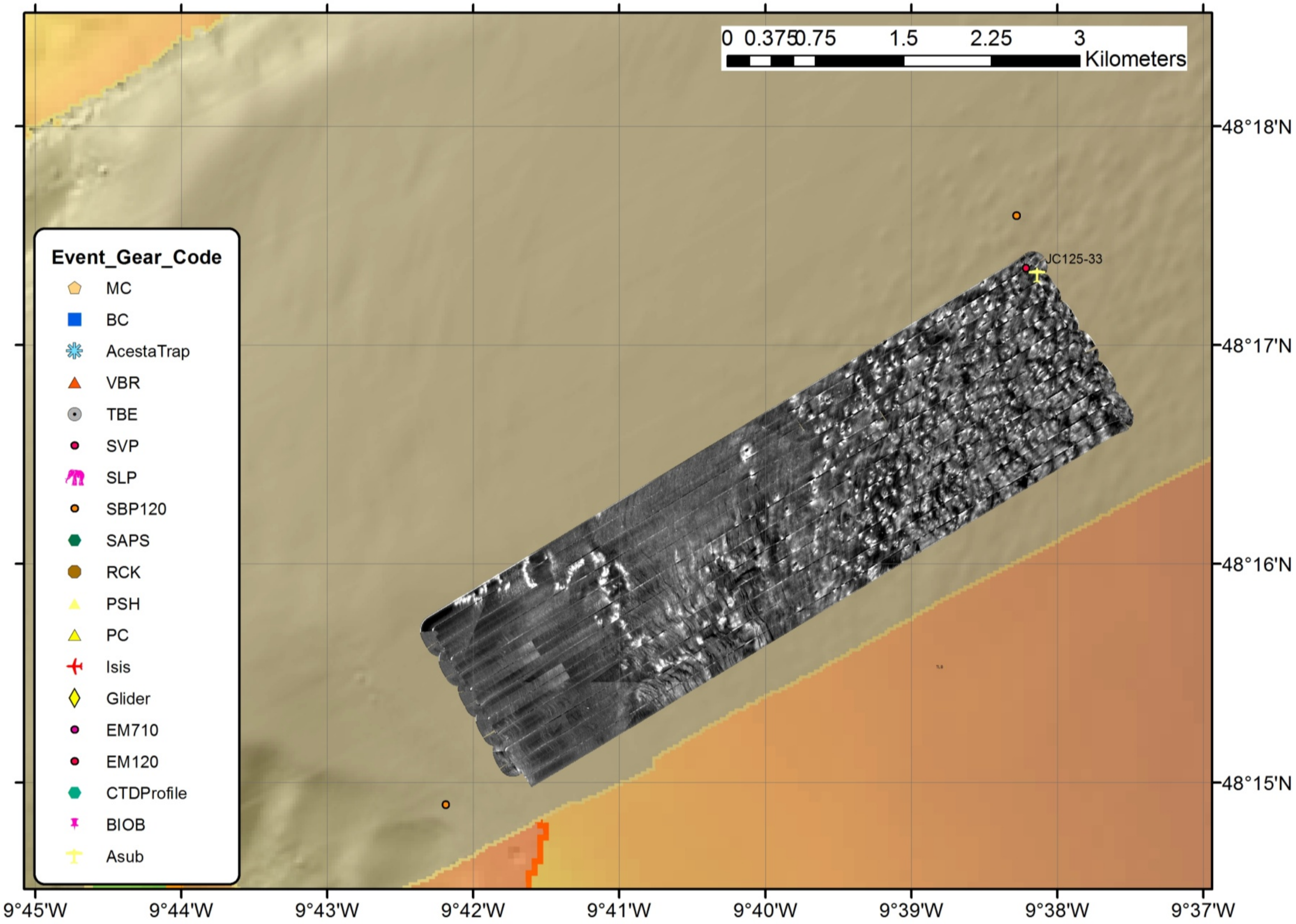
Explorer Canyon coral site:



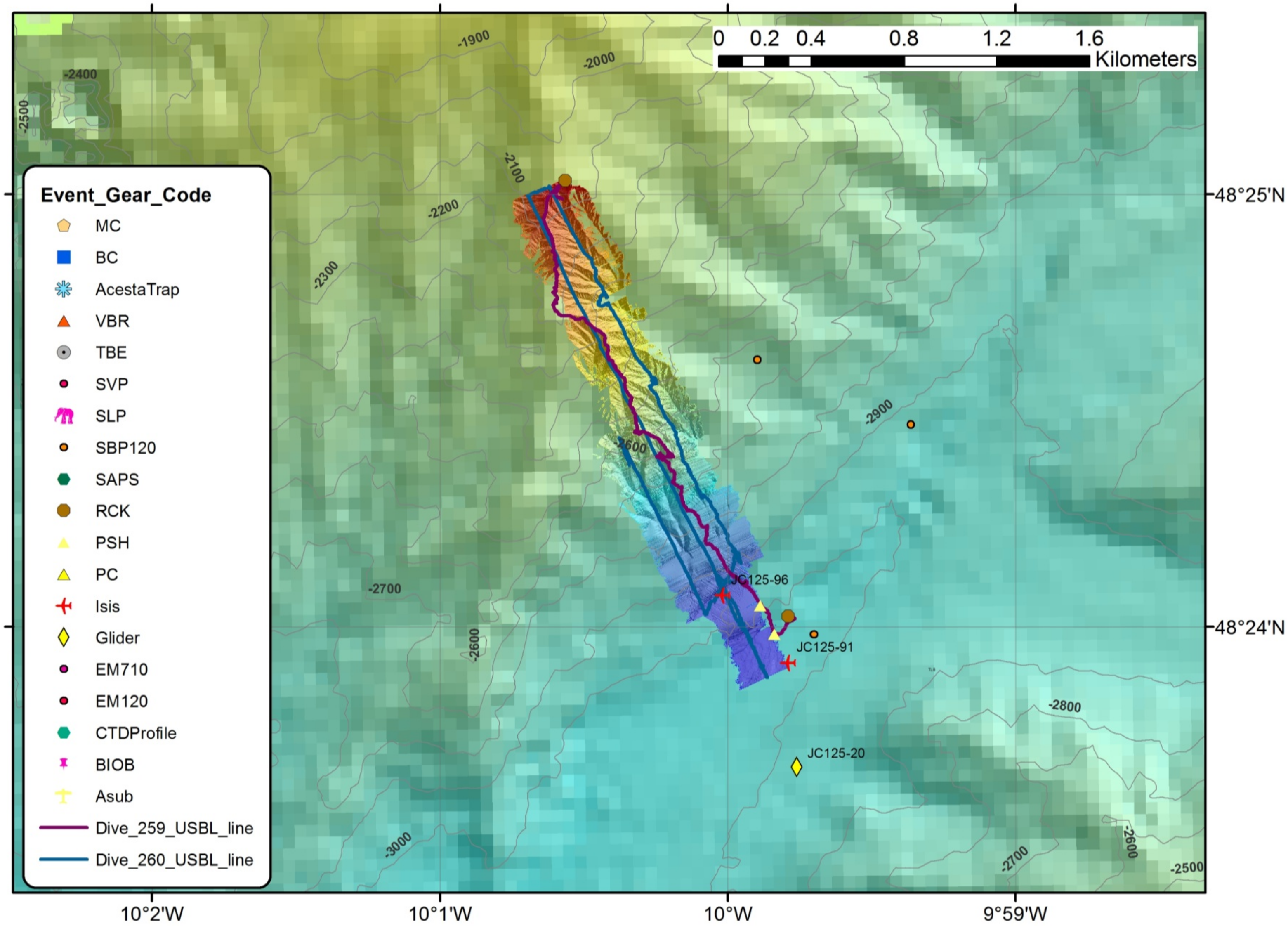
Explorer Canyon second site:



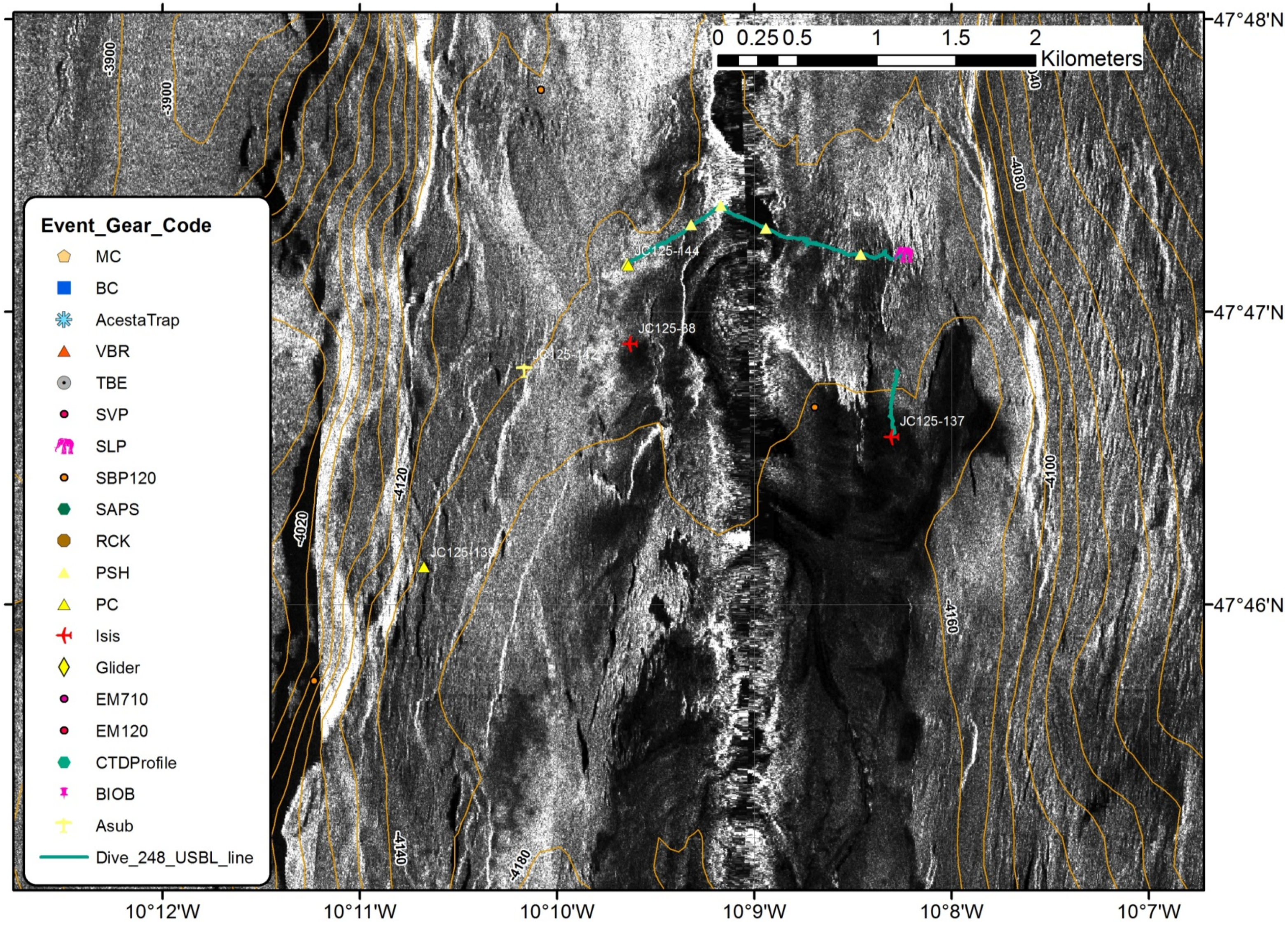
Explorer interfluve:



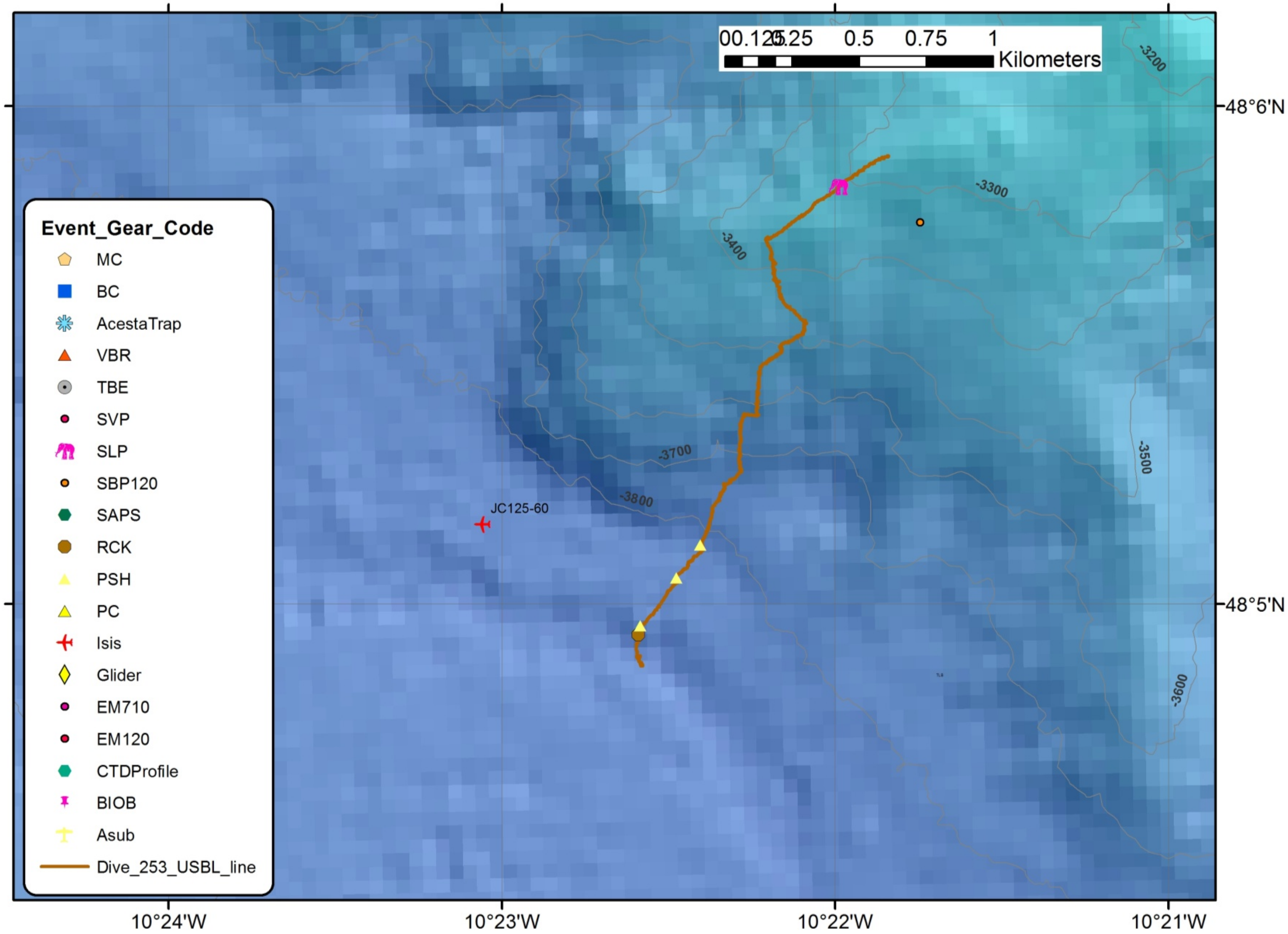
Crazy Arrete:



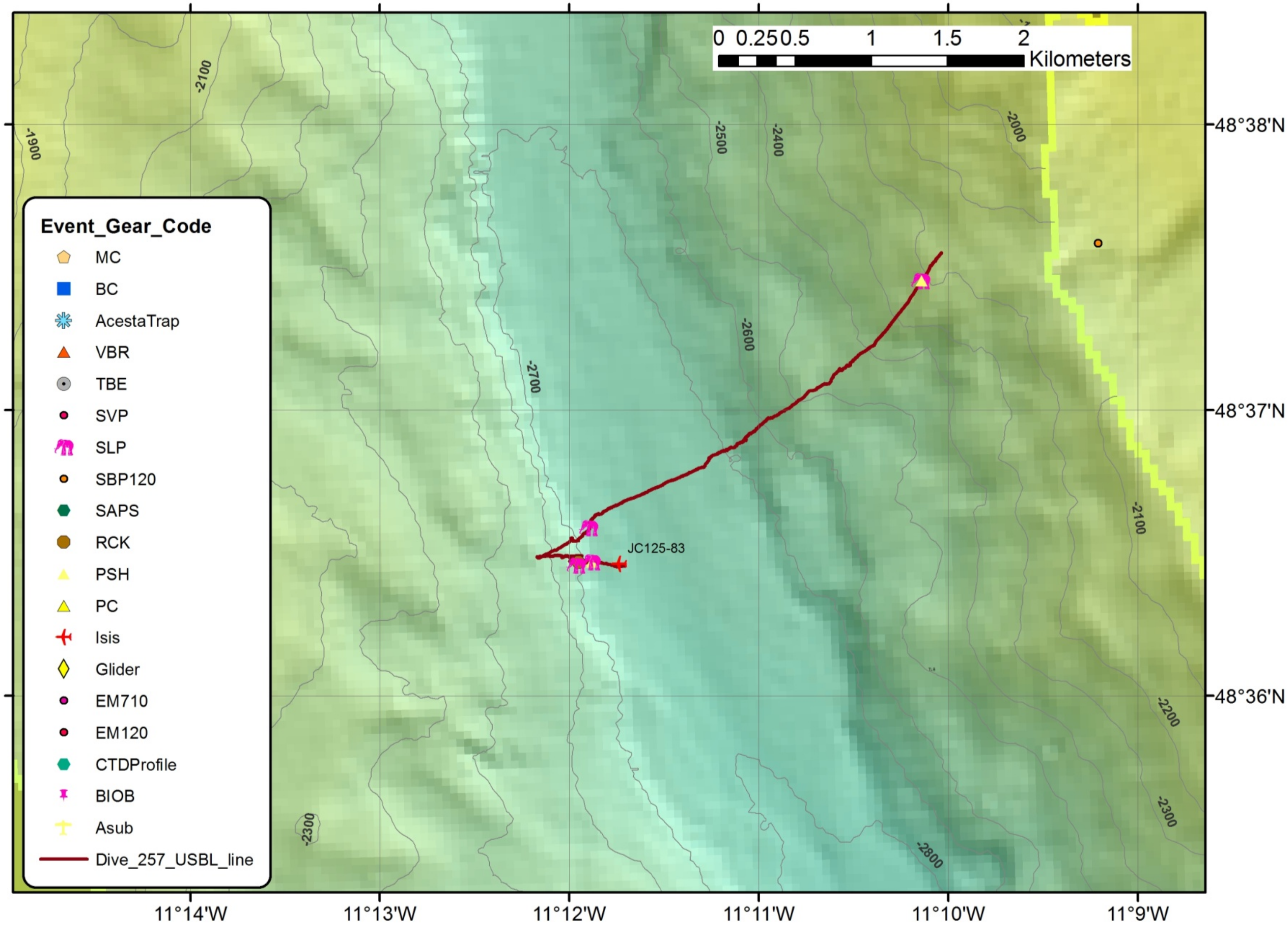
Whittard Channel Site:



