National Research Vessels

SHIP-TIME PROGRAMME 2010

RESEARCH SURVEY REPORT

Survey Code:	Survey Name:	Chief Scientist/ Institution
CE10004	Species on the Margins	Louise Allcock/NUIG

Section A: Award Summary

Title of Research Survey and Survey Code:	CE10004: Species on the Margins	
Co-Ordinator/ Chief Scientist:	PI: Prof Mark Johnson CS: Dr Louise Allcock	
Vessel used for ship-time:	*RV Celtic Voyager* ☐ *RV Celtic Explorer* ☑	
Total number of days at sea:	12 (including mob/demob)	
Total number of grant-aided ship-time days awarded:	12 (including mob/demob)	
Dates of survey:	23rd May to 3rd June	
Mobilisation/Demobilisation Ports	Killybegs / Galway	
Survey Personnel:	*No. of Scientists* *4*	*No. of Students* *10*
Final Report Completed by:	Professor Mark Johnson and Dr Louise Allcock	**Date**: 30th July 2010

Section B: Description of the Research Survey

B1 Overview of survey personnel

Names	*Institute/ Department/ Course*	*Position (undergraduate/ post graduate etc)*	*Number of Days*
Scientists			
Dr Louise Allcock	***NUIG***	***Adjunct Lecturer***	***12***
Dr Dave McCarthy	***NUIG***	***Post-doc***	***12***
Dr Caroline Cusak	***NUIG***	***Post-doc***	***12***
Dr Helka Folch	***NUIG***	***Post-doc***	***12***
Students			
Aileen Gill	***NUIG***	***Postgraduate***	***12***
Carsten Wolff	***NUIG***	***Postgraduate***	***12***
Kathryn Hughes	***NUIG***	***Postgraduate***	***12***
Niall McGinty	***NUIG***	***Postgraduate***	***12***
Dermot Ryan	***NUIG***	***Bursary student***	***12***
Robert Fitzpatrick	***TCD***	***Postgraduate***	***12***
Angela Stevens	***TCD***	***Postgraduate***	***12***
Robert Phelan	***UCC***	***Postgraduate***	***12***
Burkhardt Flemer	***UCC***	***Postgraduate***	***12***
Christine Morrow	***QUB***	***Postgraduate***	***12***

B2 Objectives

Briefly outline the overall objectives of the research survey.
Please state if objectives have changed from the original proposal. If survey included a training element please outline clearly.

The original objectives of the cruise were
1) To identify and map benthic macrofauna in slope and canyon regions using conventional cores and ROV surveys
(2) To characterize the diversity and functional diversity of the bacterial community (with a focus on water column and sponge symbionts) at different depths.
(3) To carry out preliminary on-ship screens for bioactivity on macrofaunal extracts.
(4) To collect material for the preparation of extracts in the MI biodiscovery laboratory and to supply marine structures (sponges) for biomaterials testing.
(5) To isolate bacteria from the water column and sponges and screen these extracts for bioactivity. This work will be accompanied by metagenomic screening to better understand the diversity and function of the entire (i.e. non-culturable) bacterial community.

Hydrographic and related oceanographic information were collected alongside the main aims of the cruise to gain a better understanding of the environment within canyons and on the slope.

Objective 3 was not carried out on the cruise as the intended researcher was on maternity leave and a decision was made that it would be more practical not to include this element onboard. Material was therefore frozen at -80ºC for later extraction ashore.

B3 Overview of research survey

Provide a narrative overview of the research survey including survey timelines
The information provided in this section should not exceed 5 pages (excluding tables and maps)

Sunday 23rd May 2010

The techs provided swath data from the OLEX system allowing the rough original positions to be repositioned more accurately within the canyon system.

Monday 24th May 2010

Calibration station

Sampling began at 03.18 with a CTD. This was followed by a box core. The boxcore mechanism failed to trip. After two boxcore failures, a float was added to the trigger mechanism. Although it fired OK, the boxcore didn't penetrate very far into the sediment. Although we sieved the contents for fauna, the boxcore was not suitable for taking geology cores. We therefore recast the boxcore. Although it still didn't penetrate as far as was desirable, this was because the sediment was coarse compacted sand, hence subcores were taken from within the box core sample. This preliminary station was in addition to stations originally proposed in order to allow the deep-sea core data to be calibrated with shelf data.

800 m station (Stn 1)

The first station proper was position at approximately 800 m in a roughtly semicircular bowl with steep walls rising to approximately 650 m. A CTD (to provide bottom water for the UCC microbiologists) was taken on the flat sediment in the centre of this bowl. We then moved to the lower part of the wall at the South East of this bowl to begin ROV associated operations. We cast a CTD and took bottom water samples (for UCC microbiology) and ran a plankton net to 200 m, both on the launch position of the ROV. The plankton net was to compare with the upfacing camera on the ROV whose images will be examined for gelatinous zooplankton. ROV operations ran from 8am to 8pm, but it took some time for the ROV to be ready for launch hence the ROV finally went in the water about 11.00 am. Initial pictures revealed a fairly hard sediment with some overlying sand and numerous boulders and small rocks. We mainly used the suction sampler to collect specimens for biodiscovery work. At approximately 2 pm, the power to the ROV failed and various warning lights appeared. Scientists vacated the ROV cabin and the ROV was recovered to deck shortly afterward.

During the ROV downtime, we attempted to run a boxcore but this failed to fire.

The ROV took some time to repair with additional problems with cameras and manipulator arms. The downward facing camera was replaced with a slightly smaller colour camera. The ROV was relaunched about 7 pm with the caveat that the manipulator arm might not work well. Although it was problematic, a reasonably good collection was made with the ROV returning to deck about 10.30 pm. This site was in much poorer condition, with evidence of trawl scarring.

We followed this by two plankton nets: one to 200 m and one to 600 m to collect gelatinous zooplankton.

Tuesday 25th May 2010

1,500 m station (Stn 2)

At around midnight, we moved to our next station positioned in the first part of the right hand canyon system at about 1,500 m depth. We ran a CTD for the NUIG microbial group and a boxcore for TCD geochemists.

After this we spent some time traversing the right hand wall of the canyon looking for a suitable depth gradient to explore with the ROV. We chose a position at the north of this section of canyon and at the foot of the canyon wall. It was apparent that the depth soundings we were getting did not correspond to the Olex bathymetry. When we ran the CTD (with a 10 m bottom sensor) it became clear that the soundings were not accurate. The CTD and Olex bathymetry data were in reasonably close agreement. The CTD returned to deck at approximately 6.45 am (local time). It was followed by plankton nets: one to 200 m, one to 600 m. We held position until the ROV was ready to launch.