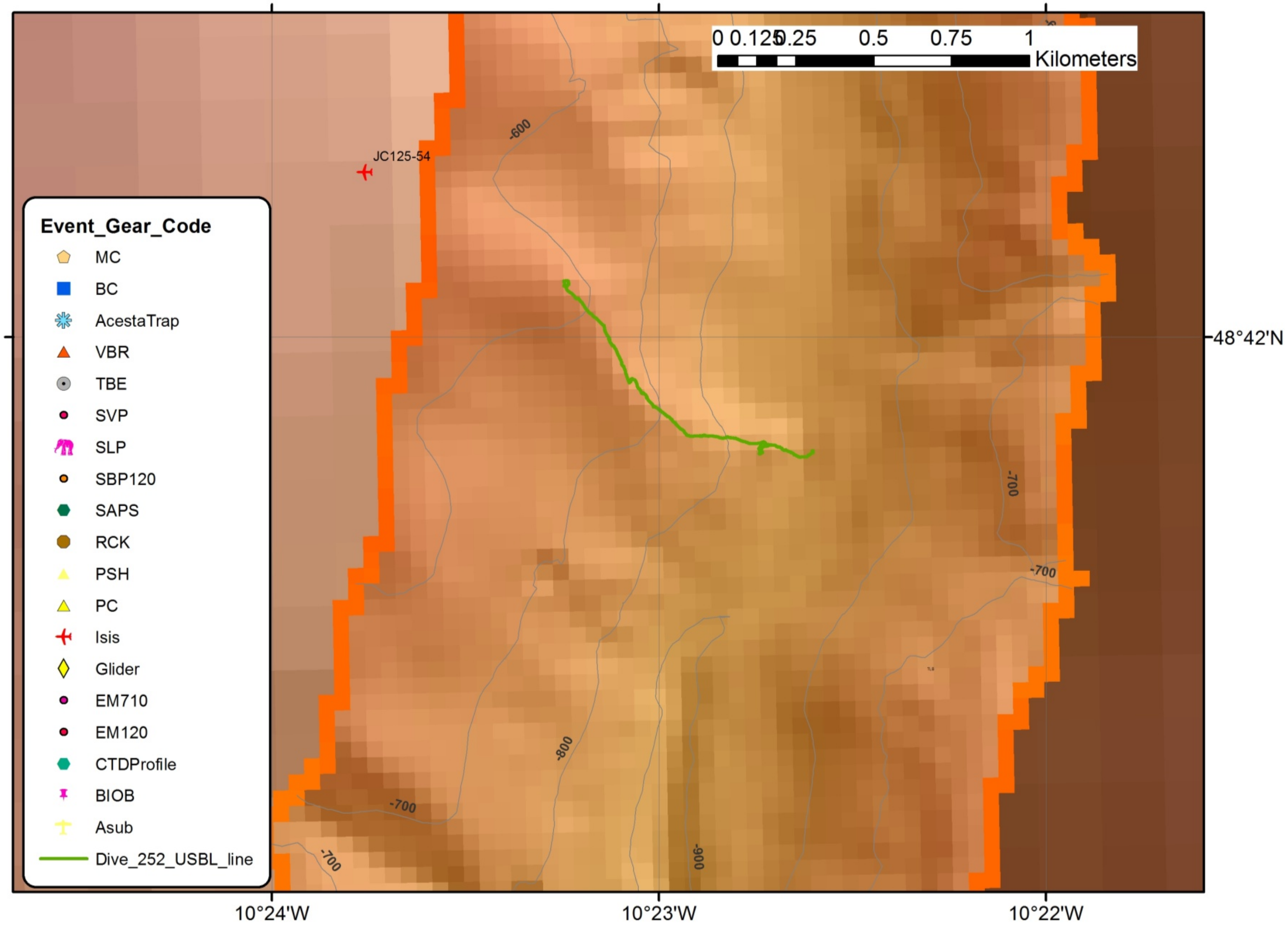
Deep gully dive:



Archeology Dive:

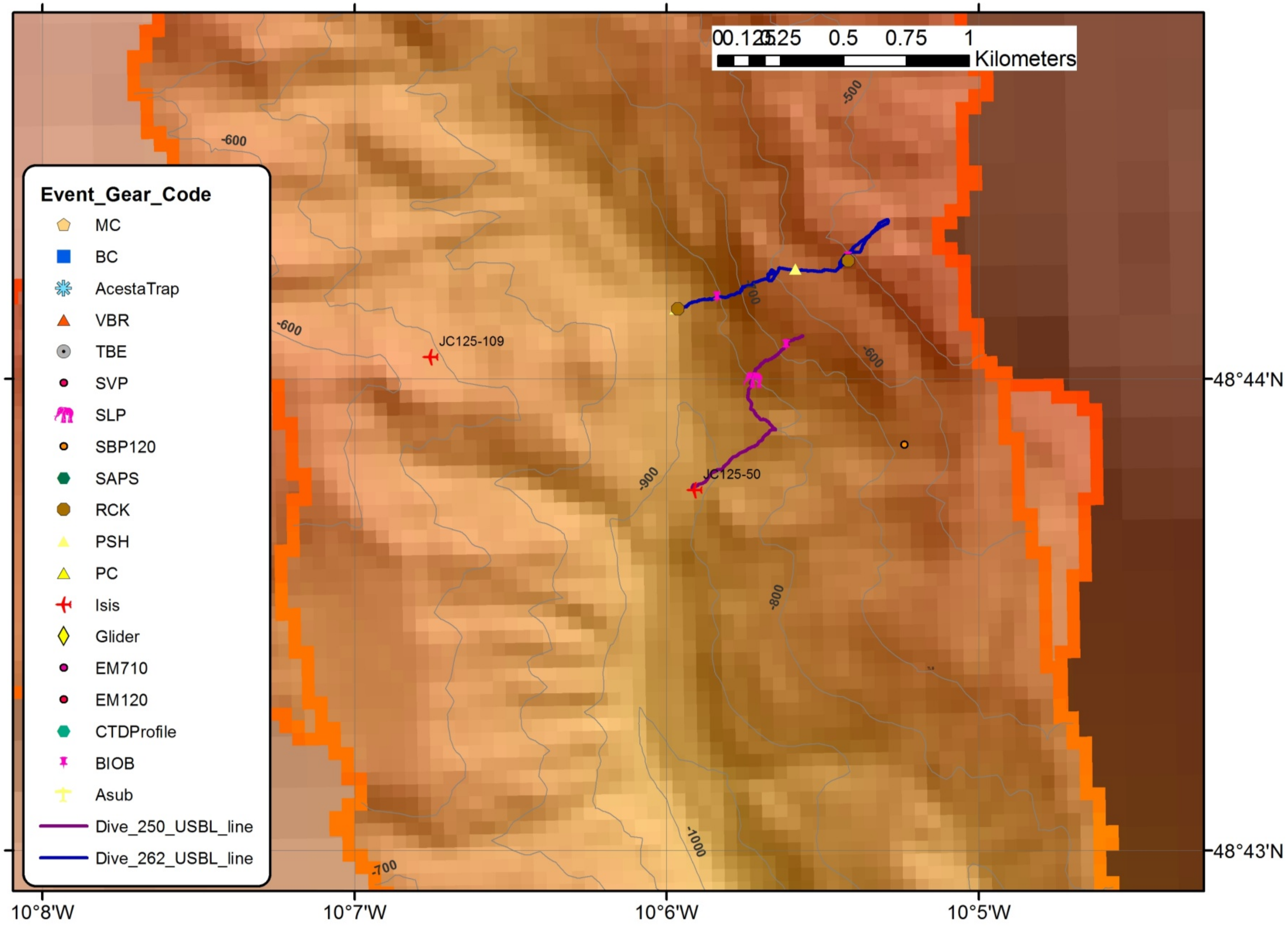


Dive252:



0 0.125 0.25 0.5 0.75 1
Kilometers
JC125-54
-600
-700
-800
-900
48°42'N
10°24'W
10°23'W
10°22'W
Event_Gear_Code
MC
BC
AcestaTrap
VBR
TBE
SVP
SLP
SBP120
SAPS
RCK
PSH
PC
Isis
Glider
EM710
EM120
CTDProfile
BIOB
Asub
Dive_252_USBL_line

Shallow site:



Appendix C – Faunal samples

Cruise	Date	JD	Station	Dive	Eve	Bio-Samp	Sample ID	Description	Container size	Sample Preservatio	Recipie
JC125	11/08/2015	223	08	243	01	01	JC125/8/D243/1/BIO-1	Swiftia sp.	50ml	90% EtOH	JNCC
JC125	11/08/2015	223	08	243	02	02	JC125/8/D243/2/BIO-2	Swiftia sp.	50ml	90% EtOH	JNCC
JC125	17/08/2015	229	31	246	01	03	JC125/31/D246/1/BIO-3	cf. Nymphaster	100ml (bag)		
JC125	17/08/2015	229	31	246	05	04	JC125/31/D246/5/BIO-4	Cidaris cidaris		4% formalin	L.Marsh
JC125	17/08/2015	229	31	246	06	05	JC125/31/D246/6/BIO-5	Cidaris cidaris		4% formalin	L.Marsh
JC125	17/08/2015	229	31	246	NA	06	JC125/31/D246/NA/BIO-6	Scleractinian framework	1500ml	90% EtOH	JNCC
JC125	17/08/2015	229	31	246	NA	07	JC125/31/D246/NA/BIO-7	Anemone on scleractinian	15ml	90% EtOH	JNCC
JC125	18/08/2015	230	35	247	01	8a	JC125/35/D247/1/BIO-8a	Kophobelemnon sp.	Eppendorf	96% EtOH	R.Hogan
JC125	18/08/2015	230	35	247	02	8b	JC125/35/D247/2/BIO-8b	Kophobelemnon sp. (subsample)	100ml (bag)	96% EtOH	R.Hogan
JC125	18/08/2015	230	35	247	02	9a	JC125/35/D247/2/BIO-9a	Halipteris sp.	Eppendorf	96% EtOH	R.Hogan
JC125	18/08/2015	230	35	247	02	9b	JC125/35/D247/2/BIO-9b	Halipteris sp. (subsample)	Glass vial	96% EtOH	R.Hogan
JC125	18/08/2015	230	35	247	01	9c	JC125/35/D247/1/BIO-9c	Halipteris sp. (subsample)	15ml tube	96% EtOH	R.Hogan
JC125	18/08/2015	230	35	247	03	10a	JC125/35/D247/3/BIO-10a	Pennatula sp.	100ml (bag)	96% EtOH	R.Hogan
JC125	18/08/2015	230	35	247	03	10b	JC125/35/D247/3/BIO-10b	Pennatula sp. (subsample)	Glass vial	96% EtOH	R.Hogan
JC125	18/08/2015	230	35	247	05	11a	JC125/35/D247/5/BIO-11a	Pennatula sp.	100ml (bag)	96% EtOH	R.Hogan
JC125	18/08/2015	230	35	247	05	11b	JC125/35/D247/5/BIO-11b	Pennatula sp. (subsample)	Eppendorf	96% EtOH	R.Hogan
JC125	18/08/2015	230	35	247	05	11c	JC125/35/D247/5/BIO-11c	Pennatula sp. (subsample)	Eppendorf	96% EtOH	R.Hogan
JC125	18/08/2015	230	35	247	06	12a	JC125/35/D247/6/BIO-12a	Kophobelemnon sp.	15ml	96% EtOH	R.Hogan
JC125	18/08/2015	230	35	247	06	12b	JC125/35/D247/6/BIO-12b	Kophobelemnon sp. (subsample)	Eppendorf	96% EtOH	R.Hogan
JC125	19/08/2015	231	38	248	06	13a	JC125/38/D248/6/BIO-13a	Umbellula sp.	15ml	96% EtOH	R.Hogan
JC125	19/08/2015	231	38	248	06	13b	JC125/38/D248/6/BIO-13b	Ophiuroid	Eppendorf	96% EtOH	R.Hogan
JC125	21/08/2015	233	47	249	NA	14a	JC125/47/D249/NA/BIO-14a	Lophelia			
JC125	21/08/2015	233	47	249	NA	14b	JC125/47/D249/NA/BIO-14b	Lophelia Live rubble	Muffled foil	-80ºC freezer	Kostas
JC125	21/08/2015	233	47	249	03	15a	JC125/47/D249/3/BIO-15a	Solenosmillia ?	500 ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	03	15b	JC125/47/D249/3/BIO-15b	Solenosmillia ?	Muffled foil	-80ºC freezer	Kostas
JC125	21/08/2015	233	47	249	04	16a	JC125/47/D249/4/BIO-16a	Lophelia	500 ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	04	16b	JC125/47/D249/4/BIO-16b	Lophelia	Muffled foil	-80ºC freezer	Kostas
JC125	21/08/2015	233	47	249	NA	17	JC125/47/D249/NA/BIO-17	Hydroids	15ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	NA	18	JC125/47/D249/NA/BIO-18	Brittle Stars	50ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	NA	19	JC125/47/D249/NA/BIO-19	Actinians	50ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	NA	20	JC125/47/D249/NA/BIO-20	Plexauridae	250ml	96% EtOH	Inge
JC125	21/08/2015	233	47	249	NA	21	JC125/47/D249/NA/BIO-21	Zoanthidea	50ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	NA	22	JC125/47/D249/NA/BIO-22	Worm tubes	15ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	NA	23	JC125/47/D249/NA/BIO-23	Dead Coral Rubble	bag	dry	Kat
JC125	21/08/2015	233	47	249	NA	24	JC125/47/D249/NA/BIO-24	Shells (various)	500ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	NA	25	JC125/47/D249/NA/BIO-25	Live Scleractinians	1500ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	02	26	JC125/47/D249/2/BIO-26	Squat Lobsters (2 species)	15ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	02	27	JC125/47/D249/2/BIO-27	Polychaeta	15ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	02	28	JC125/47/D249/2/BIO-28	Hydroids	15ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	02	29	JC125/47/D249/2/BIO-29	Actinians	15ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	02	30	JC125/47/D249/2/BIO-30	Brittle Stars	50ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	02	31	JC125/47/D249/2/BIO-31	Brachiopoda	50ml	96% EtOH	Kat
JC125	21/08/2015	233	47	249	02	32	JC125/47/D249/2/BIO-32	Fossil cupcorals (x2)	bag	dry	Veerle

JC125	21/08/2015	233	47	249	02	33	JC125/47/D249/2/BIO-33	Live+Fossil cupcorals	bag	dry	Veerle
JC125	21/08/2015	233	47	249	02	34a	JC125/47/D249/2/BIO-34a	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	21/08/2015	233	47	249	02	34b	JC125/47/D249/2/BIO-34b	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	21/08/2015	233	47	249	02	34c	JC125/47/D249/2/BIO-34c	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	21/08/2015	233	47	249	02	34d	JC125/47/D249/2/BIO-34d	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	21/08/2015	233	47	249	02	34e	JC125/47/D249/2/BIO-34e	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	21/08/2015	233	47	249	02	34f	JC125/47/D249/2/BIO-34f	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	21/08/2015	233	47	249	02	34g	JC125/47/D249/2/BIO-34g	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	21/08/2015	233	47	249	02	34h	JC125/47/D249/2/BIO-34h	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	21/08/2015	233	47	249	02	34i	JC125/47/D249/2/BIO-34i	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	21/08/2015	233	47	249	02	34j	JC125/47/D249/2/BIO-34j	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	21/08/2015	233	47	249	02	34a	JC125/47/D249/2/BIO-34a	Acesta	Eppendorf	96% EtOH	Laura
JC125	21/08/2015	233	47	249	02	34b	JC125/47/D249/2/BIO-34b	Acesta	Eppendorf	96% EtOH	Laura
JC125	21/08/2015	233	47	249	02	34c	JC125/47/D249/2/BIO-34c	Acesta	Eppendorf	96% EtOH	Laura
JC125	21/08/2015	233	47	249	02	34d	JC125/47/D249/2/BIO-34d	Acesta	Eppendorf	96% EtOH	Laura
JC125	21/08/2015	233	47	249	02	34e	JC125/47/D249/2/BIO-34e	Acesta	Eppendorf	96% EtOH	Laura
JC125	21/08/2015	233	47	249	02	34f	JC125/47/D249/2/BIO-34f	Acesta	Eppendorf	96% EtOH	Laura
JC125	21/08/2015	233	47	249	02	34g	JC125/47/D249/2/BIO-34g	Acesta	Eppendorf	96% EtOH	Laura
JC125	21/08/2015	233	47	249	02	34h	JC125/47/D249/2/BIO-34h	Acesta	Eppendorf	96% EtOH	Laura
JC125	21/08/2015	233	47	249	02	34i	JC125/47/D249/2/BIO-34i	Acesta	Eppendorf	96% EtOH	Laura
JC125	21/08/2015	233	47	249	02	34j	JC125/47/D249/2/BIO-34j	Acesta	Eppendorf	96% EtOH	Laura
JC125	21/08/2015	233	47	249	02	34a	JC125/47/D249/2/BIO-34a	Acesta	bag	-23ºC	Laura
JC125	21/08/2015	233	47	249	02	34b	JC125/47/D249/2/BIO-34b	Acesta	bag	-23ºC	Laura
JC125	21/08/2015	233	47	249	02	34c	JC125/47/D249/2/BIO-34c	Acesta	bag	-23ºC	Laura
JC125	21/08/2015	233	47	249	02	34d	JC125/47/D249/2/BIO-34d	Acesta	bag	-23ºC	Laura
JC125	21/08/2015	233	47	249	02	34e	JC125/47/D249/2/BIO-34e	Acesta	bag	-23ºC	Laura
JC125	21/08/2015	233	47	249	02	34f	JC125/47/D249/2/BIO-34f	Acesta	bag	-23ºC	Laura
JC125	21/08/2015	233	47	249	02	34g	JC125/47/D249/2/BIO-34g	Acesta	bag	-23ºC	Laura
JC125	21/08/2015	233	47	249	02	34h	JC125/47/D249/2/BIO-34h	Acesta	bag	-23ºC	Laura
JC125	21/08/2015	233	47	249	02	34i	JC125/47/D249/2/BIO-34i	Acesta	bag	-23ºC	Laura
JC125	21/08/2015	233	47	249	02	34j	JC125/47/D249/2/BIO-34j	Acesta	bag	-23ºC	Laura
JC125	22/08/2015	234	50	250	01	35a	JC125/50/D250/1/BIO-35a	Antipathes cf	bag	96% EtOH	R.Hogan
JC125	22/08/2015	234	50	250	01	35b	JC125/50/D250/1/BIO-35b	Antipathes cf	Eppendorf	96% EtOH	R.Hogan
JC125	22/08/2015	234	50	250	02	36a	JC125/50/D250/2/BIO-36a	Parantipathes cf	bag	96% EtOH	R.Hogan
JC125	22/08/2015	234	50	250	02	36b	JC125/50/D250/2/BIO-36b	Parantipathes cf	Eppendorf	96% EtOH	R.Hogan
JC125	22/08/2015	234	50	250	02	37	JC125/50/D250/2/BIO-37	Coral Rubble	1500ml	4% formalin	Claudio
JC125	22/08/2015	234	50	250	NA	38	JC125/50/D250/NA/BIO-38	Ophiuroid	15ml	96% EtOH	
JC125	21/08/2015	233	47	249	NA	39	JC125/47/D249/NA/BIO-39	Live coral	50ml	96% EtOH	
JC125	21/08/2015	233	47	249	NA	40	JC125/47/D249/NA/BIO-40	Limpets	50ml	96% EtOH	
JC125	21/08/2015	233	47	249	NA	41	JC125/47/D249/NA/BIO-41	Brachiopoda	50ml	96% EtOH	
JC125	22/08/2015	234	52	251	04	42	JC125/52/D251/4/BIO-42	Hydroids	15ml	96% EtOH	Kat
JC125	22/08/2015	234	52	251	04	43	JC125/52/D251/4/BIO-43	Ophiuroid	15ml	96% EtOH	Kat
JC125	22/08/2015	234	52	251	04	44	JC125/52/D251/4/BIO-44	Crinoid	50ml	96% EtOH	R.Hogan
JC125	22/08/2015	234	52	251	06	45a	JC125/52/D251/6/BIO-45a	Acesta	bag	-20ºC freezer	Laura

JC125	22/08/2015	234	52	251	06	45b	JC125/52/D251/6/BIO-45b	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	22/08/2015	234	52	251	06	45c	JC125/52/D251/6/BIO-45c	Acesta	Eppendorf	96% EtOH	Laura
JC125	22/08/2015	234	52	251	NA	46	JC125/52/D251/NA/BIO-46	Desmophyllum	Muffled foil	-80ºC freezer	Kostas
JC125	22/08/2015	234	52	251	NA	47a	JC125/52/D251/NA/BIO-47a	Lophelia	1500ml	96% EtOH	Kat
JC125	22/08/2015	234	52	251	NA	47b	JC125/52/D251/NA/BIO-47b	Lophelia	Muffled foil	-80ºC freezer	Kostas
JC125	22/08/2015	234	52	251	NA	48	JC125/52/D251/NA/BIO-48	Sponge on Lophelia	15ml	96% EtOH	Kat
JC125	22/08/2015	234	52	251	NA	49	JC125/52/D251/NA/BIO-49	Polychaete on Lophelia	15ml	96% EtOH	Kat
JC125	22/08/2015	234	52	251	07	50a	JC125/52/D251/7/BIO-50a	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	22/08/2015	234	52	251	07	50b	JC125/52/D251/7/BIO-50b	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	22/08/2015	234	52	251	07	50c	JC125/52/D251/7/BIO-50c	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	22/08/2015	234	52	251	07	50d	JC125/52/D251/7/BIO-50d	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	22/08/2015	234	52	251	07	50e	JC125/52/D251/7/BIO-50e	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	22/08/2015	234	52	251	07	50f	JC125/52/D251/7/BIO-50f	Acesta	Muffled foil	-80ºC freezer	Kostas
JC125	22/08/2015	234	52	251	07	50a	JC125/52/D251/7/BIO-50a	Acesta	bag	-20ºC freezer	Laura
JC125	22/08/2015	234	52	251	07	50b	JC125/52/D251/7/BIO-50b	Acesta	bag	-20ºC freezer	Laura
JC125	22/08/2015	234	52	251	07	50c	JC125/52/D251/7/BIO-50c	Acesta	bag	-20ºC freezer	Laura
JC125	22/08/2015	234	52	251	07	50d	JC125/52/D251/7/BIO-50d	Acesta	bag	-20ºC freezer	Laura
JC125	22/08/2015	234	52	251	07	50e	JC125/52/D251/7/BIO-50e	Acesta	bag	-20ºC freezer	Laura
JC125	22/08/2015	234	52	251	07	50f	JC125/52/D251/7/BIO-50f	Acesta	bag	-20ºC freezer	Laura
JC125	22/08/2015	234	52	251	07	50a	JC125/52/D251/7/BIO-50a	Acesta	Eppendorf	96% EtOH	Laura
JC125	22/08/2015	234	52	251	07	50b	JC125/52/D251/7/BIO-50b	Acesta	Eppendorf	96% EtOH	Laura
JC125	22/08/2015	234	52	251	07	50c	JC125/52/D251/7/BIO-50c	Acesta	Eppendorf	96% EtOH	Laura
JC125	22/08/2015	234	52	251	07	50d	JC125/52/D251/7/BIO-50d	Acesta	Eppendorf	96% EtOH	Laura
JC125	22/08/2015	234	52	251	07	50e	JC125/52/D251/7/BIO-50e	Acesta	Eppendorf	96% EtOH	Laura
JC125	22/08/2015	234	52	251	07	50f	JC125/52/D251/7/BIO-50f	Acesta	Eppendorf	96% EtOH	Laura
JC125	22/08/2015	234	52	251	07	50b	JC125/52/D251/7/BIO-50b	Acesta	25ml	4% formalin	Laura
JC125	22/08/2015	234	52	251	07	50c	JC125/52/D251/7/BIO-50c	Acesta	25ml	4% formalin	Laura
JC125	22/08/2015	234	52	251	07	50d	JC125/52/D251/7/BIO-50d	Acesta	25ml	4% formalin	Laura
JC125	22/08/2015	234	52	251	07	50e	JC125/52/D251/7/BIO-50e	Acesta	25ml	4% formalin	Laura
JC125	22/08/2015	234	52	251	07	50f	JC125/52/D251/7/BIO-50f	Acesta	25ml	4% formalin	Laura
JC125	22/08/2015	234	52	251	06	51a	JC125/52/D251/6/BIO-51a	Lophelia	500ml	96% EtOH	Kat
JC125	22/08/2015	234	52	251	06	51b	JC125/52/D251/6/BIO-51b	Lophelia	Muffled foil	-80ºC freezer	Kostas
JC125	22/08/2015	234	52	251	07	52	JC125/52/D251/7/BIO-52	Desmophyllum (x21)	5000ml	96% EtOH	Kat
JC125	22/08/2015	234	52	251	07	53	JC125/52/D251/7/BIO-53	Shrimp	15ml	96% EtOH	Kat
JC125	22/08/2015	234	52	251	07	54	JC125/52/D251/7/BIO-54	Crinoid	50ml	96% EtOH	R.Hogan
JC125	24/08/2015	236	60	253	05	55c	JC125/60/D253/5/BIO-55c	Seapen	Eppendorf	96% EtOH	R.Hogan
JC125	24/08/2015	236	60	253	05	56	JC125/60/D253/5/BIO-56	Gorgonia (Paragonia?)	250ml	96% EtOH	Inge
JC125	27/08/2015	239	76	254	01	57a	JC125/76/D254/1/BIO-57a	Madrepora oculata	500ml	96% EtOH	Veerle
JC125	27/08/2015	239	76	254	01	57b	JC125/76/D254/1/BIO-57b	Madrepora oculata	Muffled foil	-80ºC freezer	Kostas
JC125	27/08/2015	239	76	254	02	58a	JC125/76/D254/2/BIO-58a	Lophelia	500ml	96% EtOH	Veerle
JC125	27/08/2015	239	76	254	02	58b	JC125/76/D254/2/BIO-58b	Lophelia	500ml	-80ºC freezer	Kostas
JC125	27/08/2015	239	76	254	05	59a	JC125/76/D254/5/BIO-59a	Lophelia	500ml	96% EtOH	Veerle
JC125	27/08/2015	239	76	254	05	59b	JC125/76/D254/5/BIO-59b	Lophelia	500ml	-80ºC freezer	Kostas
JC125	27/08/2015	239	76	254	NA	60	JC125/76/D254/NA/BIO-60	Squat Lobsters	Eppendorf	96% EtOH	Kat

JC125	28/08/2015	240	78	255	03	61a-61n	JC125/78/D255/3/BIO-61a-61r	Acesta	Eppendorf/500ml/	96% EtOH/96% EtOH/-	Laura/Lau
JC125	28/08/2015	240	78	255	04	62a-62i	JC125/78/D255/4/BIO-62a-62i	Acesta	Eppendorf/500ml/	96% EtOH/96% EtOH/-	Laura/Lau
JC125	28/08/2015	240	78	255	02	63	JC125/78/D255/2/BIO-63	Lophelia fragments	Muffled foil	-80ºC freezer	Kostas
JC125	28/08/2015	240	78	255	02	64	JC125/78/D255/2/BIO-64	Shrimp (large)	15ml	95% EtOH	Kat
JC125	28/08/2015	240	78	255	02	65	JC125/78/D255/2/BIO-65	Shrimp (small) x 3	15ml	95% EtOH	Kat
JC125	28/08/2015	240	78	255	02	66	JC125/78/D255/2/BIO-66	Polychaete (polynoid)	15ml	95% EtOH	Kat
JC125	28/08/2015	240	78	255	02	67	JC125/78/D255/2/BIO-67	Galatheid x 2	15ml	95% EtOH	Kat
JC125	28/08/2015	240	78	255	02	68	JC125/78/D255/2/BIO-68	Small brachyuran crab	15ml	95% EtOH	Kat
JC125	28/08/2015	240	78	255	02	69	JC125/78/D255/2/BIO-69	Small bivalve	15ml	95% EtOH	Kat
JC125	28/08/2015	240	78	255	02	70	JC125/78/D255/2/BIO-70	Ophiuroid	15ml	95% EtOH	Kat
JC125	28/08/2015	240	78	255	02	71	JC125/78/D255/2/BIO-71	Polychaete	15ml	95% EtOH	Kat
JC125	28/08/2015	240	78	255	02	72	JC125/78/D255/2/BIO-72	Madrepora fragments	50ml	95% EtOH	Kat
JC125	28/08/2015	240	78	255	02	73	JC125/78/D255/2/BIO-73	Lophelia fragments	50ml	95% EtOH	Kat
JC125	28/08/2015	240	78	255	02	74a	JC125/78/D255/2/BIO-74a	Antipathes cf (Black coral)	50ml	96% ethanol	R.Hogan
JC125	28/08/2015	240	78	255	02	74b	JC125/78/D255/2/BIO-74b	Antipathes cf (Subsample of Black c	eppendorf	96% ethanol	R.Hogan
JC125	28/08/2015	240	78	255	02	75a	JC125/78/D255/2/BIO-75a	Sticopathes cf	50ml	96% ethanol	R.Hogan
JC125	28/08/2015	240	78	255	02	75b	JC125/78/D255/2/BIO-75b	Sticopathes cf	eppendorf	96% ethanol	R.Hogan
JC125	28/08/2015	240	78	255	04	76	JC125/78/D255/4/BIO-76	Anemone	25ml	96% EtOH	Kat
JC125	28/08/2015	240	78	255	03	77	JC125/78/D255/3/BIO-77	Lophelia fragments	25ml	96% EtOH	Kat
JC125	29/08/2015	241	80	256	11	78A-K	JC125/80/D256/11/BIO-78A-K	Acesta samples (A-K)	muffled foil/ 125m	-80ºC freezer / 96% Et	Kostas/La
JC125	29/08/2015	241	80	256	08	79	JC125/80/D256/8/BIO-79	Polychaeta	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	08	80	JC125/80/D256/8/BIO-80	Amphipod	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	08	81	JC125/80/D256/8/BIO-81	Shrimp	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	08	82	JC125/80/D256/8/BIO-82	Anemone?	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	11	83	JC125/80/D256/11/BIO-83	Crinoid (Antedon)	50ml	95% EtOH	R.Hogan
JC125	29/08/2015	241	80	256	11	84	JC125/80/D256/11/BIO-84	Crinoid (Antedon)	15ml	95% EtOH	R.Hogan
JC125	29/08/2015	241	80	256	11	85	JC125/80/D256/11/BIO-85	Ophiuroid x 2	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	86	JC125/80/D256/1/BIO-86	Scleractinian	Dry/bag	Dry	Veerle
JC125	29/08/2015	241	80	256	01	87	JC125/80/D256/1/BIO-87	polychaeta x 4	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	88	JC125/80/D256/1/BIO-88	Galatheid x 5	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	89	JC125/80/D256/1/BIO-89	Galatheid	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	90	JC125/80/D256/1/BIO-90	Anemone	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	91	JC125/80/D256/1/BIO-91	Oyster juvenile x 4	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	92	JC125/80/D256/1/BIO-92	Ophiuroid x 10	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	93	JC125/80/D256/1/BIO-93	?Eunice large	50ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	94	JC125/80/D256/1/BIO-94	Solitary coral	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	95	JC125/80/D256/1/BIO-95	Solitary coral	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	96	JC125/80/D256/1/BIO-96	Solitary coral	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	97	JC125/80/D256/1/BIO-97	Solitary coral	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	98	JC125/80/D256/1/BIO-98	No sample			
JC125	29/08/2015	241	80	256	01	99	JC125/80/D256/1/BIO-99	Scleractinian	Bag	Dry	Veerle
JC125	29/08/2015	241	80	256	01	100	JC125/80/D256/1/BIO-100	Madrepora x 5 subsample	Muffled foil	-80ºC freezer	Kostas
JC125	29/08/2015	241	80	256	01	101	JC125/80/D256/1/BIO-101	Madrepora live	150ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	102	JC125/80/D256/1/BIO-102	Madrepora fragments	150ml	95% EtOH	Kat