Maintenance on the ROV took longer than expected. Launch was shortly before 4pm. At approximately 4.30 pm the ROV reached the bottom. A slight contact bump caused a connector to disconnect causing loss if power to the thrusters and necessitating return of the vehicle to the surface. ROV relaunched at 5.50pm (local time), reaching bottom approximately 6.30 pm. ROV returned to deck at approximately 10pm. Although collecting time was limited, the fauna was extremely varied including predatory tunicates, a cirrate octopus, and several large sponges. We followed a transect directly up the wall starting on the canyon floor before the wall and climbing steeply from about 1,544 m at 19:36 to 1,350 m at 21:05.
We followed the ROV with plankton nets and a CTD, completed shortly after midnight.

Wednesday 26th May 2010

We then moved to the foot of the canyon wall to run a couple of boxcores. The first two drops failed so we moved further away from the wall in case the terrain was not quite flat. A third drop on this flatter ground failed. The crew removed the float from the boxcore mechanism to see whether this would have an effect. A fourth drop failed. At this point we decided to move to the next station since it was 4 am and there were several gears to complete at the new station before scheduled ROV operations began at 8 am.

2,000 m station

The CTD was cast at approximately 4:30 am. The 10m sensor apparently failed to trip as the pressure reading stabilized at 2070 db while cable was still being paid out. However upward readings mirrored downward readings and the CTD returned to deck in good working order.

Despite the night-time problems with the boxcore, we had little choice but to attempt a drop. Once again, it failed to fire.

We chose a position on which to run the ROV. We ran a CTD. There were minor problems with the winch at 12 m but these were swiftly sorted. We ran a plankton net from 0-200 metres. As this was surfacing, the ROV team announced the ROV was

ready for launch, hence we did not run a 0-600 m plankton net but launched the ROV at the first opportunity.

We knew from bathymetry that the walls of this part of the canyon were not as steep as in the shallower section already surveyed. We discovered that the walls were extremely silty with few sponges or other fauna suitable for biodiscovery. Hence after gathering some urchins for TCD and climbing the full height of the wall, we decided to move back to the canyon explored yesterday which had a lot of fauna suitable for biodiscovery projects but which we had had limited time to explore. Hence we returned the ROV to deck

1,500 m station

We selected a site approximately 300 m from yesterday's transect and relaunched the ROV. At about 1,200 m depth, a problem with the winch developed. This took some time to fix and the ROV did not reach the seafloor until shortly after 4pm. Good collections were made, but unfortunately just before we started to focus on echinoderms for TCD, the robotic arm broke and the ROV was recovered to deck., surfacing at approximately 6.30 pm. As usual we ran two plankton nets and a CTD at the ROV recovery site.

During the day, the boatswain and chief engineer had modified the boxcore firing mechanism. Tests on deck suggested it was firing more easily than before. We moved to the flattest available ground around station 2 and cast the boxcore at approximately 1,500 m. The boxcore fired successfully.

2,000 m station

Because we had no geochemistry boxcore (indeed no boxcore at all) from this site, we returned. A successful boxcore returned to deck shortly after midnight. The deeper penetration reflected the sediment seen on the ROV and suggested that the boxcore was working well.

Thursday 27th May 2010

1,000 m station

This station was on the edge of the spur between the two canyon systems. We cast a CTD followed by a boxcore. The boxcore failed to fire so we sent it back down. It fired on the second drop but only contained a handful of gravel. We concluded this was probably a reflection of the hard substrate and did not attempt a third drop. We decided to run the ROV in this position but waited until daylight to run the plankton nets. The plankton nets were run between 6 am and 7 am. The ROV was launched shortly after 9 am. The substrate was very hard with some *Lophelia*, mostly silted up. We collected some material with the suction hose, but this unfortunately blocked and we were forced to recover the vehicle to deck to retrieve it. On the second dive, we launched at the foot of a nearby wall, ran transects and collected up the wall. While collecting a large sponge at 1,290 m at 5.05 pm, a problem with the hydraulic arm caused the ROV to lose power. The ROV was hauled back to the TMS but on contact with the TMS the tether broke. The ROV was recovered to the stern deck at approximately 10 pm. It was clear that sheltered water was required to move the ROV from the stern to its side gantry. However, to minimize impact on the science programme, we used the night for science activities before heading to sheltered waters.

Friday 28th May 2010

Abyssal plain

The NUIG microbiologists and TCD geochemist both required samples from the abyssal plain, hence we cast a CTD and boxcore in 3,000 m before heading for Blacksod Bay in the early hours. Maintenance was carried out on the ROV during transit and by about 5 pm, the tether had been repaired and the ROV reunited with the TMS on the side gantry. We then headed back to the sample site arriving at approximately 1 am.

Saturday 29th May 2010

We ran a CTD and boxcore in approximately 2,400 m for the NUIG microbiologists and TCD geochemist.

2,900 m station

We then moved to our deepest ROV site: on a wall extending from 2,750 m to 2,900 m. We chose a site on the wall at approximately 2,800 m depth, close to the maximum operating depth of the ROV. We ran a CTD (registering a depth of 2,900 m) and ran the plankton net to 200 m and 600 m. The robotic arm needed repair and on subsequent testing it lost hydraulic fluid again, hence requiring further repair. There were also issues with the hi-def camera and we decided to dive without this working properly. The ROV was launched at 11:50 am local time returning to deck at approximately 8.30 pm.

We ran two zooplankton nets at the ROV recovery site. We did not run a CTD as we were extremely close to the launch site still. We moved to another deep-water site (2,900 m) in the bottom of the canyon for the NUIG microbiologists and TCD geochemists where we ran a CTD and a boxcore.

Sunday 30th May 2010

2,800 m station

We ran a CTD and two zooplankton nets (to 200 m and 600 m) and were on station for the CTD launch by breakfast. We delayed the launch while the ROV pilots attempted to get the hi-def camera working. We launched at approximately 11 am, but at about 500 m, the pilots notice the pan and tilt on the forward facing camera wasn't working, hence the ROV was recovered to deck and relaunched a few minutes later when the camera had been freed. We landed on soft bottom where we collected echinoderms before moving NE to the canyon wall. Like yesterday, this was a sheer cliff of clay. We slowly climbed the cliff, collecting chitons, sponges and anemones. On the softer silt at the top of the wall we collected more urchins. The ROV began ascent about 6pm, arriving on deck approximately 8pm. We ran two plankton nets (to 200 m and 600 m). UCC required no bottom water so we did not run a CTD.

We then moved back to the canyon entrance (at about 2,950 m) to run a CTD and a boxcore for the NUIG microbiologists and the TCD geochemist.