JC125	29/08/2015	241	80	256	01	103	JC125/80/D256/1/BIO-103	Solitary coral	15ml	95% EtOH	Kat
JC125	29/08/2015	241	80	256	01	104a	JC125/80/D256/1/BIO-104a	Antipathes cf	50ml	95% EtOH	Raissa
JC125	29/08/2015	241	80	256	01	104b	JC125/80/D256/1/BIO-104b	Antipathes cf subsample	eppendorf	95% EtOH	Raissa
JC125	29/08/2015	241	80	256	08	105a	JC125/80/D256/8/BIO-105a	Sticopathes sp	50ml	95% EtOH	Raissa
JC125	29/08/2015	241	80	256	08	105b	JC125/80/D256/8/BIO-105b	Sticopathes sp subsample	eppendorf	95% EtOH	Raissa
JC125	29/08/2015	241	80	256	08	106	JC125/80/D256/8/BIO-106	Crinoids (just pieces)	45ml	95% EtOH	Raissa
JC125	30/08/2015	242	83	257	08	107a	JC125/83/D257/8/BIO-107a	Umbellula (whole)	plastic bag	95% ethanol	Raissa
JC125	30/08/2015	242	83	257	08	107b	JC125/83/D257/8/BIO-107b	Umbellula (subsample)	eppendorf	95% ethanol	Raissa
JC125	30/08/2015	242	83	257	04	108a	JC125/83/D257/4/BIO-108a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	04	109a	JC125/83/D257/4/BIO-109a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	04	110a	JC125/83/D257/4/BIO-110a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	04	109b	JC125/83/D257/4/BIO-109b	Peniagone (subsample)	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	04	108b	JC125/83/D257/4/BIO-108b	Peniagone (subsample)	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	04	110b	JC125/83/D257/4/BIO-110b	Peniagone (subsample)	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	111a	JC125/83/D257/7/BIO-111a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	07	111b	JC125/83/D257/7/BIO-111b	Peniagone (subsample)	cryovial	98% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	111c	JC125/83/D257/7/BIO-111c	Peniagone (subsample)	Muffled foil	-80ºC freezer	Kostas
JC125	30/08/2015	242	83	257	07	112a	JC125/83/D257/7/BIO-112a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	07	112b	JC125/83/D257/7/BIO-112b	Peniagone (subsample)	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	112c	JC125/83/D257/7/BIO-112c	Peniagone (subsample)	Muffled foil	-80ºC freezer	Kostas
JC125	30/08/2015	242	83	257	07	113a	JC125/83/D257/7/BIO-113a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	07	113b	JC125/83/D257/7/BIO-113b	Peniagone (subsample)	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	113c	JC125/83/D257/7/BIO-113c	Peniagone (subsample)	Muffled foil	-80ºC freezer	Kostas
JC125	30/08/2015	242	83	257	07	114a	JC125/83/D257/7/BIO-114a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	07	115a	JC125/83/D257/7/BIO-115a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	07	116a	JC125/83/D257/7/BIO-116a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	07	117a	JC125/83/D257/7/BIO-117a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	07	118a	JC125/83/D257/7/BIO-118a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	07	119a	JC125/83/D257/7/BIO-119a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	07	120a	JC125/83/D257/7/BIO-120a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	07	121a	JC125/83/D257/7/BIO-121a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	07	114b	JC125/83/D257/7/BIO-114b	Peniagone tissue	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	115b	JC125/83/D257/7/BIO-115b	Peniagone tissue	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	116b	JC125/83/D257/7/BIO-116b	Peniagone tissue	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	117b	JC125/83/D257/7/BIO-117b	Peniagone tissue	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	118b	JC125/83/D257/7/BIO-118b	Peniagone tissue	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	119b	JC125/83/D257/7/BIO-119b	Peniagone tissue	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	120b	JC125/83/D257/7/BIO-120b	Peniagone tissue	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	121b	JC125/83/D257/7/BIO-121b	Peniagone tissue	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	114c	JC125/83/D257/7/BIO-114c	Peniagone tissue	Muffled foil	-80ºC freezer	Kostas
JC125	30/08/2015	242	83	257	07	115c	JC125/83/D257/7/BIO-115c	Peniagone tissue	Muffled foil	-80ºC freezer	Kostas
JC125	30/08/2015	242	83	257	07	116c	JC125/83/D257/7/BIO-116c	Peniagone tissue	Muffled foil	-80ºC freezer	Kostas
JC125	30/08/2015	242	83	257	07	117c	JC125/83/D257/7/BIO-117c	Peniagone tissue	Muffled foil	-80ºC freezer	Kostas
JC125	30/08/2015	242	83	257	07	118c	JC125/83/D257/7/BIO-118c	Peniagone tissue	Muffled foil	-80ºC freezer	Kostas

JC125	30/08/2015	242	83	257	07	119c	JC125/83/D257/7/BIO-119c	Peniagone tissue	Muffled foil	-80ºC freezer	Kostas
JC125	30/08/2015	242	83	257	07	120c	JC125/83/D257/7/BIO-120c	Peniagone tissue	Muffled foil	-80ºC freezer	Kostas
JC125	30/08/2015	242	83	257	07	121c	JC125/83/D257/7/BIO-121c	Peniagone tissue	Muffled foil	-80ºC freezer	Kostas
JC125	30/08/2015	242	83	257	07	122a	JC125/83/D257/7/BIO-122a	Peniagone (whole)	500 ml	formalin	Leigh
JC125	30/08/2015	242	83	257	07	122b	JC125/83/D257/7/BIO-122b	Peniagone tissue	cryovial	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	122c	JC125/83/D257/7/BIO-122c	Peniagone tissue	Muffled foil	-80ºC freezer	Kostas
JC125	30/08/2015	242	83	257	07	123	JC125/83/D257/7/BIO-123	Ophiuroid	15ml	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	07	124	JC125/83/D257/7/BIO-124	Polychaete x 2	15ml	95% ethanol	Leigh
JC125	30/08/2015	242	83	257	06	125a	JC125/83/D257/6/BIO-125a	cf. Distichoptilum gracile	bag	96% ethanol	Inge
JC125	30/08/2015	242	83	257	06	125b	JC125/83/D257/6/BIO-125b	cf. Distichoptilum gracile subsample	eppendorf	96% ethanol	Raissa
JC125	01/09/2015	244	91	259	08	126	JC125/91/D259/8/BIO-126	Yellow anemone	eppendorf	96% ethanol	Kat
JC125	01/09/2015	244	91	259	08	127	JC125/91/D259/8/BIO-127	Anthomastus	eppendorf	96% ethanol	Kat
JC125	01/09/2015	244	91	259	08	128	JC125/91/D259/8/BIO-128	Cup coral	eppendorf	96% ethanol	Kat
JC125	01/09/2015	244	91	259	08	129	JC125/91/D259/8/BIO-129	Barnacles	eppendorf	96% ethanol	Raissa
JC125	04/09/2015	247	109	262	10	130	JC125/109/D262/10/BIO-130	cf. Lophelia	?	96% ethanol	?
JC125	04/09/2015	247	109	262	10	131	JC125/109/D262/10/BIO-131	cf. Lophelia	?	formalin	?
JC125	04/09/2015	247	109	262	10	132	JC125/109/D262/10/BIO-132	cf. Lophelia	?	Bleach	?
JC125	04/09/2015	247	109	262	10	133	JC125/109/D262/10/BIO-133	Solitary coral	500ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	134	JC125/109/D262/10/BIO-134	Solitary coral	500ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	135	JC125/109/D262/10/BIO-135	Solitary coral	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	136	JC125/109/D262/10/BIO-136	Yellow encrusting sponge	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	137	JC125/109/D262/10/BIO-137	Sabellidae polychaete x 8	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	138	JC125/109/D262/10/BIO-138	Sabellidae polychaete x 3	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	139	JC125/109/D262/10/BIO-139	Serpulidae x 3	15ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	140	JC125/109/D262/10/BIO-140	cf. Lophelia	Muffled foil	-80ºC freezer	Kostas
JC125	04/09/2015	247	109	262	10	141	JC125/109/D262/10/BIO-141	Madrepora	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	142	JC125/109/D262/10/BIO-142	Squat Lobsters	45ml	96% ethanol	Veerle
JC125	04/09/2015	247	109	262	10	143	JC125/109/D262/10/BIO-143	Annelid	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	144	JC125/109/D262/10/BIO-144	Ophiuroid x15	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	145	JC125/109/D262/10/BIO-145	Thin red sabellids (~ 10x)	15ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	146	JC125/109/D262/10/BIO-146	Scale worms x 9	15ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	147	JC125/109/D262/10/BIO-147	Large polynoid	15ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	148	JC125/109/D262/10/BIO-148	Large polynoid	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	149	JC125/109/D262/10/BIO-149	cf. Stolonifira (~ 100 x)	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	150	JC125/109/D262/10/BIO-150	Anemones x 10	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	151	JC125/109/D262/10/BIO-151	Oyster juvenile x 6	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	152	JC125/109/D262/10/BIO-152	cf. limpet	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	153	JC125/109/D262/10/BIO-153	Sponge	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	154	JC125/109/D262/10/BIO-154	Anemone	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	155	JC125/109/D262/10/BIO-155	Anemone	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	156	JC125/109/D262/10/BIO-156	Polychaetes x 3	cryovial	96% ethanol	?
JC125	04/09/2015	247	109	262	10	157	JC125/109/D262/10/BIO-157	Polychaetes x 3	cryovial	96% ethanol	?
JC125	04/09/2015	247	109	262	10	158	JC125/109/D262/10/BIO-158	cf. tunicates x 4	45ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	159	JC125/109/D262/10/BIO-159	sabellid	15ml	96% ethanol	?

JC125	04/09/2015	247	109	262	10	160	JC125/109/D262/10/BIO-160	Scallop juvenile	15ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	161	JC125/109/D262/10/BIO-161	Hydroids	15ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	162	JC125/109/D262/10/BIO-162	??? Juvenile x 3	15ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	163	JC125/109/D262/10/BIO-163	Yellow desmosponge	15ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	164	JC125/109/D262/10/BIO-164	White encrusting sponge	15ml	96% ethanol	?
JC125	04/09/2015	247	109	262	10	165	JC125/109/D262/10/BIO-165	Chiton	cryovial	96% ethanol	?
JC125	04/09/2015	247	109	262	10	166	JC125/109/D262/10/BIO-166	Polychaete	cryovial	96% ethanol	?
JC125	04/09/2015	247	109	262	10	167	JC125/109/D262/10/BIO-167	Anemone	15ml	96% ethanol	?
JC125	04/09/2015	247	109	262	08	176i	JC125/109/D262/8/BIO-176i	Ascesta	?	?	?
JC125	04/09/2015	247	109	262	08	176j	JC125/109/D262/8/BIO-176j	Ascesta	?	?	?
JC125	04/09/2015	247	109	262	08	176k	JC125/109/D262/8/BIO-176k	Ascesta	?	?	?
JC125	04/09/2015	247	109	262	04	177a	JC125/109/D262/4/BIO-177a	Antipatharia	bag	96% ethanol	Raissa
JC125	04/09/2015	247	109	262	04	177b	JC125/109/D262/4/BIO-177b	Antipatharia subsample	eppendorf	96% ethanol	Raissa
JC125	04/09/2015	247	109	262	09	178	JC125/109/D262/9/BIO-178	Crinoids	eppendorf	96% ethanol	Raissa
JC125	04/09/2015	247	109	262	10	179a	JC125/109/D262/10/BIO-179a	Crinoids x 3	15ml jar	96% ethanol	Kat/NOC
JC125	04/09/2015	247	109	262	10	179b	JC125/109/D262/10/BIO-179b	Crinoid	eppendorf	96% ethanol	Raissa
JC125	04/09/2015	247	109	262	08	176a	JC125/109/D262/8/BIO-176a	Ascesta muscle tissue	Muffled foil	-80ºC freezer	Kostas
JC125	04/09/2015	247	109	262	08	176b	JC125/109/D262/8/BIO-176b	Ascesta muscle tissue	Muffled foil	-80ºC freezer	Kostas
JC125	04/09/2015	247	109	262	08	176c	JC125/109/D262/8/BIO-176c	Ascesta muscle tissue	Muffled foil	-80ºC freezer	Kostas
JC125	04/09/2015	247	109	262	08	176d	JC125/109/D262/8/BIO-176d	Ascesta muscle tissue	Muffled foil	-80ºC freezer	Kostas
JC125	04/09/2015	247	109	262	08	176e	JC125/109/D262/8/BIO-176e	Ascesta muscle tissue	Muffled foil	-80ºC freezer	Kostas
JC125	04/09/2015	247	109	262	08	176f	JC125/109/D262/8/BIO-176f	Ascesta muscle tissue	Muffled foil	-80ºC freezer	Kostas
JC125	04/09/2015	247	109	262	08	176g	JC125/109/D262/8/BIO-176g	Ascesta muscle tissue	Muffled foil	-80ºC freezer	Kostas
JC125	04/09/2015	247	109	262	08	176h	JC125/109/D262/8/BIO-176h	Ascesta muscle tissue	Muffled foil	-80ºC freezer	Kostas
JC125	04/09/2015	247	109	262	08	176i	JC125/109/D262/8/BIO-176i	Ascesta muscle tissue	Muffled foil	-80ºC freezer	Kostas
JC125	04/09/2015	247	109	262	08	176j	JC125/109/D262/8/BIO-176j	Ascesta muscle tissue	Muffled foil	-80ºC freezer	Kostas
JC125	04/09/2015	247	109	262	10	180	JC125/109/D262/10/BIO-180	Brittle stars x 3	15 ml	96% ethanol	Kat/NOC
JC125	05/09/2015	248	111	263	05	181a	JC125/111/D263/5/BIO-181a	Antipathes cf	45 ml	96% ethanol	Raissa
JC125	05/09/2015	248	111	263	05	181b	JC125/111/D263/5/BIO-181b	Antipathes cf subsample	eppendorf	96% ethanol	Raissa
JC125	05/09/2015	248	111	263	07	182a	JC125/111/D263/7/BIO-182a	Pennatula cf. aculeata	45 ml	96% ethanol	Raissa
JC125	05/09/2015	248	111	263	07	182b	JC125/111/D263/7/BIO-182b	Pennatula cf. Aculeata subsamples	eppendorf	96% ethanol	Raissa
JC125	05/09/2015	248	111	263	11	183a	JC125/111/D263/11/BIO-183a	Umbellula sp.	plastic bag	96% ethanol	Raissa
JC125	05/09/2015	248	111	263	11	183b	JC125/111/D263/11/BIO-183b	Umbellula sp. (subsample)	eppendorf	96% ethanol	Raissa
JC125	05/09/2015	248	111	263	06	184	JC125/111/D263/6/BIO-184	Stylasterid	Bucket	96% ethanol	Inge
JC125	05/09/2015	248	111	263	06	185	JC125/111/D263/6/BIO-185	Ophiuroid	15 ml	96% ethanol	Kat
JC125	05/09/2015	248	111	263	05	186	JC125/111/D263/5/BIO-186	Acanthogorgia	500 ml	96% ethanol	Inge/Kat
JC125	05/09/2015	248	111	263	05	187	JC125/111/D263/5/BIO-187	Ophiuroid	15 ml	96% ethanol	Kat/NOC
JC125	05/09/2015	248	111	263	05	188	JC125/111/D263/5/BIO-188	Solenosmilia	1500 ml	96% ethanol	Inge/Kat
JC125	05/09/2015	248	111	263	05	189	JC125/111/D263/5/BIO-189	Eunice (?)	15 ml	96% ethanol	Kat/NOC
JC125	05/09/2015	248	111	263	06	190	JC125/111/D263/6/BIO-190	Bivalver (4)	45 ml	96% ethanol	Kat/NOC
JC125	05/09/2015	248	111	263	06	191	JC125/111/D263/6/BIO-191	Polychaete	15 ml	96% ethanol	Kat/NOC
JC125	05/09/2015	248	111	263	05	192	JC125/111/D263/5/BIO-192	worm (unknown)	15 ml	96% ethanol	Kat/NOC
JC125	05/09/2015	248	111	263	05	193	JC125/111/D263/5/BIO-193	Polychaete	15 ml	96% ethanol	Kat/NOC
JC125	05/09/2015	248	111	263	05	194	JC125/111/D263/5/BIO-194	Solitary coral on rock (3)	Bucket	96% ethanol	Kat/NOC

JC125	05/09/2015	248	111	263	05	195	JC125/111/D263/5/BIO-195	Ophiuroid (1)	15 ml	96% ethanol	Kat/NOC
JC125	05/09/2015	248	111	263	05	196	JC125/111/D263/5/BIO-196	Bamboo Coral	15 ml	96% ethanol	Inge/Kat
JC125	05/09/2015	248	111	263	05	197	JC125/111/D263/5/BIO-197	(Polynoid) Scale worms	15 ml	96% ethanol	Kat/NOC

Appendix D: ISIS system cruise Report

Isis Stats:

No. of dives JC124	3	(Dive no. 242 to Dive no.244)
No. of dives JC125	20	(Dive no. 245 to Dive no. 264)
No. of dives JC126	4	(Dive no. 265 to Dive no. 268)

Total run time for (JC124-5-6) thrusters:	247.26 hrs
Total time at seabed or survey depth:	181.36 hrs
Isis ROV *total* run time:	3780.81 hrs
Max Depth and Dive Duration:	4184 m and 1.5hrs (Dive 268) (6.58hrs in water)
Max Dive Duration and Depth:	14.45hrs at 1468m (Dive 248) (16.62 hrs in water)
Shallowest Depth and Duration	100 m for 4.03hrs (Dive243) (4.67hrs in water)
Equipment:	Reson Seabat (183.97GB) Techas (4.94GB) CTD (326.9MB) DVLNAV (24.45GB) Sonardyne (5.28GB) OFOP Event Logger (870.4MB) HD Video (38.33TB) Scorpio Digital Still (85.98GB) 21,632jpg 12M Tritech (4.44GB) Turbidity(57MB)

Master 1 Lacie Raid unit ser# MRVL0001B6E8219A7891 will be installed in the NOC media room for BODC to archive and provide access for scientists post cruise.