Monday 31st 2010

1,500 m station

We returned to the 1,500 m station to run a boxcore close to the foot of the wall we had dived with the ROV. This boxcore had failed previously. It failed again but the recast was successful.

1,000 m station
We returned to the wall close to the 1,000 m station to obtain a second location on this wall. We ran a boxcore. We also ran a CTD and two plankton nets (to 200 m and 600 m) and waited on station for the ROV to be ready to dive.

The ROV was launched at 8.45 am, but the GAPS system did not appear to be working properly so the ROV was recovered to deck shortly afterwards. It was relaunched almost immediately and was on the bottom in approximately 1300 m water depth at 9.50 am. We dived at the one site until mid-afternoon making extensive collections and running several transects. We surfaced because the suction hose was blocked, the ROV arriving on deck approximately 3.45 pm. In transpired that the robotic arm had failed again. The ROV was ready to relaunch by approximately 5.30 pm but by this time the forecast swell had arrived and was greater than the operational limits of the ROV. It was clear from the forecast that there would be no opportunity for further ROV dives, since to return to Galway on schedule, we would need to leave the canyon system inside 24 hours. Additionally, the swell was too great for the crew to handle the boxcore safely, hence we decided simply to complete our CTD stations (one of which had been missed when the tether on the ROV broke), and take a phytoplankton sample for other researchers at the Marine Institute.

These operations were completed late on Monday evening, after which we called a halt to scientific operations and headed for Galway.

Tuesday 1st June 2010
Once inside the Aran Islands, the water was calm. The depths here are just outside safe diving limits, hence we decided to launch the ROV to attempt to collect some additional sponge material. Despite strong currents, a small collection was made.

We entered Galway docks on Tuesday evening and completed demobilisation as planned on Wednesday.

Figure 1. Location of sampling sites as plotted in Google Earth.

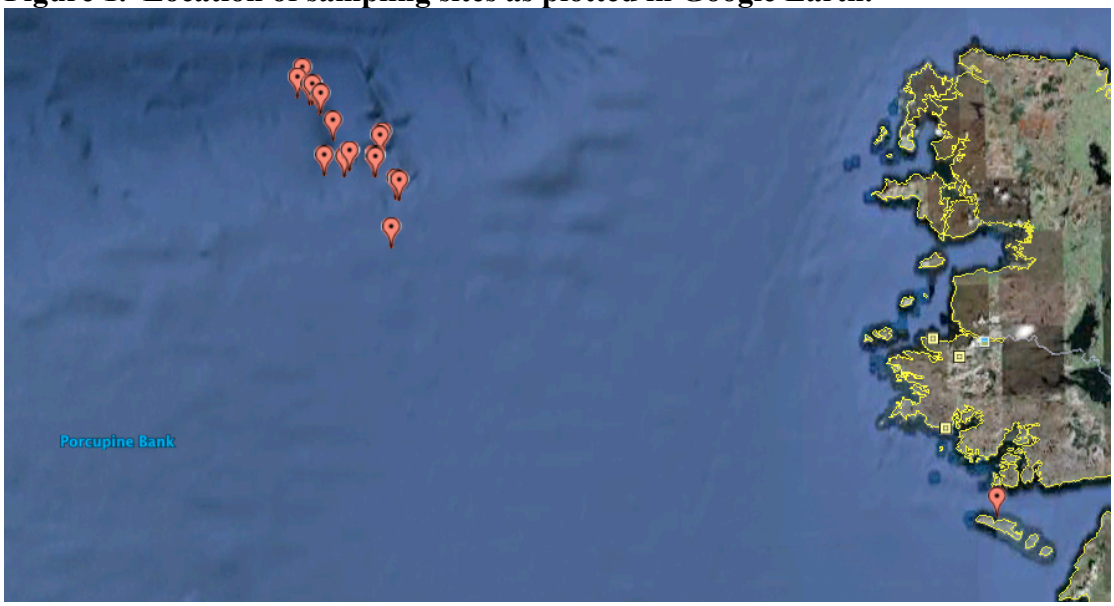

Table 1. Sampling events during cruise CE10004.

Event	Latitude (N)	Longitude (E)	Depth (m)	Date/Time	Gear
1	53.88	-12.34	390	24 May 02:18	CTD
2	53.88	-12.34	390	24 May 03:01	BOX CORE
3	53.88	-12.34	390	24 May 04:05	BOX CORE
4	54.01	-12.32	796	24 May 05:15	CTD
5	54.01	-12.32	796	24 May 05:50	BOX CORE
6	54.00	-12.31	748	24 May 06:56	CTD
7	54.00	-12.31	748	24 May 07:37	Plankton Net (0-200m)
8	54.00	-12.31	740	24 May 09:55	ROV
18	54.00	-12.31	740	24 May 11:54	Defined ROV transect
24	54.00	-12.31	800	24 May 15:19	BOX CORE
25	54.00	-12.31	739	24 May 18:07	ROV
26	54.00	-12.31	739	24 May 18:33	Defined ROV transect
27	54.00	-12.31	739	24 May 18:41	Defined ROV transect
28	54.00	-12.31	739	24 May 18:51	Defined ROV transect
29	54.00	-12.31	739	24 May 21:01	Defined ROV transect
30	54.00	-12.31	648	24 May 22:11	Plankton Net (0-200m)
32	54.06	-12.41	1528	25 May 00:56	CTD
33	54.06	-12.41	1528	24 May 01:43	BOX CORE
34	54.06	-12.42	1500	25 May 04:30	CTD
35	54.06	-12.42	1500	25 May 05:53	Plankton Net (0-200m)
36	54.06	-12.42	1500	25 May 06:15	Plankton Net (0-600m)
37	54.06	-12.42	1500	25 May 14:18	ROV
38	54.06	-12.42	1500	25 May 17:35	Defined ROV transect
39	54.06	-12.42	1500	25 May 18:09	Defined ROV transect
40	54.06	-12.42	1500	25 May 18:18	Defined ROV transect
41	54.06	-12.42	1323	25 May 21:21	Plankton Net (0-200m)
42	54.06	-12.42	1323	25 May 22:09	Plankton Net (0-600m)
43	54.06	-12.42	1323	25 May 23:11	CTD
44	54.06	-12.41	1330	26 May 00:12	BOX CORE
45	54.06	-12.41	1330	26 May 01:03	BOX CORE
46	54.06	-12.42	1430	26 May 01:59	BOX CORE
47	54.06	-12.42	1430	26 May 03:00	BOX CORE
48	54.11	-12.39	2070	26 May 03:30	CTD
49	54.11	-12.39	2070	26 May 05:00	BOX CORE
50	54.12	-12.38	2113	26 May 06:30	CTD
51	54.12	-12.38	2113	26 May 08:00	Plankton Net (0-200m)
52	54.12	-12.38	2113	26 May 08:30	ROV
53	54.12	-12.38	2113	26 May 09:40	Defined ROV transect
54	54.12	-12.38	2113	26 May 09:59	Defined ROV transect
55	54.12	-12.38	2113	26 May 10:50	Defined ROV transect
56	54.06	-12.41	1469	26 May 13:15	ROV
57	54.06	-12.41	1469	26 May 15:15	Defined ROV transect
58	54.06	-12.41	1469	26 May 15:55	Defined ROV transect
59	54.06	-12.41	1469	26 May 16:49	Defined ROV transect
60	54.06	-12.41	1305	26 May 18:00	Plankton Net (0-200m)
61	54.06	-12.41	1305	26 May 18:20	Plankton Net (0-600m)
62	54.06	-12.41	1305	26 May 19:05	CTD
63	54.06	-12.42	1557	26 May 21:33	BOX CORE
64	54.12	-12.39	2000	26 May 23:14	BOX CORE

65	54.07	-12.53	1087	27 May 01:00	CTD
66	54.07	-12.53	1087	27 May 01:40	BOX CORE
67	54.07	-12.53	1087	27 May 02:00	BOX CORE
68	54.07	-12.53	1087	27 May 05:00	Plankton Net (0-200m)
69	54.07	-12.53	1087	27 May 06:00	Plankton Net (0-600m)
70	54.07	-12.53	1130	27 May 08:10	ROV
71	54.07	-12.53	1130	27 May 09:01	Defined ROV transect
72	54.07	-12.53	1130	27 May 10:08	Defined ROV transect
73	54.07	-12.53	1130	27 May 10:23	Defined ROV transect
74	54.06	-12.55	1350	27 May 12:25	ROV
75	54.06	-12.55	1350	27 May 13:13	Defined ROV transect
76	54.06	-12.55	1350	27 May 14:05	Defined ROV transect
77	54.06	-12.55	1350	27 May 15:14	Defined ROV transect
78	54.28	-12.74	2964	28 May 01:00	CTD
79	54.28	-12.74	2964	28 May 03:00	BOX CORE
80	54.15	-12.60	2400	29 May 01:27	CTD
81	54.15	-12.60	2400	29 May 03:00	BOX CORE
82	54.24	-12.69	2800	29 May 05:30	CTD
83	54.24	-12.69	2800	29 May 05:45	Plankton Net (0-200m)
84	54.24	-12.69	2800	29 May 06:00	Plankton Net (0-600m)
85	54.24	-12.69	2800	29 May 10:50	ROV
86	54.24	-12.69	2800	29 May 14:50	Defined ROV transect
87	54.24	-12.69	2800	29 May 16:39	Defined ROV transect
88	54.24	-12.69	2800	29 May 17:03	Defined ROV transect
89	54.24	-12.69	2800	29 May 19:56	Plankton Net (0-200m)
90	54.24	-12.69	2800	29 May 20:41	Plankton Net (0-600m)
91	54.24	-12.71	2931	29 May 23:15	CTD
92	54.24	-12.71	2931	30 May 00:54	BOX CORE
93	54.22	-12.66	2815	30 May 03:00	CTD
94	54.22	-12.66	2815	30 May 05:00	Plankton Net (0-200m)
95	54.22	-12.66	2815	30 May 05:30	Plankton Net (0-600m)
96	54.22	-12.66	2815	30 May 09:50	ROV
97	54.22	-12.66	2815	30 May 11:58	Defined ROV transect
98	54.22	-12.66	2815	30 May 12:52	Defined ROV transect
99	54.22	-12.66	2815	30 May 13:15	Defined ROV transect
100	54.22	-12.66	2615	30 May 19:07	Plankton Net (0-200m)
101	54.22	-12.66	2615	30 May 20:01	Plankton Net (0-600m)
102	54.26	-12.76	3000	30 May 22:45	CTD
103	54.26	-12.76	3000	31 May 00:26	BOX CORE
104	54.06	-12.41	1330	31 May 04:40	BOX CORE
105	54.06	-12.55	1300	31 May 05:55	BOX CORE
106	54.06	-12.55	1300	31 May 06:55	CTD
107	54.06	-12.55	1300	31 May 07:15	Plankton Net (0-200m)
108	54.06	-12.55	1300	31 May 07:45	ROV
109	54.06	-12.55	1300	31 May 08:59	Defined ROV transect
110	54.06	-12.55	1300	31 May 10:53	Defined ROV transect
111	54.06	-12.55	1350	31 May 20:00	CTD
112	54.06	-12.55	1350	31 May 20:00	Phytoplankton net (25 microns)
113	53.19	-9.74	55	01 Jun 10:02	ROV

B4 Benefits, impact and contribution of the outputs to marine research and the marine sector in general.

Outline clearly the specific outcomes and benefits of the research survey.
The information provided in this section should not exceed 1/2 page (excluding tables and maps)

The benefits of the survey to marine research fall into three areas: identification of marine biodiversity, functional studies and material for biodiscovery. The identification of species fundamentally underpins all research in biodiscovery and ecosystem function. There is a reasonable expectation that taxonomic work following this cruise will lead to the identification of species new to science. The basis for the taxonomic work from the cruise is over 200 specimens preserved for morphological and genetic work, mostly focussed on sponges. Material retained as vouchers will allow taxonomic identities to be assigned to specimens used in biodiscovery work. The follow-up biodiscovery work will be carried out both in UCC and based on the collection in the Marine Biodiscovery laboratory in the Marine Institute. Sponge material at UCC will be used in functional metagenomics and microbial diversity analysis. This will produce genetic information informative about microbial community structure and with the potential to identify novel gene sequences coding for compounds with exploitable bioactivity. The 28 cryo-preserved specimens held for the Marine Biodiscovery Laboratory are available in sufficient biomass for repeated extractions and provide a resource for existing screening, future funding applications and collaborative research. Such a resource has not previously been available in Ireland.

Studies of ecosystem function complement the biodiversity and biodiscovery research as they help define processes affecting the biomass and provide information on links to other ecosystems for the species of the canyons. A total of 45 urchins were collected for stable isotope analysis, which will help identify the role that these species play in the ecosystem and whether this changes with depth and habitat (coral reef associated or not). Pore water extracted from the sediment will also be used to build a picture of the flows of nutrients and organic matter through the canyon ecosystem. This will be complemented by information on the abundance, diversity, and community structure of microbial species in the water column.