A Backup Raid unit will remain with the ROV Team for a period of 1 year before being recycled

Contents

1. Mobilisation:

Southampton (NOC): 4th Aug to 9th Aug 2015

The Isis system was mobilised in Southampton. This was a straight forward installation with no load testing planned. This was due to the last one being carried out in October 2013 following the refurbishment of the Dynacon System. Unfortunately due to the lack of understanding it was deemed necessary that a load test be carried out, based on all installations to deck should now be tested. This subject of testing all equipment to deck every time it is installed needs to be discussed, and formalised. A 5,000kg test was carried out as requested by the program manager, effectively loosing us ¾ of a day whilst we waited for the water bag to be delivered from the Discovery. 7,000kg and 9,000kg loads are required to do the job properly.

With the LARS positioned the gratings were lifted and the excess of the hydraulic hoses was coiled within the skid pans. This greatly improved the mass of hoses that usually clutter the deck

The new 1,750kg streaming weight was positioned onto the LARS prior to the ROV being placed. This fitted well and proved to work well when the umbilical was streamed vertically.

In an attempt to improve the joining of the two control containers, an aluminum gutter arrangement was fabricated by JJ Engineering once the containers had been seated on deck. This proved to work well.

The umbilical was terminated and load tested to 7,000kg using the integral lugs of the LARS. The vehicle was then connected and made ready for a dock test to be carried out. This went well with all functions of the vehicle working correctly.

2. De-Mobilisation:

Southampton (NOC): 12th Sept to 13th Sept 2015

The de-mobilisation took place at NOC dock, Southampton.
All containers and equipment was lifted shore side without any problems.

3. Isis Handling System:

3.1 Hydraulic Power Unit (HPU):

This worked well for the duration of the cruise with no problems reported.

Future modifications/requirements:

- Overhaul of the frame, motors and pump strings. Pumps and motors may still have some hrs remaining before this is necessary. These could be removed so that rest could be sent away for blasting and painting.
- As an upgrade, and part of the above the HPU could be modified such that it would fit into a 20ft container (reduce height) allowing for easier freighting.
- Tag all hydraulic hoses.

- Storage Winch case drain hose outer jacket blistered. This is not high pressure but should be replaced.

3.2 Storage Drum/ Traction Winch/ Umbilical:

Prior to the mobilisation, the new umbilical that was installed in September 2013 was removed and replaced with the umbilical from the *James Cook*. It was thought that replacing with a new umbilical from the same batch as the previous problematic wire would be a waste of time, giving the same problems as previously encountered. Upon inspection of the new wire it was noted that it had the same one or two strands on the outer armor that were not lying nicely.
The umbilical from the *James Cook* went onto the Dynacon storage drum without too much hassle. The appearance and feel of this umbilical is very different from the one replaced, with it being much more flexible and having a much smoother even distribution of strands.

Following the first three shallow dives with the ROV at the Haig Fras (Dive 242,243, and 244) the ship steamed to a deep water location close to the next work sites. At this station the ROV umbilical was streamed vertically to 3856m using the new 1,750kg streaming weight. During this process the ROV G6 and C5 Sonadyne beacons were tested. The wire was lowered at a max rate of 40m/min, and remained at depth for one hour before being hauled to the surface at 40m/min.

As part of the connection of the umbilical to the ROV the new turns counter that Josue had designed was mounted to the underside of the gimbal assembly. This was connected to the ROV through a blocked oil filled tail and DGO to the science bus. Following its first deployment water penetrated the electronics causing the unit to fail. This was identified to be a missing 'o' ring in the DGO connector. A second unit was added to the ROV later in the cruise (Dive 259). Unfortunately this unit also failed due to water ingress, but with no obvious signs as to the where it had entered.

Throughout the cruise the ROV termination and gimbal arrangement was monitored for any turns or twists, which previously had been problematic. No turns developed throughout the cruise.

During Dive 248 the ROV lost power due to a fuse failure on one of the phases in the Jetway. Following the replacement of the fuse and the reinstatement of the Jetway the vehicle developed a second failure whereby loss of coms and telemetry happened. Following extensive tests the ROV was recovered as a dead vehicle. During the recovery it was noted that a large kink in the umbilical just above the last float (approx. 70m from the vehicle) was visible.

Investigating into the dead sub it was identified that the fibre to the vehicle had failed. Various tests were carried out to identify the fault eliminating topside prism and the ROV.
Using the OTDR it was concluded that the damaged umbilical had caused the black vehicle fibre to fail. No light readings could be obtained.

80m of umbilical was removed and a re-termination was made.

It was discovered at this point that an omission in our safe system of work for working on the ISIS high voltage equipment had occurred. It had been wrongly assumed that isolating the supply to the Prism optical fibre multiplexor would remove all hazards emanating from the laser source therein whilst actually the provision of an additional optical fibre source for the high definition cameras that had been added at some time in the past had in fact introduced an uncontrolled laser source that would be hazardous to the person terminating the optical fibre. It was not readily apparent how or where this hazard could be eliminated so additional precautions and verbal instructions were issued for the re-terminations that were to occur during the rest of the cruise.

No turns under the termination bullet were recorded, further establishing that the kink in the Umbilical was the fault.
The OTDR and light meter readings concluded that the black fibre was now operational, and the fault had been removed.
Further tests identified that the grey fibre was now not passing light from the termination to the winch Junction box. Removing the winch slip ring from the equation proved that the umbilical was fine and all fibres passed light with good readings. (See umbilical log)
It is likely that the connector on the outboard side of the slip ring may be faulty, rather that the slip ring itself. This is likely to have been caused during all the testing of the fibres.

A load test was carried out (7000kf for 5 mins) before re-connecting to the vehicle.
(Cert No.Umb03-003 issued)

With only two fibres required for operations it was decided that the grey be taken out of the equation for the rest of the cruise. Had there been any problems on the other two fibres, we could have switched in the box on the side of the winch, and connected into the grey fibre in the vehicle.

Following Dive 250 it was again noted that a small kink in the umbilical, approx. 70m from the ROV and just above the last float was visible. Once this had been wound onto the storage drum, it was no longer visible. During the following deployment it was barely noticeable. Following Dive 253 the kink was reported as slightly more visible. No conclusion has to how this is happening has been made.

Some further Fibre issues were encountered on Dive 254 where the HD Scorpio Camera lost communications, followed by the Pilot HD Camera. At the time of the failure the vehicle had 1.6 turns recorded on it turns counter, which had been put in the anticlockwise direction, whilst carrying out a video survey of a coral mound. By removing these turns the communication to these cameras was re-established.
Following this dive the termination was lifted clear form the vehicle and found to be clear of any signs of twisting or turns. With no solid evidence as to where the fault may be, it was decided to continue with the termination to see how things progress.

During dive 259 the vehicle telemetry failed for no apparent reason. A slight decrease in readings had been noted on the prizm monitoring prior to the vehicle blackout. The vehicle was recovered safely following the dead sub procedures. It was later confirmed that the vehicle and topside telemetry was working correctly and the black fibre in the umbilical had failed within 36m distance from the vehicle. (OTDR check) The red and grey fibres were still showing at full umbilical length with good light meter readings.

Due to the slight kinks developing just above the final floats it was thought that this must be the point of failure, even though slightly further into the umbilical than that of the OTDR reading (36m). This damage is not considered as significant based on previous cruises. However, with nothing better to go on at this stage it was decided that a 100m of the

umbilical was to be removed, to be well clear of any damaged cable. A re-termination was made. A load test of 7000kg was carried out.
(Cert No.Umb03-003 issued)
Fibres made and tested from container to vehicle:

Black	7.22dB 1310nm	8.11dB 1550nm	8554m	
Red	8.68dB 1310nm	8.73dB 1550nm	8553m	
Grey	Broken at slip-ring			8512m

Near to the end of dive 260 multibeam survey the ROV showed signs of being pulled when heading on the Northerly direction track. By reversing and coming up, a rope became visible in the up looking camera and science camera. Further reversing and a reciprocal movement with the ship prevented the ROV and umbilical from getting tangled. Following this avoidance action and during a rotation of the vehicle from a heading of 270° to 180° the ROV showed signs of the telemetry failing. At the current depth it was decided to do no further investigation by making any unnecessary heading changes and to just continue to the surface for recovery.

Following the recovery of the sub the ROV was set up for a short test. This consisted of lowering the ROV into the water and carrying out the following.

1. Rotate the ROV through 360° in each direction with no load on the umbilical.
2. Rotate the ROV through 360° in each direction with some load on the umbilical. (this was to entail the winch just taking the weight of the ROV)

The plan was to see if fibre issue was at this end of the umbilical or related to the kinks that were occurring following the last float.

Result: Following the 360 ° turn in the anticlockwise direction it was noted that the attenuation in the fibre slightly increased. A further 180° turn in the same direction caused the vehicle to lose communications and become dead.

Following the recovery of the ROV and the removal of the termination, it was noted that vehicle fibre would fail if a turn was made in the black inner of the umbilical. (starting at 6dB inceasing to 13 or 14dB as the turn increased) This turn was again in the anticlockwise direction. Both the red and grey fibres showed no light readings.

At this stage a further 80m of umbilical was removed and yet another re-termination was made. A load test of 7000kg was carried (Cert No.Umb03-004 issued)

Fibres made and tested from container to vehicle:

Black	7.60dB 1310nm	7.91dB 1550nm	8455m	
Red	5.95dB 1310nm	6.04dB 1550nm	8466m	
Grey	Broken at slip-ring			8425m

Due to the small amount of turns required to make the fibres fail it was decided that the termination be made using the pinned socket and slotted bullet. With the good characteristics of the umbilical not showing any signs of torque rotation it is thought by pinning the socket to the bullet to prevent rotation will remove the likely hood of putting a turn in the short cable beneath the bullet. A single turn seen above the termination should be less critical due to the length distributed over. This worked well for the duration of the cruise, but should not be considered a long term solution. The failure of the fibres with minimal turns encountered is not normal behavior of the umbilical compared to previous wires. A series of tests is recommended to compare fibre characteristics with the previous umbilical.

Following Dive 261 a further seven dives was completed with the pinned arrangement. During the recoveries of these dive no turns twists or were encountered in the umbilical, and no further attenuation issues were experienced during the dives.

At the end of the cruise a final 70m of umbilical was removed from storage drum.
Total length remaining xxxxxm

Future modifications/recommendations/maintenance:

- Umbilical lube
- Investigate storage drum slip ring and all associated connectors.
- Investigate fibre failure under small turns conditions
- Add procedure for the isolation of the CWDM into the safe system of work, when carrying out HV isolation.
- Redo power lead crimp (it is twisted) and tighten backplane screw in storage drum HV join box. Also change GND screw to a longer one.

3.3 Launch and Recovery System (LARS):

Prior to the start of the cruise the rubber wheel on the snubber assembly was changed for one of the polyprop ones. This was done to prevent the tyre coming of the wheel of which had happened on several occasions with the system prior to overhaul.

During the recovery of the ROV from Dive 242 it was noted that the vehicle did not latch well into the docking head. A couple of attempts were made before it was clear that all four latches had locked and it was safe to maneuver the vehicle through the A Frame. The following Dive (243) it was not possible to latch the vehicle into the latches for the deployment. The dive was postponed whilst an investigation was carried out. Having looked at some pictures of the snubber assembly prior to the refurbishment, it revealed that the ring had been assembled onto the wrong set of holes, preventing the ROV bullet from getting far enough into the latches. The snubber ring was raised by one set of holes, and no further latching problems were encountered.

During the recovery of Dive 248 it was noted that a loud scoring noise was coming from the tugger assembly, disappearing when the wheel was disengaged. Upon inspection of the wheel assembly it was noted that the bolts had come loose and one had come out far enough that it was scoring the cheek plate. The snubber wheel was replaced and the bolts were loctited with an extra strong compound.

A few drops of oil have been seen coming from the docking head assembly, and a few fittings have been nipped up during the cruise.

Future modifications/recommendations/maintenance:

- Use tab washers or wire the bolts on the snubber wheel.
- Cure oil drops from docking head.
- Replaced damaged bolts form where the snubber ring has bent them when trying to latch the ROV prior to the moving of the snubber assembly.

3.4. CCTV & Lighting:

The four camera CCTV system that has been in use for many years once again performed without any problems. As part of the system maintenance prior to the cruise the multiple single cables feeding the pan and tilt unit that had been so problematical in the past were replaced with a single multi core cable which greatly eased the installation.

Four new Hagar LED lights have been installed around the work area of the ROV. These proved to be a great addition to the ships inadequate lighting in this area.

Future modifications/recommendations/maintenance:

- Replace faulty mounting bracket with new or repaired part.

3.5 Portable Hydraulic Deck Pack Unit

Not used for the duration of the cruise.

Future modifications/recommendations/maintenance:

- None

4. ISIS External Equipment:

4.1 Elevator A:

Not on cruise.

Future modifications required:

- None

4.2 Elevator B:

Not on cruise.

Future modifications required:

- None

4.3 USBL Acoustic System (Sonardyne):

Ranger USBL survey PC

Telegrams from Ranger2 software required for Database(x2), OFOP (NSH5A PSONALL) and Techsas.
A problem occurred with the Ranger2 software freezing when attempting to track a beacon when not in the water. Resolution was only to enable beacon tracking just prior to diving.

In the past a repeat Sonardyne display has been broadcast to the bridge via the shipboard Avocent matrix system. As this was overlooked at the start of the ROV dives the ROV Compatt5 beacon 110 was tracked on the ship system and displayed on the bridge whilst the ROV was tracked on the WMT beacon 2702. The positional accuracies and consistency achieved during this cruise appeared to be the best we have experienced – presumably down to an excellent calibration process.

Future modifications/recommendations/maintenance:

- Purchase an Avocent unit for routine ship connection.

Homer

Not used for the duration of the cruise.

Compatt 5 Midi Beacon:

The Compatt 5 beacon Address 110 was used for the duration of the cruise.
Due to the ROV topside system not being able to be duplicated onto the bridge as on previous cruises, the C5 Midi beacon was tracked from the main lab Sonardyne system, using the Port pole and Standard head. This system was able to be duplicated onto the bridge, and therefore was run in parallel to ROV system tracking the G6 WMT beacon on the Starboard pole and Big head.
This beacon worked well with no problems reported.

Future modifications/recommendations/maintenance:

- Batteries to be disconnected and stored in Li battery store at NOC
- Procure new batteries if required for 2016-17 program.

G6 WMT Beacons:

Beacons 2709 and 2702 were used for the duration of the cruise. Due to initial problems with AUV AVtrak beacon it was decided that the proven G6 beacon 2702 would be used for their operations throughout the cruise. The new recently procured G6 2709 beacon was used in tandem with the C5 for all ROV dives.
Following Dive 242 it was noted that even though the G6 beacon was tracking well on Isis, the surface position of the vehicle was much closer than the USBL was showing. During Dive 243 it was noted that the G6 beacon was again tracking well, but compared to the C5 beacon being tracked on the ships system there was a significant discrepancy in its position. Both poles and offsets were checked on the lab and ROV systems, with all offsets showing as correct. The G6 2709 beacon was then configured using the 'locator beacon' option in the software. This worked well giving comparable positions to the C5 beacon with more realistic TAT (turn around time) and beacon settings to that of the G6 2702 beacon. For some reason in this mode the software identified the beacon as a C6 beacon and not the WMT. These settings were left for the remainder of the JC124 Dives (namely the next dive 244).

Following a steam to a new location and start of the next cruise (JC125) a deep water steam of the umbilical was carried out. For this stream the G6 2709 beacon was configured on the software terminal, and a new beacon (WMT) added to the ROV Ranger topside. By doing this the beacon and topside had compatible settings prior to the deployment. Both the C5 and G6 2709 beacon were attached to the streaming weight and deployed to a depth of 3856m. Both beacons tracked well with their positioning pretty much on top of each other.

Both the G6 and C5 beacons continued to perform with no problem for the duration of cruise.

The G6 2702 beacon used by the AUV worked well with no reported problems.

Future modifications/recommendations/maintenance:

- Connect to terminal and switch off both beacons

4.4 Football Floats:

8 x 6000m floats were used for the duration of the cruise

Future modifications/recommendations/maintenance:

- Check and re-tighten float latches where necessary

4.5 Suction Sampler:

During the pre-dive for 258 the drive sprocket on the rotate motor sheared and had to be replaced. Unfortunately this happened whilst the chambers were being filled and the outer chamber had filled prior to a couple of the inner chambers. With the empty chambers now buoyant they were able to float slightly allowing one of them to lift slightly into the inspection hatch. When the unit was rotated the carousal jammed and the motor was able to shear the plastic sprocket. It is suggested that the bung be removed whilst this process is carried out.
During the pre-dive for 262 the drive sprocket failed again. This time it revealed itself as the keyway shifting round in the slot of the sprocket. The carousel would rotate with no chambers, but with any load the motor would just spin with the gear mechanism not moving. Due to the lack of requirement for suction chambers on the dive to follow it was decide we continue operations without making any repairs.

Future modifications/recommendations/maintenance:

- Procure spare motor drive sprockets, with correct size spline key slot.
- Strip down and service suction motor.
- Ensure suction sampler spares kit is replenished and enough spare suction hose is in stock.

4.6 Push Cores:

These worked well for the duration of the cruise.

Future modifications/recommendations/maintenance:

- Check number of tubes remaining and stock accordingly for next cruise.