B5 Data

Provide a description of the data collected from the research survey, the usage of the data and how it will be stored.
The information provided in this section should not exceed 1/2 page (excluding tables and maps)

Station data and sample data have been stored in a custom-built database written in MySQL which is compatable with the Biodiscovery database. Hence all biological samples have a Biodiscovery Tracking Number. These data were curated by Helka Folch, the Biodiscovery database postdoc and Helka has onging responsibiity for these data.

The CTD data have been processed by Kieran Lyons (Marine Institute). The data are held by the Chief Scientist but the MI have a copy. The data are available to all cruise participants and will be used in a variety of ways.

The ACDP data have been passed to Martin White, oceanographer at NUIG. A copy is held by the Chief Scientist.

GAPS data have been processed to extract latitude, longitude and depth (one record per second) for ROV dives and are included (in processed form) in the station database. They are available to all researchers working with ROV video data.

Video data from the ROV cameras are available in their origial format but have also been converted to .avi files. A metadata catalogue of video data is being compiled and will be incorporated in the station database. The data are held by the Chief Scientist and are being made available to researchers on request. It is anticipated that students will analyse these data over the next two years.

Video from the HiDef camera has also been captured to disk. As for other video data, a metadata catalogue will be produced. The Chief Scientist is holding these data. A copy of all video data will be provided to the MI in due course.

B6 Contribution to marine research programmes

Outline specific National/EU/International research programmes this survey supported. Please include the funding sources for these programmes as well as the total amount of funding leveraged (Repeat the table below, if necessary).

National/EU/International Research programme(s):	National programme: Beaufort award in Marine Biodiscovery
Total Programme cost:	*€7.23m*
Value to Irish partners:	*€7.23m*
Project duration:	*7 years*
Contract no.:	
Project partners:	*NUI Galway, UCC, QUB*
Project web address:	*n/a*

The cruise specifically supported PhD students funded by the Beaufort project: Robert Phelan & Burkhardt Flemer at UCC, Carsten Wollf at NUIG and Christine Morrow at QUB, with material also supplied to Paul McEvilly at NUIG. The materials provided from the cruise will enhance the students' research theses and the experience for the students on the cruise forms valuable training in seagoing research and work in multidisciplinary teams.

The cruise did was aligned with the Census of Marine Life international initiative COMARGE. This increases the visibility of Irish deep sea research: the crusie was promoted on the comarge web site (http://www.ifremer.fr/comarge/en/index.html).

Appendices

Please number and attach any relevant Appendices here.

1. *Report from NUIG microbiology group (Dave McCarthy & Aileen Gill)*
2. *Report from Marine Biodiscovery laboratory (Caroline Cusak)*
3. *Report from UCC Biodiscovery group (Robert Phelan & Burkhardt Flemer)*
4. *Report from NUIG sponge group (Carsten Wolff)*
5. *Report from QUB sponge group (Christine Morrow)*
6. *Report from TCD biogeochemistry group (Robert Fitzpatrick)*
7. *Report from TCD biogeochemistry group (Angela Stevens)*
8. *Report from NUIG/UCC zooplankton groups and on adhesion research at NUIG (Niall McGinty)*

APPENDIX 1

Report from NUIG microbiology group

(Dave McCarthy & Aileen Gill)

Dave McCarthy & Aileen Gill
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School of Natural Sciences,
National University of Ireland, Galway.

Prokaryotic Community Structures

Prokaryotic assemblages are fundamental to the biogeochemical functioning of marine ecosystems. However, the general patterns of diversity, distribution, and dominance of functional and taxonomic groups of Bacteria and Archaea in the deep sea environment remain largely unknown. Furthermore, the extent of prokaryotic biodiversity is immense and is likely to contain many biological elements suitable for biotechnological exploitation.
Our contribution to this study will be to assess the abundance, diversity, and community structure of prokaryotic species in the water column at benthic stations along the canyon. This will be achieved primarily through the application of culture-independent nucleic acid based methods, augmented by complementary culture-based microbiological methods. Our studies will focus on numerically dominant species and on species that respond to nutrient enrichment in hyperbaric incubations. Prokaryotic abundance throughout the water column will be assessed by epifluorescent microscopy.
Enrichment incubations under in-situ temperature and pressure conditions will help to identify and characterise the active members of the prokaryotic community, along with isolating deep-sea microorganisms which will be screened for biotechnological potential.
Prokaryotic diversity and community structure in the water column will be examined by Denaturing Gradient Gel Electrophoresis (DGGE) of PCR-amplified 16S rRNA genes. This approach will also be applied to enrichment incubation communities, in order to track selective changes in population structure resulting from nutrient inputs.

A full list of samples collected for use by NUI-Galway is presented at the end of this report (Table 4).

METHODOLOGY

Harvesting Prokaryotic Biomass from Seawater

Bulk water samples (28 L) for DNA isolations were collected primarily from benthic (near bottom), mid-water column and shallow (150 m) depths by means of a CTD rosette. Seawater from a single depth was routinely collected from three Niskin bottles into pre-chilled (4 °C) food-grade plastic containers, rinsed thoroughly with 0.1 µm filtered seawater before collection of samples. Full containers were immediately transferred to a containerised temperature controlled laboratory (7 °C) for processing.

Microbial biomass was collected and concentrated by filtering 28 L volumes of seawater with 0.22 µm Sterivex filter cartridges (Millipore) and 0.1 µm Durapore® 47 mm filter membranes (Millipore), using Watson Marlow 205U peristaltic pumps (Figure 1). Samples were preserved as follows: for DNA analysis by the addition of lysozyme buffer and frozen at -20°C; for viable cell preservation by the addition of 40% glycerol in sterile seawater and frozen at -20°C. Total prokaryotic community DNA will be extracted from filter membranes using a modified protocol QIAGEN® DNA Mini Kit™ and used for PCR/DGGE analysis of community structure and biodiversity.

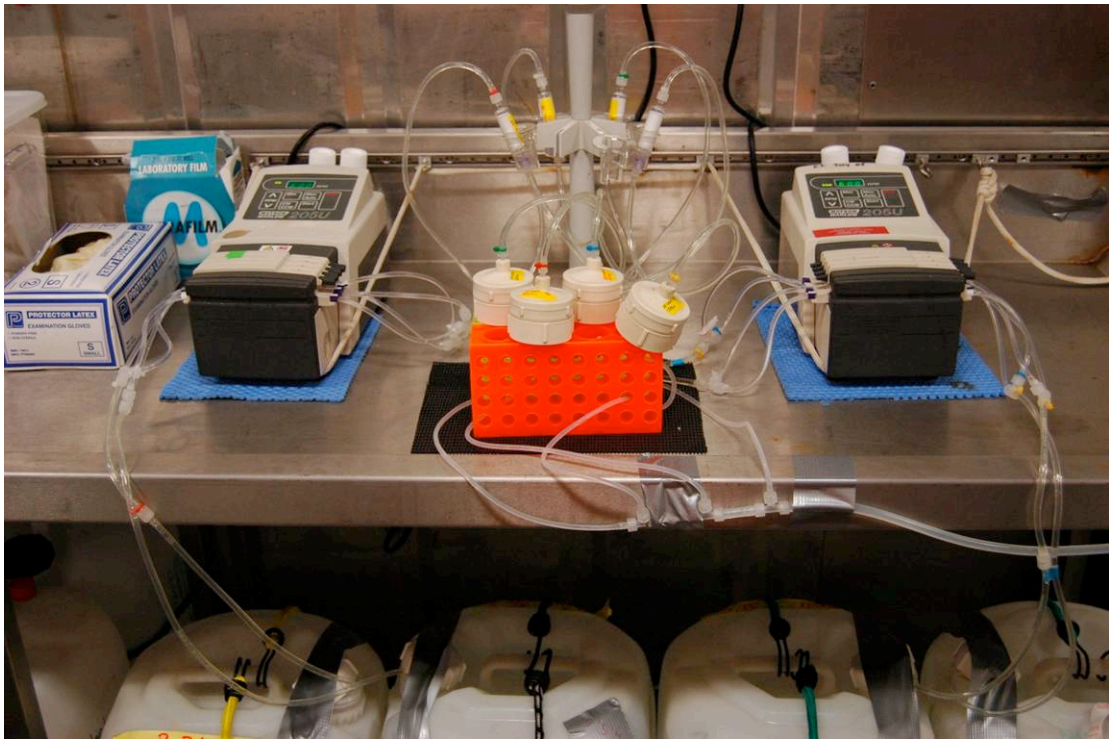

Figure 1. Filtering Apparatus for collection of Prokaryotic Biomass

Prokaryotic Abundance (Epifluorescence Microscopy)
Samples for prokaryotic abundance (50 ml) were taken from CTD casts; from depths ranging between 50 m and 3000 m. Samples were immediately fixed with the addition of 1% formalin (0.4% Formaldehyde final conc.) and stored at 4°C. These samples will analysed by epifluorescence microscopy.

FISH (Flourescent *in-situ* Hybridisation)

Flourescent *in situ* hybridisation is a microscopic imaging technique that uses fluorescently labelled DNA probes to bind to phylogenetically informative nucleic acid sequences within cells. It may also be possible to probe for the presence of specific functional genes in the population.

Samples were collected for FISH analysis from CTD casts as shown in the Table below. (Full Sampling Details Appendix 1).
Samples were processed by one or both of two methods:
Samples to be stored in RNA Later ® stabilising agent (Ambion Biosciences, UK) were collected from the CTD and stored at 2° C. Samples (typically 50mL in volume) were then filtered under vacuum onto 0.2 μm polycarbonate filters with a minimum of time delay. A drop of RNA Later® was added to the filter, and the filter was subsequently stored at -20 °C.

Samples to be fixed in formaldehyde were processed by adding Formalin (37%, Sigma) to samples to give a final concentration of 1% formaldehyde. These samples were then stored at either room temperature for approximately 1 hour or 2° C for up to 24 hours. Samples were then filtered under vacuum onto 0.2 μm polycarbonate filters and the filter stored at -20 °C .

Table 1. Preservation method(s) employed for FISH samples

	RNA Later ®	1% Formaldehyde
CE 10 004_01		4
CE 10 004_04		4
CE 10 004_32		4
CE 10 004_48		4
CE 10 004_50	4	
CE 10 004_65	4	4
CE 10 004_78	4	4
CE 10 004_80	4	4
CE 10 004_102	4	4

.

Hyperbaric Enrichment Incubations
Enrichment incubations of benthic and pelagic seawater samples were established with low concentrations of organic and inorganic substrates. Details of Incubated samples and incubation conditions are shown in Table 2. Details of substrate composition and concentrations are presented in Table 3.
Briefly, aliquots (200 ml) of seawater samples collected from the CTD were supplemented with various nutrients (details in table 3.) and sealed into sterile plastic incubation bags. Replicates were then incubated at ambient pressure (1 Atm) or in Pressure vessels at in-situ pressure, in the dark at 7 °C (see Figure 2.). The enrichments were incubated for the duration of the cruise, then removed to the microbiology department NUIG where prolonged low temperature incubations will continue until the end of June. After termination of the incubations and decompression of the pressurised samples prokaryotic biomass will be collected from the incubation bags by centrifugation and DNA extracted for the purposes of DGGE community structure analysis.

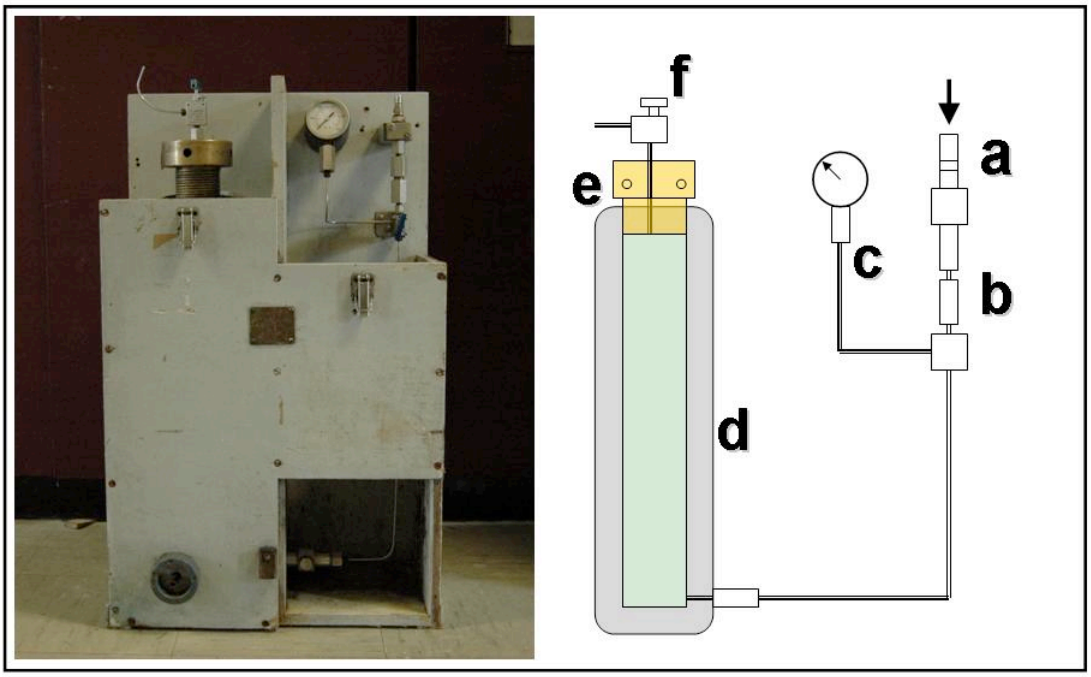

Figure 2. Hyperbaric Culture Vessels for Enrichment Incubations
(a) Hydraulic pump hose connector; (b) Non-return valves; (c) Pressure gauge; (d) Titanium cylinder; (e) Phosphor-bronze lid; (f) Bleed valve.