- Look into design for core catcher.
- Make a set of spare rubber seals for top of tubes.
- Ensure the M12 washer under the penny washer is sufficient thickness to allow the rubber valve to rotate.
- Make sure the bung ends of the tube assemblies are matched with the correct core tubes (grey), else they do not fit properly.

4.7 Niskin Bottle Arrangement:

The Russ new design appeared to work well when trialed. Unfortunately there was no science requirement during the cruise to give it a good ground truthing.

Future modifications/recommendations/maintenance:

- Spares for Niskin bottles (to include rubber tubing, nylon firing lines and crimps)

5. Isis ROV:

5.1 Thrusters:

All thrusters worked well for the duration of the cruise.
Some noise was starting to be noticed on the lateral thrusters, but was not significant enough to warrant a change. The thruster seals worked well, with no loss of oil experienced.

Future modifications/improvements/maintenance:

- Do the thrusters require the belafram pressure balance reservoir? Or could it be replace by an end cap incorporating a bleed to aid bleeding on assembly and water drain point.
- Check thruster spares and ensure sufficient are held in stock (including rotors).
- Service all motors. Bearing seals etc.

Thruster Controllers:

Following Dive 255 it was noted that some of the DGO's on the thruster pods had come loose. These were tightened with no further problems encountered.
The aft lateral DGO was found to have no retaining groove, and therefore could have come off. A temporary fix was made during the cruise to avoid timely repairs and draining of junction boxes. During dives it was noted that pairs of thrusters were not giving equal outputs despite being given an equal amount of operator input via the joystick control. This could be attributable to either a mismatch of parameters in the thruster's respective .ini files or an anomaly in the Topside code.

Future modifications/improvements/maintenance:

- Continue discussing with WHOI and Inegeia where we go next with the new pressure balanced drive modules.
- Inspect all pods and DGO connections. Remove clean and replace if necessary.
- Replace aft lateral DGO.

- Look at possibility of increasing power output of the drive bloks on the lateral thrusters. Discuss with WHOI any concerns with doing this?
- Investigate mismatch of parameters in thruster ini file.

5.2 Vehicle Main System Compensators:

The vehicle main system compensators worked well for the whole duration of the cruise and no significant oil loss or pressure drop was observed between dives.

Future modifications/improvements/maintenance:

- Inspect all schilling comps for any signs of damage that may have been experienced from the implosion of the HydroLek pressure bottle on dive 268

5.3 Tool Sled:

Drawer:

The draw worked well for the duration of the cruise. The drawer was removed completely during the vertical swath dive to increase overall vehicle buoyancy and to improve vehicle trim.

Future modifications/improvements/maintenance:

- None
- Check to see if the draw hydraulic function is fitted with a pilot check valve block. This may be the cause of the water ingress?
- Possible split draw for Vibrocore operations.

Swing Arms:

These worked well for the duration of the cruise.
The port swing arm was removed for the Reson SWATH electronics bottle.
The new black lids and slotted retaining arrangement made the opening and closing of these boxes much easier with the manipulators.

Future modifications/improvements/maintenance:

- Strip and service both port and stbd units.
- Check latching pin position to ensure pin locates properly when closed and adjust if necessary.
- Service both latching pin hydraulic cylinders.

5.4 Hydraulic System:

The ISIS hydraulic system worked well for the duration of the cruise with no significant problems encountered. However during a couple of post-dive hydraulic oil checks it was suspected that water had entered the system as the appearance was cloudy. No source of obvious water ingress was found and the problem did not occur with any logical regularity. Following the final dive of the cruise (268) it was noted that a significant amount of water had entered the system. As the only changes made prior to this were the addition of the

Vibrocore for its trials cruise, it is more than likely that one of the two hydraulic components integrated are the problem. The Vibrator motor is coupled direct to the starboard arm hydraulic supply, and the hydraulic power unit that operates the cutter, winch and clamp are connected to the suction motor rotate supply. It is possible that one of these units is drawing water into the Isis hydraulic system.
Following the final dive the hydraulic system was drained and thoroughly flushed with clean hydraulic oil. The water separator and high pressure filters were also replaced.

Future modifications/improvements/maintenance:

- Flush system thoroughly
- Replace all filters/seperators and re-stock spares.
- Conduct visual inspection of hydraulic system and all hoses.
- Check that the type of hydraulic hose currently being used is suitable and ensure that enough spare hose is ordered.

5.5 Manipulators:

Port Side: KRAFT

The Kraft Predator arm was used extensively for sampling on most dives and worked reliably for the majority of the cruise.

Future modifications/improvements/maintenance:

- Perform visual inspection of Kraft Predator. Flush compensating oil.
- Service Jaws
- ***Starboard Side: Schilling T4***

The Schilling T4 arm was not used as extensively as the Kraft Predator due to vehicle tool sled configuration. However it performed well and remained reliable throughout the cruise.
The arm was removed from the vehicle following Dive 264 to make space for the Vibrocore system

Future modifications/improvements/maintenance:

- Perform visual inspection of Schilling T4. Flush compensating oil.

5.6 Pan & Tilt Units:

Following Dive 249 it was noted that pilot P&T was not operating correctly. Upon inspection it became apparent that the unit had been knocked bending the camera mounting bracket and shearing the end stop pins. With the pins replaced and bracket straightened no further issues were reported.
The science P&T worked well without any faults.

Future modifications/improvements/maintenance:

- Flush comps on both units.
- Inspect and service as necessary
- Procure more shear pins

- Try and improve the movement from the joysticks. (smooth out)

5.7 CWDM Fibre Optic Multiplexor

During the re-termination of the umbilical it was highlighted that no mechanism is in place to make sure the CWDM light source has been isolated.

Prior to the cruise both the Scorpio cameras and CWDMs were re configured to enable operation of Image download via the ROV umbilical Ethernet connection. This implementation required a fixed 100GB connection on both sides of the CWDM so a laptop was used to achieve this. Connection to the ROVNET auto negotiate switch did not work.

Future modifications/improvements/maintenance:

- As part of the HV and prism isolation procedure an additional section for the isolation of the CWDM needs to be put in place.
- The Scorpio and CWDM could potentially be rewired from a 4 wire Ethernet to 8 wire Ethernet connection to allow for 1000GB operation. Compromise would be to lose a flash sync connection (currently not used) and join common GND connections.

5.8 Cameras:

5 x video channels are used for mini cams, 1 x video channel is used for the monochrome rear camera, and the remaining two are allocated to the HD pilot and science cams, should they need to be replaced with a pal camera.

It has been discussed that doubling up on a couple of the video channels could be advantageous, such that different pairs could be used together giving more camera capacity. This should be further looked into, especially if the Schilling cam is to be integrated.

Generally all camera tails need to be identified, marked up and documented correctly to the LP Junction Box (1 x updated central drawing). Where some cameras have fixed locations it would be beneficial to reduce their tail length so as to reduce clutter on the vehicle and aid filling with comp oil. Some type of video extender could be used in circumstance where a tail needs to be longer.

Pegasus:

Not used for the duration if the cruise.

Future modifications/improvements/maintenance:

- Investigate white balance which from last cruise did not appear to work from the Devcon GUI – the Insite GUI was found not to be compatible with Windows 7.

Super Scorpio Digital Still:

This unit worked well for cruise duration. The new download capability through the CWDM worked very well.

Some movement was witnessed during operation and thought to be the module within the housing. It is possible that some flex in the mounting to the vehicle may be the cause, and may require stiffening.

Future modifications/improvements/maintenance:

- Investigate marks on inside of glass dome.
- Include camera control in proposed joy-box development.
- Investigate module movement

High Definition Pilot and Science camera units (Mini Zeus)

Both cameras worked well for the duration of the cruise.

Future modifications/improvements/maintenance:
- Investigate pal video lines on both HD pbof's
- Send back to Insite for upgrades.

Mini Cams:

Uplook , Drawer 1, Draw 2, LED Sampler/Gauges, Niskin (5 total)

Two additional mini cams were integrated onto the vehicle prior to the start of the cruise. One for the draw with a second position on the light bar for overhangs on the canyon wall. The other was positioned at the rear of the vehicle looking at the Niskin bottles. The gauges cam was rotated 90deg so that the gauges could be seen in landscape on the topside screens.

For the Vibrocore trials these cameras were configured differently, with the Niskin camera being moved forward and mounted under the port manipulator arm. The light bar overhang camera mounted on the port side of the light bar looking down, complementing the draw camera.

2 x IT1000 cameras labeled as faulty were investigated with faults identified. 1 x unit appeared to work ok, but may still have a flickering fault. The other unit had a blown regulator board, which when bypassed work ok. A new regulator board has been sourced from Insite

Future modifications/improvements/maintenance:

- Procure 2 x regulator boards (£95) each and replace in both IT1000 cameras. These units can then be used as working spares.
- Look at doubling up cameras on video channels and power supplys.

Mercury (Aft Cam):

This is an excellent low light monochrome camera providing sharp pictures with minimal lighting and is well suited for vehicle rear view monitoring. No problems were encountered.

Future modifications/improvements/maintenance:

- None.

5.9 Lights:

2 x Aphos LED (set at 100% power output) Port and starboard outer units on ROV
2 x Aphos LED (set at 75% power output) Port and starboard inner units on ROV

During Dive 249 the port inner Aphos was nudged with the Kraft manipulator requiring a slight adjustment following the recovery. No damage was done to the light.

During Dive 255 port inner light (75%) was not working at full capacity.

During Dive 263 stbd inner light (75% power) was noted as being dim. Post dive investigation on both failed units showed the units as not outputting; with variations on the LED as the %power was changed.

During Dive 265 the port inner light appeared dim. This remained on the vehicle for the following two shallow dives, but was replaced prior to the final 4000m Dive 268.

Whilst removing the 2 x starboard light units it was noted that some damage, or just wear had occurred on one of the harnesses.

Future modifications/improvements/maintenance:

- Look at Diffusers and what benefits this could have.
- Possible solution procure 2 x new lights for HyBIS with a wider beam angle, then donate 2 x narrow beam lights from Isis to HyBIS.
- Rtn units 0000201, 0000190, and 0000205 to Cathx for investigation.
- Check and replace damaged cable harnesses.
- Manufacture extension cables so that two DSPL LED lights can be powered from a single light circuit.
- Install additional lights under manips either side of the draw.

5.10 Lasers:

Three of the laser units failed during the cruise. Following a complete strip down and re-build two of the units were made useable again.

Future modifications/improvements/maintenance:

- Contact Sidus listing all the failed units they have supplied us.
- Look at alternative design.
- Possible in house design and manufacture.
- Strip and re-build all units.

5.11 Sonars:

RDI Doppler WorkHorse Navigator 300KHz:

Possible water column tracking encountered during high current movements on the vehicle.

Future modifications/improvements/maintenance:

- Investigate firmware, for version and mode clarification.
- If money becomes available a spare should be purchased as they have been known to leak through transducer interface.
- Contact Lois Whitcomb (WHOI) to see if the configuration needs to be changed as a result of a software upgrade.

Tritech Imaging (Fwd):

The unit work well for the duration of the cruise.

Future modifications/improvements/maintenance:

- If money becomes available a spare should be purchased.
- Modify the Hybis 4000m unit to have DGO?

Reson Multibeam

This system was only used on three dives this cruise. On both occasions it worked well with no problems encountered. On the second dive it was used in a vertical configuration, mounted to the front of the ROV, between the top and bottom beam of the ROV frame. The tool sled, and port swing arm were removed to save buoyancy and help trim the vehicle to the horizontal.

Future modifications/improvements/maintenance:

- Blanks required for cables

5.12 Digiquartz Pressure Sensor:

Worked well for the duration of the cruise.

Future modifications/improvements/maintenance:

- None

5.13 Electrical Systems and Wiring:

The DC deck cable is not functioning. Possibly due to failure to energize the HV relay.

Future modifications/improvements/maintenance:

- Investigate and repair

5.14 Altimeter:

Worked well for the duration of the cruise.

5.15 Novatech Radio/Strobe Beacons

Worked well for the duration of the cruise

5.16 PRIZM –FO Comms

The subsea lasers have more than 4000 hours of use. Check software levels, spares and change them if necessary.
Install software on another PC to test Sound Alarm or create a Labview VI.

5.17 Scientific Sensors

CTD: SBE49 Ser no 4970149 – 0279

Worked well for the duration of the cruise.

Future modifications/improvements/maintenance:

- Write TCP software to connect to Seabird and send data to DB (Josue)

Thermometer: SBE38 Ser#
Not fitted

Turbidity: ECO-NTU-RTD

Worked well with no problems reported.

Future modifications/improvements/maintenance:

- Write software to add timestamp, convert data and send it to DB (Josue)

5.18 Low Voltage JB (port side):

No problems encountered during the cruise.

Future modifications/improvements/maintenance:

- Documentation to be sorted.
- The current science bus connector plate is too replaced, ultimately by MCIL connectors.
- Ident all sensors and cameras tails. Possible addition of tails for duplicating of tooling cameras.
- Look at set length tails for instruments and cameras that have a fixed location.

5.19 High Power JB (Starboard Side).

This junction box will need to be opened to investigate the deck cable issue, and to replace the lighting harnesses.

5.20 High Power Tube.

During Dive 245 it was noted that the aft lights had failed and were unable to be switched on or off via the GUI. This was closely followed by the up light and gauges lights. The volts and GUI had also frozen with no GF monitoring on the DC or AC circuits. Following a re-boot of topside it was also noted that the 5V and 24V backplanes were not coming on.

Following the recovery of the vehicle and further investigations it was first thought that the fault lie in the telemetry tube and the daughter board for the affected Wecons. (See below)

With this not rectifying the problem it was then thought that the next common location was the Wecons and the backplane in the HV tube. The likelihood of all the Wecons failing was minimal, and therefore the one for the rear lights was identified as a possible common link due to it failing first. (High Power Wecon 86)
Wecons affected by this was:

82 (stbd vert, stbd Hor, aft lat)
87 (suction bullet)
88 (draw)
On same channel and back plane)
73 (back plane 24 and 5V)
74 (stbd in , stbd out)
71 (port hor, fwd lat, port vert)
75 (port in port out)

With this Wecon replaced the faults disappeared, and no further problems were encountered.

Future modifications/improvements/maintenance:

- Check spares and stock accordingly

5.21 Low Power Tube.

Not opened.

5.22 Telemetry Tube.

The daughter board in telemetry tube replaced. This was identified as the common fault for the backplanes and rear light Wecons. Intermittently this appeared to make some difference, but was not consistently reliable. Some damage to the boards removed was encountered. (A couple of tombstones were identified, and a couple of small resisters were knocked off). These were repaired, but may need to be looked at in more detail.
Future modifications/improvements/maintenance:

- Check all spares and replace where necessary.

6. Isis System Topside:

6.1 Clearcoms:

One external unit failed and was replaced with a spare.
Request from bridge for a headset or phone to improve clarity of communications.

Future modifications/improvements/maintenance:

- Replace/repair failed unit.
- Identify no of spare headsets, order spares if necessary.
- Look at bridge request.

6.2 Jetway:

During Dive 248 the Jetway failed.
Brief investigations identified the unit to have blown a fuse on one of its incoming phases. This was replaced and the system re-instated into it operational status. No further problems were encountered.
It was also discovered during the fuse failure fault finding that the digital panel meter fitted to the jetway consul does not necessarily give accurate readings of input voltage or output current when compared with an external multimeter.
Future modifications/improvements/maintenance:

- Procure spare fuses.
- Investigate replacement unit
- Investigate discrepancy in incoming voltages

6.3 Device Controller:

Some issues were reported with loss of command to the pan and tilt units.
These were easily rectified with a software re-boot and cycle of the end-stops on the Kongsberg software. A requirement for this and future cruises is to record both pilot and science Pan & Tilt camera angles for scientific calculation of area viewed. The Device controller software was developed to achieve this with UDP broadcast of values monitored and recorded by the new Database software.

6.4 Techsas PC:

Operated well for the duration of the cruise

Future modifications/improvements/maintenance:

- None

6.5 CLAM PC:

An Audio alarm software added to highlight max and min Delta. Software modified to read correct EK600 water depth (Absolute depth not depth below transducer in meters not feet ie wrong string portion displayed)

Future modifications/improvements/maintenance:

- Investigate potential repair of com port
- Change range of red indicator
- Create Labview VI to read Sonardyne depth + button to toggle it + offset control
- Change conversion Labview VIs to C/python scripts and locate on another PC

- Purchase additional USB audio adaptor as fitted to IsisMedia and Worshop computers

6.6 Event Logger PC:

Operated well for the duration of the cruise

Future modifications/improvements/maintenance:

- None

6.7. Reson 7125 Multibeam:

The Reson Multi-beam sonar was used three times during the cruise, initially downward looking and then forward looking.
The Reson system requires numerous data inputs from the ship and ROV system. All previous cruise connections could not be used as the ship multi-beam now uses the Seapath unit located in the Gravity Meter room. This provides ship VRU, GGA and ZDA. The ZDA string and 1pps required by Reson is time critical and was found to be a problem in the past however it was found that UDP broadcasts of this data with a synchronised ZDA and 1pps from the Seapath met the Reson requirements. To achieve this a spare Isis Moxa unit was installed in the control van next to the Reson computer configured –

- ROVMoxa6 now 192.168.62.24
- port1 19200 Seapath VRU UDP 4003 com8
- port2 9600 Seapath GGA UDP 4004 com9
- port3 9600 Seapath ZDA UDP 4005 com10 (ZDA sync option)

Future modifications/improvements/maintenance:

- Purchase spare Moxa unit
- Purchase spare transducer cables and blanks

6.8 Tritech Super Seaking PC:

This unit was heavily relied upon for the safe operation of this cruise, and performed without any issues. During some dives it was requested that the system be logged.
This logging was done locally and transferred to the RAID following each dive. A failure of the com port was re-established by mapping a virtual Moxa port (port8 moxa61)
Future modifications/improvements/maintenance:

- Possible direct logging to data base?