Table 2. Incubated Samples and Experimental Conditions.
Replicates of each sample were supplemented with nutrient formulas detailed in Table 2. A further control replicate was incubated under identical conditions without any supplementation.

Deployment	Sample Depth	Conditions
CE10004_32	1500 m (Benthic)	7°C ; 1 atm & 150 Bar
CE10004_78	1500 m (Pelagic)	7°C ; 1 atm & 150 Bar
CE10004_78	3000 m (Benthic)	7°C ; 1 atm & 300 Bar

Table 3. Nutrient Supplements and Concentrations.

Supplement	Formula	Final conc.
Organics	Peptone Yeast Extract N-acetyl-D-Glucosamine	25 µg ml^{-1} 5 µg ml^{-1} 12.5 µg ml^{-1}
Inorganics	$NaHCO_3$ Na_2HPO_4 $(NH_4)_2SO_4$	320 µg ml^{-1} 16 µg ml^{-1} 3.2 µg ml^{-1}
No Supplement	n/a	n/a

Table 4. CTD Log including Full List of Samples Collected by NUI Galway.
FISH: Fluorescent in-situ Hybridisation; TC: total count, prokaryotic abundance; INC: Enrichment incubations; DNA: fixed for community genomic DNA extraction; GLYC: Fixed for viable culture isolations.

CE10004
Biodiscovery

Depl. 1
Date 24/05/10
Time 03:45
Lat 53°52.870
Lon 12°20.277
depth 390m

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	Btm	10mab	Fish, TC	**13**		surf	
2	Btm	10mab		**14**			
3	Btm	10mab		**15**			
4	Btm	10mab		**16**			
5	Btm	10mab		**17**			
6	150		Fish, TC	**18**			
7	150			**19**			
8	150			**20**			
9	50		Fish, TC	**21**			
10	50			**22**			
11	50			**23**			
12	surf			**24**			

General Comments:

FISH filtered onto 0.2, all stations

Depl. 4
Date 24/05/10
Time 06:15
Lat 54°00.35
Lon 12°19.37
depth 796

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM	10mab		**13**			
2	BTM	10mab		**14**			
3	BTM	10mab		**15**			
4	BTM	10mab	DNA, Fish, TC	**16**			
5	BTM	10mab	DNA	**17**			
6	BTM	10mab	DNA	**18**			
7	150		DNA, Fish, TC	**19**			
8	150			**20**			
9				**21**			
10				**22**			
11				**23**			
12				**24**			

General Comments:

Depl. 6
Date 24/05/10
Time 08:00
Lat 54°00.08
Lon 12°18.59
depth 760

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM	10mab		**13**			
2	BTM	10mab		**14**			
3	BTM	10mab		**15**			
4	BTM	10mab		**16**			
5	BTM	10mab		**17**			
6	BTM	10mab		**18**			
7				**19**			
8				**20**			
9				**21**			
10				**22**			
11				**23**			
12				**24**			

General Comments:

Depl. 32
Date 25/05/10
Time 00:58
Lat 54°03.578
Lon 12°24.717
depth 1520

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM	10mab	Inc	**13**	1400	TC	
2	BTM	10mab	Glyc	**14**	1000	DNA	
3	BTM	10mab	Glyc	**15**	1000	DNA	
4	BTM	10mab	Glyc	**16**	1000	DNA	
5	BTM	10mab	DNA	**17**	1000	TC, FISH	
6	BTM	10mab	DNA	**18**	500	DNA	
7	BTM	10mab	DNA	**19**	500	DNA	
8	BTM	10mab	TC, Fish	**20**	500	DNA	
9	BTM	10mab		**21**	500	TC, FISH	
10	BTM	10mab		**22**	250	TC	
11	BTM	10mab		**23**	100	TC	
12	1450		TC	**24**	50	TC	

General Comments:

Depl.	34	
Date	25/05/10	
Time	05:35	
Lat	54°03.780	
Lon	12°24.980	
	1440	
depth	(1560)	1560db (10mab)

Bottle	**Depth**	**comment**	**other**	**Bottle**	**Depth**	**comment**	**other**
1	BTM	10mab	TC	**13**			
2	BTM	10mab		**14**			
3	BTM	10mab		**15**			
4	BTM	10mab		**16**			
5	BTM	10mab		**17**			
6	BTM	10mab		**18**			
7	1540	30mab	TC	**19**			
8	1490	70mab	TC	**20**			
9	1390	170mab	TC	**21**			
10				**22**			
11				**23**			
12				**24**			

General Comments:

Bridge gave depth 1440m, CTD pressure sensor gave 1560 db

Depl.	43	
Date	25/05/10	
Time	23:00	
Lat	54°03.883	
Lon	12°24.745	
depth	1350	1366db (10mab)

Bottle	**Depth**	**comment**	**other**	**Bottle**	**Depth**	**comment**	**other**
1	Btm	10mab		**13**			
2	Btm	10mab		**14**			
3	Btm	10mab		**15**			
4	Btm	10mab		**16**			
5	Btm	10mab		**17**			
6	Btm	10mab		**18**			
7				**19**			
8				**20**			
9				**21**			
10				**22**			
11				**23**			
12				**24**			

General Comments:

1366 db by CTD

Depl. 48

Date 26/05/10
Time
Lat 54°06.860
Lon 12°23.59
depth 2023m 2070db (bottom)

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM	10mab		**13**	1200	Glyc	
2	BTM	10mab	Glyc	**14**	1200	Glyc	
3	BTM	10mab	Glyc	**15**	1200	Glyc	
4	BTM	10mab	Glyc	**16**	1200	DNA	
5	BTM	10mab	DNA	**17**	1200	DNA	
6	BTM	10mab	DNA	**18**	1200	DNA	
7	BTM	10mab	DNA	**19**	1200	TC, FISH	
8	BTM	10mab	TC, Fish	**20**	1000	TC	
9	BTM	10mab		**21**	1500	TC	
10	BTM	10mab		**22**	150	TC	
11	BTM	10mab		**23**			
12	1500m		TC	**24**			