6.9 Topside PC:

Operated well for the duration of the cruise

Future modifications/improvements/maintenance:

- None

6.10 DVLNAV PC:

On a few occasions the DVLNAV computer lost its Octans serial port feed and reverted to Doppler heading. It was found the Octans source was functioning but the DVLNAV com port was frozen. A restart of the software / computer rectified the problem.

Future modifications/improvements/maintenance:

- Investigate the potential to use a Moxa virtual com port to replace the Edgeport 16port usb expansion unit

6.11 Pilot/Engineer PC

Operated well for the duration of the cruise

Future modifications/improvements/maintenance:

- Change the GUI to remove TMS + change the color of STEP FORWARD/AFT Button (to avoid confusion with HDG button on the right)
- Investigate Wecon temp display as the 55 shown the majority of the time is likely to be incorrect.

6.12 Data Management

With an aim to improve data management efficiencies a change in hardware and process were implemented for this cruise.
A Minimac file server, Thunderbolt KiPro disk caddie and 4 off Thunderbolt 2 Lacie 42TB RAID5 Drives were installed in the ROV control van. Video file copying from the 4 off KiPro video recorders to the RAID units was as per previous cruises but achieved by the scientific watch within the control van. 2 off Imacs (read only) were setup in the main lab and made available for scientists online review and editing of all Isis ROV generated data.
Non video data was recorded as previous cruises through the Techsas datalogger operating a Crontab which copied the local data to the old Raid system every hour.

Future modifications/improvements/maintenance:

- A licenced copy of Paragon NTFS software for the Imacs would enable support for Windows NTFS formatted disks for scientific copying purposes
- Phase out old Raid system to new solution.
- Investigate suitability of Database software as alternative to Techsas

6.13 Direct to Disk Video Recording trial

To progress the video recording system a direct to disk recording system was trialled. The system comprised a Minimac I7, 3GHz, 16MB with Thunderbolt2 attached PCIe expansion rack unit housing a Blackmagic quad HD-SDI video capture board. A Lacie RAID drive provided for the data storage.

It was found that the top specified Apple Minimac could not cope with the processing required for 3 HD 1080i video and 1 PAL cameras (Scientific, Pilot, Scorpio & composite cameras). A baseline compression codec used Apple ProRes 422 overload the CPU. Diagnostics found that a single channel required 40% of the CPU and therefore could cope with only 2 HD channels. Reducing the level of compression would enable the Minmac to cope with 4 channels but with the overhead of increased storage requirement.

Future modifications/improvements/maintenance:

- Investigate suitability of the Apple Imac Pro as replacement of the Minimac
- Investigate alternative software to the basic inclusive Blackmagic software for improved display and control.

7. Isis Topside Technical Details:

7.1 Ship Connections:

The ROV web video server enables ship network viewing of 4 ROV cameras during dives. It is also the best approach for providing the Bridge with an Avocent connected display.
A trial of live Internet broadcast was conducted using this source.

7.2 Fibre Optic Terminations:

Prior to the cruise a new fibre optic break out box was fitted to the winch in order to separate the high voltage connections from the fibre connections. This has provided much improved operator safety and provided a much more flexible and efficient means of operations. It is thought that the grey fibre pass in the slip ring may be problematic. It is likely a new lead or connector is required.

A total of four terminations were made for this cruise.

Termination 1	Start of Cruise
Termination 2	Following Dive 248
Termination 3	Following Dive 259
Termination 4	Following Dive 260

The Umbilical Grey fibre needs investigating at the winch slip ring. There is a possible connector fail on the container side of the unit.

Future modifications/improvements/maintenance:

- Check all test equipment.
- Replace and stock connectors, glue etc
- F/O termination box in data container for the connection of fibres from the winch JB to the CWDM and Prizm fibres.
- Investigate grey fibre through slipring.

7.3 Air Conditioning Units

Worked well for the duration of the cruise

Future modifications/improvements/maintenance:

- None

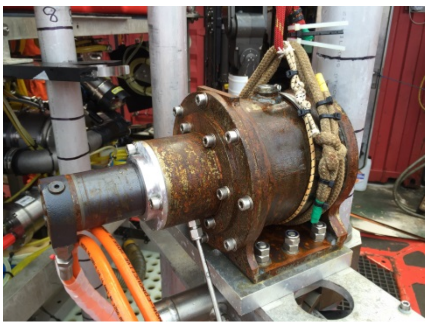
8.0 ISIS Dive Summary (hrs run)

Cruise No.	Dive No.	Dive Hrs Decimal	Dive Hrs:Mins:Sec	Cruise Total Hrs Decimal	System Total Hrs decimal	Max Depth (m)	Bottom Time Hrs:Mins:Sec	Bottom Time (Hrs Decimal)
JC124	242	2.490	02:29:25			100	01:45:06	1.752
JC124	243	4.674	04:40:28			100	04:01:46	4.029
JC124	244	4.265	04:15:53			100	03:28:07	3.469
JC124 Totals	**(3 Dives)**		11:25:46	**11.43**	**3544.98**	**100**	9:14:59	**9.250**
JC125	245	4.331	04:19:50			1330	01:54:45	1.913
JC125	246	14.850	14:51:00			1084	13:06:00	13.100
JC125	247	16.617	16:37:00			1468	14:27:00	14.450
JC125	248	11.733	11:44:00			4168	05:34:00	5.567
JC125	249	11.350	11:21:00			1408	09:15:00	9.250
JC125	250	6.667	06:40:00			911	05:07:00	5.117
JC125	251	10.883	10:53:00			766	09:32:00	9.533
JC125	252	5.450	05:27:00			861	03:58:00	3.967
JC125	253	11.767	11:46:00			3958	07:02:00	7.033
JC125	254	11.783	11:47:00			1082	09:52:00	9.867
JC125	255	8.783	08:47:00			754	07:26:00	7.433
JC125	256	15.067	15:04:00			842	13:15:00	13.250
JC125	257	12.633	12:38:00			2760	08:44:00	8.733
JC125	258	4.933	04:56:00			1341	00:09:00	0.150
JC125	259	12.133	12:08:00			3037	07:27:00	7.450
JC125	260	19.100	19:06:00			2978	12:23:00	12.383
JC125	261	12.917	12:55:00			1035	10:47:00	10.783
JC125	262	8.517	8:31:00			874	07:10:00	7.167
JC125	263	13.200	13:12:00			1549	10:36:00	10.600
JC125	264	9.133	09:08			709	07:33:00	7.550
JC125 Totals	**(20 dives)**		221:50:50	**221.85**	**3766.83**	**4168**	165:17:45	**165.296**
JC126	265	2.583	02:35:00			219	01:54:00	1.900
JC126	266	2.500	02:30:00			204	01:49:00	1.817
JC126	267	2.317	02:19:00			230	01:36:00	1.600
JC126	268	6.583	06:35:00			4184	01:30:00	1.500
JC126 Totals	**(4 dives)**		13:59:00	**13.98**	**3780.81**	**4184**	6:49:00	**6.817**

9.0 Vibrocorer Trials 2

The original design of the Vibrocorer system was that it would be powered from its own power pack consisting of two pumps and a valve pack. These pumps would be supplied from the Isis hydraulic unit. The idea behind this was that it would be a standalone system, isolating the Vibrocore hydraulic components from the Isis hydraulic circuit. This was seen as essential if the equipment was to be used on different vehicles where control on the cleanness of the oil could not be controlled.

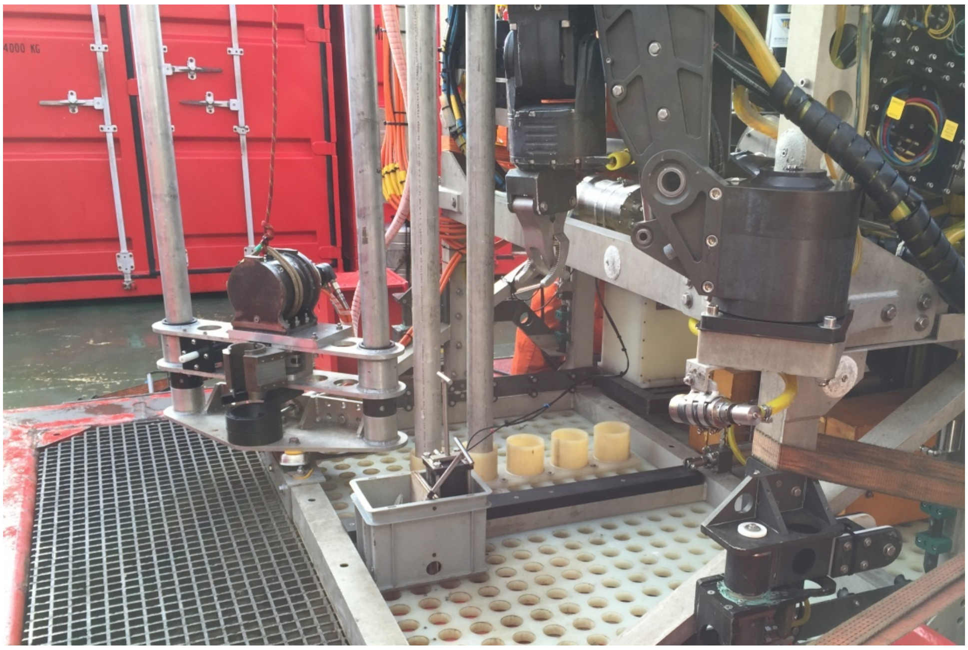
Unfortunately from the first trials cruise it was identified that the pump driving the vibrator motor was not adequate with regards to flow output. For this reason, and to keep the trials moving it was decided to give the vibrator motor a direct feed from the manipulator supply on the Isis hydraulic system. This increased flow did make a difference, to the motor speed, but was still unable to vibrate into the sediment.



Following a visit from the MBARI techs to advise where we go next, it was concluded that the vibrator currently being used was too small and not heavy enough. A new spec motor was supplied from MBARI, and a new unit manufactured by the engineers in Liverpool. This new motor would still require the high flow supply from the Isis hydraulic system. At this stage in the development it was thought that the concept be proved before worrying too much about an independent hydraulic power unit (HPU).

Vehicle Configuration:

New Vibrator Motor



- Vibrator connected to starboard manipulator manifold (approx. flow at 1500rpm and 1000psi is 15.5l/min
- Hydro Lek HPU Pump A connected to suction sampler rotate valve on Isis HPU.
- HydroLek HPU Pump B not connected.
- HydroLek Pump A supplies Vibrocore clamp, cutter, and winch.
- HydroLek telemetry connected to science bus 2 on Isis LP junction box.
- HydroLek topside unit connected to Isis serial port.

A rig was devised so that two cores could be taken on the same dive. One core was placed in the clamp and Vibrocore assembly and a second tube in the clamp and foot assembly (see above). Once the first core had been taken this was removed with the port (Kraft Predator) manipulator and replaced with the second tube. The second tube remained in the Vibrocore assembly until the vehicle was recovered. A useful tip gained from the MBARI team was to position the clamp and vibrator assembly at the base of the unit, when removing and replacing the tubes. The original design was to do this operation with the clamp assembly at the top of the rig, maneuvering the tubes in or out from the underside. This new method worked well and was a lot easier.

The science HD and Scorpio Still cameras were removed to make way for the Vibrocore installation. The pilot pan & tilt complete with HD camera and lasers remained in its original configuration. Three tooling cameras were repositioned to facilitate manipulator work and the operation of the system.

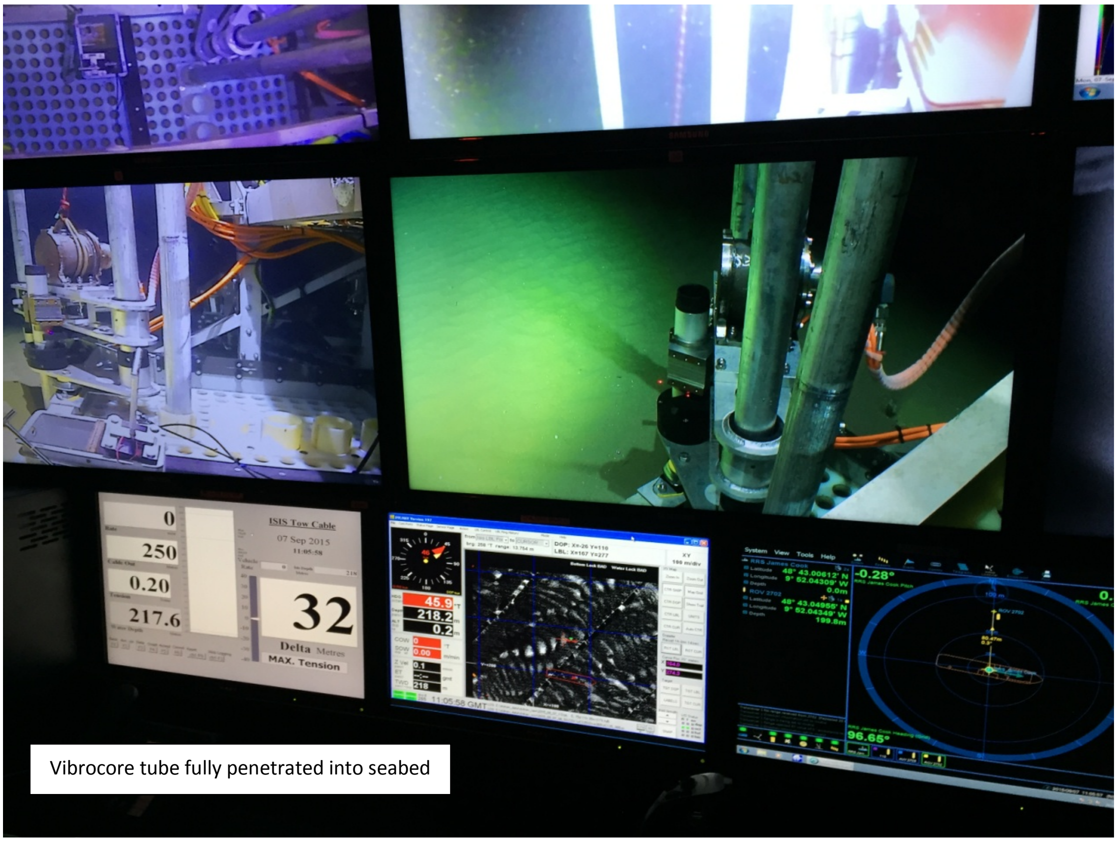
Operation:

Isis hydraulic motor started at 500rpm
Isis manifold set to 75%

Isis slurp rotate valve set to 75%
This configuration enabled the operation of the cutter, clamp and winch.

The Isis hydraulic motor was increased to 1000rpm for the operation of the vibrator motor. This speed appeared to be the most suitable for the majority of coring operations.

1. The ROV was positioned at the specified location on the seabed, with a down force of approximately 120kg applied by the thrusters. This amount of thrust enabled the hydraulic system to function without power limiting the vehicle.
2. Cutter blade was opened.
3. Core tube was lowered to seabed using the winch.
4. Clamp repositioned approximately 500mm up from the cutter plate.
5. Vibrator motor started at 1000rpm
6. When the clamp and motor assembly reach the cutter plate the vibrator was stopped. The clamp was then opened and the winch hauled lifting the clamp and vibrator up the tube. It was again positioned 500mm up from the cutter plate and clamped back onto the tube.
7. Vibrator motor on and continue to vibrate.
8. This process was continued until it was deemed that the tube would no longer penetrate, or was at the top of the tube (see pic below)
9. The winch was then hauled pulling the core from the seabed. The clamp assembly was again re-positioned on the tube a couple of time as the core was retracted.
10. With the core tube clear of the seabed the winch continued to haul just until the end of the tube went into the cutter blade housing. With the end of the tube visible the cutter was closed and the tube lowered onto the plate.
11. The tube could now either be changed or left in this position depending on whether it was the first or second core.



Vibrocore tube fully penetrated into seabed

Dive Log:

Dive 265 (JC126) Mon 7th Sept 2015
Deployed 09-15hrs
Recovered 11-50hrs (Mon 7th Sept)
Max Depth 219m

- 2 x cores configured on vehicle
- First core struggle to penetrate. But was later identified to be restricted by the drifting cutter that had slightly closed.
- Second core penetrated well (approx. 1.3m)
- Varying Isis hydraulic motor speed from 1000rpm to 1250rpm to 1500rpm seemed to make a difference at times when the core appeared to stop penetrating.
- Port inner light appeared dim. Cathx Unit 0000205 (inventory No. 250007893
- The swapping of the core tube from the vibrator to the quiver work well using the port (Kraft) manipulator arm.

Dive 266 (JC126) Mon 7th Sept 2015
Deployed 13-45hrs
Recovered 16-15hrs (Mon 7th Sept)
Max Depth 204m

- Again a variation in motor speeds was applied at times when the core stopped penetrating
- 2 x cores taken as per previous dive.

Dive 267 (JC126) Mon 7th Sept 2015
Deployed 17_48hrs
Recovered 20-07hrs (Mon 7th Sept)
Max Depth 219m

- 2 x cores taken with what looked like 950mm penetration.
- Same technique applied.
- No post dive carried out.

Dive 268 (JC126) Tue 8th Sept 2015
Deployed 09-15hrs
Recovered 15-50hrs (Tue 8th Sept)
Max Depth 4184m

- Full pre dive and change of port inner light.
- Proposed last Dive
- Marginal weather conditions (25knts, moderate sea state)

- Decision made to deploy
- A ‘puff’ of something seen on gauges camera at approx. 3200m, with slight shudder witnessed on some cameras.
- Arrived seabed and core position. (4184m)
- No comms to Hydro Lek power unit, so unable to carry out core operations.
- Vibrator still working on Isis Hyd.
- Short video transect to second waypoint.
- Dive aborted.
- Upon close inspection of gauges camera it looked like a possible failure of Hydro Lek telemetry bottle had occurred.
- Vehicle recovered
- Confirmed Hydro Lek pressure bottle fail.
- Isis hyd oil contaminated .

Conclusion:

- The new vibrator motor appears to work well and is a vast improvement on the previous model.
- 1000rpm on the Isis hydraulic motor seems to be the most suitable motor for the vibrator. It was also noted that increasing to 1250 and 1500rpm at times enabled the vibrator to change frequency and penetrate further. Following a short burst at the higher speeds it was found returning to 1000rpm worked best.
- The new way of removing and replacing the core tubes with the manipulator worked well, and has proved the concept for a more ambiguous design.
- The three tooling cameras and the Pilot HD worked well in their positions for facilitating the operation of the system.
- HydroLek HPU is not suitable for running the vibrator motor. In addition to this the pressure rating of the system needs to be investigated, and may not be suitable for deep water operations.
- Either the Vibrator or HydroLek Pump A appears to be drawing water into the Isis hydraulic system.

Modifications/Improvements/Ideas:

- Invert the clamp assembly so that the lead is now on the top, rather than the bottom.
- Look at a split tool tray concept that could be used to store and move additional core tubes. This may be able to facilitate push cores and or a rock box.
- Look at moving winch from the top of the Vibocore assembly to the tool sled or front of the vehicle.
- St/Steel construction vibrator with fitted lift point.
- Decide whether a bespoke Isis system would be better than a unit that can be used on other vehicles.
    - This would allow the Isis hydraulic system to be used for all functions removing the requirement for the HydroLek HPU.
    - A more compact system tailor made to the front of Isis.
- Investigate water ingress into vibrator motor.

Appendix E: CTD Configuration files

Stainless CTD frame:

CTD cast 001 – 003

PSA file: C:\Program Files (x86)\Sea-Bird\SeasaveV7\Cruise\JC124_5_6\JC125_0869_SS_NMEA.psa

Date: 09/09/2015

Instrument configuration file: C:\Program Files (x86)\Sea-Bird\SeasaveV7\Cruise\JC124_5_6\CTD Data\Raw\JC125_CTD002.xmlcon

Configuration report for SBE 911plus/917plus CTD

Frequency channels suppressed : 0
Voltage words suppressed : 0
Computer interface : RS-232C
Deck unit : SBE11plus Firmware Version >= 5.0
Scans to average : 1
NMEA position data added : Yes
NMEA depth data added : No
NMEA time added : No
NMEA device connected to : deck unit
Surface PAR voltage added : No
Scan time added : No

1) Frequency 0, Temperature

Serial number : 03P-4380
Calibrated on : 21 February 2015
G : 4.37196363e-003
H : 6.54728653e-004
I : 2.35808615e-005
J : 1.83104127e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 04C-2165
Calibrated on : 23 Feburary 2015
G : -9.76447073e+000
H : 1.34261013e+000
I : -2.18209470e-003
J : 2.12798698e-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 : 03 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-4383
Calibrated on : 21 January 2015
G : 4.39868310e-003
H : 6.55386899e-004
I : 2.41901957e-005
J : 1.99915848e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 04C-2580
Calibrated on : 07 October 2014
G : -1.04730248e+001
H : 1.53967964e+000
I : 3.35591804e-004
J : 6.40365145e-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 : 43-1624

Calibrated on : 19 December 2014
Equation : Sea-Bird
Soc : 5.26600e-001
Offset : -5.13900e-001
A : -3.49460e-003
B : 2.26850e-004
C : -3.23930e-006
E : 3.60000e-002
Tau20 : 1.49000e+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, Altimeter

Serial number : 41302
Calibrated on :
Scale factor : 15.000
Offset : 0.000

9) A/D voltage 3, Turbidity Meter, WET Labs, ECO-BB

Serial number : 169
Calibrated on : 14 April 2010
ScaleFactor : 1.000000
Dark output : 0.000000

10) A/D voltage 4, Fluorometer, Chelsea Aqua 3

Serial number : 08-2615-126
Calibrated on : 06 August 2014
VB : 0.170100
V1 : 0.285800
Vacetone : 0.215200
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

11) A/D voltage 5, Transmissometer, Chelsea/Seatech

Serial number : 07-6075-001
Calibrated on : 22 June 2015
M : 23.1417
B : -0.2543
Path length : 0.250

12) A/D voltage 6, Free

13) A/D voltage 7, Free

Scan length : 37

Pump Control

This setting is only applicable to a custom build of the SBE 9plus.

Enable pump on / pump off commands: NO

Data Acquisition:

Archive data: YES

Delay archiving: NO

Data archive: C:\Program Files (x86)\Sea-Bird\SeasaveV7\Cruise\JC124_5_6\CTD Data\Raw\JC125_CTD003.hex

Timeout (seconds) at startup: 60

Timeout (seconds) between scans: 10

Instrument port configuration:

Port = COM1

Baud rate = 19200

Parity = N

Data bits = 8

Stop bits = 1

Water Sampler Data:

Water Sampler Type: SBE Carousel

Number of bottles: 36

Port: COM2

Enable remote firing: NO

Firing sequence: User input

Tone for bottle fire confirmation uses PC sound card.

Header information:

Header Choice = Prompt for Header Information

prompt 0 = Cruise:

prompt 1 = Vessel:

prompt 2 = Cast number:

prompt 3 = Station number:

prompt 4 = Latitude:

prompt 5 = Longitude:

prompt 6 = Date (Julian):

prompt 7 = Time (GMT):

prompt 8 = Depth (uncorrected):

prompt 9 = Operator:

TCP/IP - port numbers:

Data acquisition:

Data port: 49163

Status port: 49165

Command port: 49164

Remote bottle firing:

```
    Command port:       49167
    Status port:        49168
  Remote data publishing:
    Converted data port:  49161
    Raw data port:      49160
--------------------------------------------
Miscellaneous data for calculations
  Depth, Average Sound Velocity, and TEOS-10
    Latitude when NMEA is not available:  0.000
    Longitude when NMEA is not available: 0.000
  Average Sound Velocity
    Minimum pressure [db]:             20.000
    Minimum salinity [psu]:            20.000
    Pressure window size [db]:         20.000
    Time window size [s]:              60.000
  Descent and Acceleration
    Window size [s]:                   2.000
  Plume Anomaly
    Theta-B:                     0.000
    Salinity-B                   0.000
    Theta-Z / Salinity-Z             0.000
    Reference pressure [db]            0.000
  Oxygen
    Window size [s]:                   2.000
    Apply hysteresis correction:         1
    Apply Tau correction:              1
  Potential Temperature Anomaly
    A0:                        0.000
    A1:                        0.000
    A1 Multiplier:                  Salinity
--------------------------------------------
Serial Data Output:
  Output data to serial port: NO
--------------------------------------------
Mark Variables:
  Variables:
  Digits   Variable Name [units]
  ------   ---------------------
  0      Scan Count
  4      Depth [salt water, m]
  7      Conductivity [S/m]
  5      Salinity, Practical [PSU]
--------------------------------------------
Shared File Output:
  Output data to shared file: NO
--------------------------------------------
TCP/IP Output:
  Raw data:
    Output raw data to socket:           NO
    XML wrapper and settings:            NO
    Seconds between raw data updates:      0.000
```

Converted data:
Output converted data to socket: NO
XML format: NO

SBE 11plus Deck Unit Alarms
Enable minimum pressure alarm: NO
Enable maximum pressure alarm: NO
Enable altimeter alarm: NO

SBE 14 Remote Display
Enable SBE 14 Remote Display: NO

PC Alarms
Enable minimum pressure alarm: NO
Enable maximum pressure alarm: NO
Enable altimeter alarm: NO
Enable bottom contact alarm: NO
Alarm uses PC sound card.

Options:
Prompt to save program setup changes: YES
Automatically save program setup changes on exit: NO
Confirm instrument configuration change: YES
Confirm display setup changes: YES
Confirm output file overwrite: YES
Check scan length: NO
Compare serial numbers: NO
Maximized plot may cover Seasave: NO

CTD cast 004 – 020

PSA file: C:\Program Files (x86)\Sea-Bird\SeasaveV7\Cruise\JC124_5_6\JC125_1142_SS_NMEA.psa

Date: 08/31/2015

Instrument configuration file: C:\Program Files (x86)\Sea-Bird\SeasaveV7\Cruise\JC124_5_6\CTD Data\Raw\JC125_CTD015.XMLCON

Configuration report for SBE 911plus/917plus CTD

Frequency channels suppressed : 0
Voltage words suppressed : 0
Computer interface : RS-232C
Deck unit : SBE11plus Firmware Version >= 5.0
Scans to average : 1
NMEA position data added : Yes
NMEA depth data added : No

NMEA time added : No
NMEA device connected to : deck unit
Surface PAR voltage added : No
Scan time added : No

1) Frequency 0, Temperature

Serial number : 03P-4380
Calibrated on : 21 February 2015
G : 4.37196363e-003
H : 6.54728653e-004
I : 2.35808615e-005
J : 1.83104127e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 04C-2165
Calibrated on : 23 Feburary 2015
G : -9.76447073e+000
H : 1.34261013e+000
I : -2.18209470e-003
J : 2.12798698e-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 : 03 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-4383
Calibrated on : 21 January 2015
G : 4.39868310e-003
H : 6.55386899e-004
I : 2.41901957e-005
J : 1.99915848e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 04C-2580
Calibrated on : 07 October 2014
G : -1.04730248e+001
H : 1.53967964e+000
I : 3.35591804e-004
J : 6.40365145e-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 : 43-1624
Calibrated on : 19 December 2014
Equation : Sea-Bird
Soc : 5.26600e-001
Offset : -5.13900e-001
A : -3.49460e-003
B : 2.26850e-004
C : -3.23930e-006
E : 3.60000e-002
Tau20 : 1.49000e+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, Altimeter

Serial number : 41302
Calibrated on :
Scale factor : 15.000
Offset : 0.000

9) A/D voltage 3, Turbidity Meter, WET Labs, ECO-BB

Serial number : 169
Calibrated on : 14 April 2010
ScaleFactor : 1.000000
Dark output : 0.000000

10) A/D voltage 4, Fluorometer, Chelsea Aqua 3

Serial number : 08-2615-126
Calibrated on : 06 August 2014
VB : 0.170100
V1 : 0.285800
Vacetone : 0.215200
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

11) A/D voltage 5, Transmissometer, Chelsea/Seatech

Serial number : 07-6075-001
Calibrated on : 22 June 2015
M : 23.1417
B : -0.2543
Path length : 0.250

12) A/D voltage 6, Free

13) A/D voltage 7, Free

Scan length : 37

Pump Control
This setting is only applicable to a custom build of the SBE 9plus.
Enable pump on / pump off commands: NO

Data Acquisition:
Archive data: NO
Delay archiving: NO
Data archive: C:\Program Files (x86)\Sea-Bird\SeasaveV7\Cruise\JC124_5_6\CTD Data\Raw\JC125_CTD017.hex
Timeout (seconds) at startup: 60
Timeout (seconds) between scans: 10

Instrument port configuration:
Port = COM1
Baud rate = 19200
Parity = N
Data bits = 8
Stop bits = 1

Water Sampler Data:

Water Sampler Type: SBE Carousel
Number of bottles: 36
Port: COM2
Enable remote firing: NO
Firing sequence: Sequential
Tone for bottle fire confirmation uses PC sound card.

Header information:
Header Choice = Prompt for Header Information
prompt 0 = Cruise:
prompt 1 = Vessel:
prompt 2 = Cast number:
prompt 3 = Station number:
prompt 4 = Latitude:
prompt 5 = Longitude:
prompt 6 = Date (Julian):
prompt 7 = Time (GMT):
prompt 8 = Depth (uncorrected):
prompt 9 = Operator:

TCP/IP - port numbers:
Data acquisition:
Data port: 49163
Status port: 49165
Command port: 49164
Remote bottle firing:
Command port: 49167
Status port: 49168
Remote data publishing:
Converted data port: 49161
Raw data port: 49160

Miscellaneous data for calculations
Depth, Average Sound Velocity, and TEOS-10
Latitude when NMEA is not available: 0.000
Longitude when NMEA is not available: 0.000
Average Sound Velocity
Minimum pressure [db]: 20.000
Minimum salinity [psu]: 20.000
Pressure window size [db]: 20.000
Time window size [s]: 60.000
Descent and Acceleration
Window size [s]: 2.000
Plume Anomaly
Theta-B: 0.000
Salinity-B 0.000
Theta-Z / Salinity-Z 0.000
Reference pressure [db] 0.000
Oxygen
Window size [s]: 2.000
Apply hysteresis correction: 1

```
    Apply Tau correction:              1
  Potential Temperature Anomaly
    A0:                            0.000
    A1:                            0.000
    A1 Multiplier:                     Salinity
--------------------------------------------
Serial Data Output:
  Output data to serial port: NO
--------------------------------------------
Mark Variables:
  Variables:
  Digits   Variable Name [units]
  ------   ---------------------
  0        Scan Count
  4        Depth [salt water, m]
  7        Conductivity [S/m]
  5        Salinity, Practical [PSU]
--------------------------------------------
Shared File Output:
  Output data to shared file: NO
--------------------------------------------
TCP/IP Output:
  Raw data:
    Output raw data to socket:            NO
    XML wrapper and settings:             NO
    Seconds between raw data updates:      0.000
  Converted data:
    Output converted data to socket:       NO
    XML format:                          NO
--------------------------------------------
SBE 11plus Deck Unit Alarms
  Enable minimum pressure alarm:    NO
  Enable maximum pressure alarm:    NO
  Enable altimeter alarm:          NO
--------------------------------------------
SBE 14 Remote Display
  Enable SBE 14 Remote Display:     NO
--------------------------------------------
PC Alarms
  Enable minimum pressure alarm:    NO
  Enable maximum pressure alarm:    NO
  Enable altimeter alarm:          NO
  Enable bottom contact alarm:      NO
  Alarm uses PC sound card.
--------------------------------------------
Options:
  Prompt to save program setup changes: YES
  Automatically save program setup changes on exit: NO
  Confirm instrument configuration change: YES
  Confirm display setup changes: YES
  Confirm output file overwrite: YES
```

Check scan length: NO
Compare serial numbers: NO
Maximized plot may cover Seasave: NO

<u>Appendix F: JC124/125/126 sea surface vertebrate species list</u>

<u>Cetaceans</u>
Blue Whale *Balaenoptera musculus*
Fin Whale *Balaenoptera physalus*
Long-finned Pilot Whale *Globicephala melas*
Bottlenose Dolphin *Tursiops truncatus*
Short-beaked Common Dolphin *Delphinus delphis*

<u>Seabirds</u>
Northern Fulmar *Fulmarus glacialis*
Cory's Shearwater *Calonectris diomedea (borealis)*
Great Shearwater *Puffinus gravis*
Manx Shearwater *Puffinus puffinus*
Balearic Shearwater *Puffinus mauretanicus*
Sooty Shearwater *Puffinus griseus*
European Storm Petrel *Hydrobates pelagicus*
Wilson's Storm Petrel *Oceanites oceanicus*
Northern Gannet *Morus bassanus*
European Shag *Phalacrocorax aristotelis*
Grey Phalarope *Phalaropus fulicarius*
Great Skua *Stercorarius skua*
Pomarine Skua *Stercorarius pomarinus*
Arctic Skua *Stercorarius parasiticus*
Long-tailed Skua *Stercorarius longicaudus*
Black-headed Gull *Chroicocephalus ridibundus*
Mediterranean Gull *Larus melanocephalus*
Yellow-legged Gull *Larus michahellis*
Lesser Black-backed Gull *Larus fuscus (graellsii/intermedius)*
Black-legged Kittiwake *Rissa tridactyla*
Sabine's Gull *Xema sabini*
Arctic Tern *Sterna paradisaea*
Guillemot *Uria aalge*

<u>Land birds</u>
Ringed Plover *Charadrius hiaticula*
Turnstone *Arenaria interpres*
Whimbrel *Numenius phaeopus*
Feral (Racing) Pigeon *Columba livea*
Pied/White Wagtail *Motacilla alba*
European Robin *Erithacus rubecula*
Common Redstart *Phoenicurus phoenicurus*
Northern Wheatear *Oenanthe oenanthe*
European Reed Warbler *Acrocephalus scirpaceus*
Willow Warbler *Phylloscopus trochilus*
Chiffchaff *Phylloscopus collybita*