General Comments:

Sal & O2 data noisy/spiky from 100-200m on descent. CTD bottom alarm failed -came to rest on bottom, CTD: 2070 db. Sterivex burst (presumed back pressure)

Depl. 50
Date 26/05/10
Time 07:30
Lat 54°07.383
Lon 12°22.964
depth 2130

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM	10mab	FISH	**13**	150		
2	BTM	10mab		**14**	150		
3	BTM	10mab		**15**	150		
4	BTM	10mab		**16**	150		
5	BTM	10mab		**17**		FISH	
6	BTM	10mab		**18**			
7	BTM	10mab		**19**			
8	BTM	10mab		**20**			
9	150			**21**			
10	150			**22**			
11	150			**23**			
12	150			**24**			

General Comments:

Depl. 62

Date 26/05/10
Time 20:15
Lat 54°03.798
Lon 12°24.680
depth 1307 1395db

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM	10mab		**13**			
2	BTM	10mab		**14**			
3	BTM	10mab		**15**			
4	BTM	10mab		**16**			
5	BTM	10mab		**17**			
6	BTM	10mab		**18**			
7	1000			**19**			
8	1000			**20**			
9	1000			**21**			
10	150			**22**			
11	150			**23**			
12				**24**			

General Comments:

Depl. 65
Date 27/05/10
Time 00:00
Lat 54°04.437
Lon 12°31.505
depth 1115m 1122db (bottom)

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM	c. 5mab	DNA	**13**	500	DNA	
2	BTM	5mab	DNA	**14**	500	DNA	
3	BTM	5mab	DNA	**15**	500	DNA	
4	BTM	5mab	Glyc	**16**	500	Glyc	
5	BTM	5mab	Glyc	**17**	500	Glyc	
6	BTM	5mab	Glyc	**18**	500	Glyc	
7	BTM	5mab	TC, FISH	**19**	500	TC FISH	
8	BTM	5mab		**20**	500		
9	BTM+10	15mab	TC,	**21**	150	TC FISH	
10	BTM+20	25mab	TC	**22**	150		
11	1000		TC	**23**	150		
12	1000			**24**	50	TC	

General Comments:

O2 & Sal readings very noisy 60-200m on descent. Alarm failed -touched bottom 1122db. Bottom bottles fired @5mab. Ran filtering without 0.1 to see if STVX burst -they didn't

Depl. 78

Date 28/05/10
Time 00:12
Lat 54°17.039
Lon 12°44.368
depth 2964 2999db (10mab)

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM	10mab	Inc	**13**	1500	inc, FISH	
2	BTM	10mab	DNA	**14**	1500	Glyc	
3	BTM	10mab	DNA	**15**	1500	Glyc	
4	BTM	10mab	DNA	**16**	1500	Glyc	
5	BTM	10mab	Glyc	**17**	1500	DNA	
6	BTM	10mab	Glyc	**18**	1500	DNA	
7	BTM	10mab	Glyc	**19**	1490	DNA	
8	BTM	10mab	TC, FISH	**20**	1490	TC	
9	2950	30mab	TC	**21**	900	TC	
10	2920	50mab	TC	**22**	600	TC	
11	2500		TC	**23**	300	TC	
12	2000		TC	**24**	150	TC, FISH	

General Comments:

10mab =2970 cable out=2999db used 0.1 filters in-line, but at reduced pump speed =60rpm. no burst -except glycerol BTM ruptured being syringed.

Depl. 80
Date 029/05/2010
Time 01:00
Lat 54°09.042
Lon 12°36.003
depth 2400 db

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM		TC, FISH	**13**	2366	40mab	
2	BTM			**14**	2200		TC
3	BTM		DNA (28L)	**15**	1800		TC
4	BTM		DNA	**16**	1500	28L	DNA,TC, FISH
5	BTM		DNA	**17**	1500		DNA
6	BTM		Glyc (28L)	**18**	1500		DNA
7	BTM		Glyc	**19**	1500		
8	BTM		Glyc	**20**	1200		TC
9	2386	20mab	TC	**21**	1000		TC
10	2366	40mab	DNA, TC (28L)	**22**	750		TC
11	2366	40mab	DNA	**23**	500		TC
12	2366	40mab	DNA	**24**	150		TC, FISH

General Comments:

BTM (10mab) = 2431db, 2406m cable out. Bottle 2 failed to close.

Depl. 82

Date	29/05/10		
Time	04:30		
Lat	54°14.519		
Lon	12°41.640		
depth	2760	2944db	2910 cable out

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM			**13**			
2	BTM			**14**			
3	BTM			**15**			
4	BTM			**16**			
5	BTM			**17**			
6	BTM			**18**			
7	BTM			**19**			
8	BTM			**20**			
9				**21**			
10				**22**			
11				**23**			
12				**24**			

General Comments:

BTM (10mab) = 2944db, 2910m cable out

Depl.	91		
Date	29/05/10		
Time	22:25		
Lat	54°14.481		
Lon	12°42.399		
depth	2927m	2966db	2935 cable out

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM			**13**	2925	20mab	
2	BTM			**14**	2900	45mab	
3	BTM			**15**	1500		
4	BTM			**16**	1000		
5	BTM			**17**	500		
6	BTM			**18**	200		
7	BTM			**19**	100		
8	BTM			**20**	50		
9	BTM			**21**			
10	BTM			**22**			
11	BTM			**23**			
12	BTM			**24**			

General Comments:

2935 cable out, 2966db

Depl. 93

Date 30/05/10
Time 02:22
Lat 54°13.028
Lon 12°39.663
depth 2795 2800db 2790 cable out

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM			**13**			
2	BTM			**14**			
3	BTM			**15**			
4	BTM			**16**			
5	BTM			**17**			
6	BTM		TC	**18**			
7	2780	20mab	TC	**19**			
8	2760	40mab	TC	**20**			
9				**21**			
10				**22**			
11				**23**			
12				**24**			

General Comments:

BTM (10mab) =2790m cable out

Depl. 102
Date 30/05/10
Time 21:50
Lat 54°15.545
Lon 12°45.583
depth 2965 db

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM		Gly (28L)	**13**	2940	40mab	TC, FISH
2	BTM		Gly	**14**	2880	100mab	TC, FISH
3	BTM		Gly	**15**	2780	200mab	TC
4	BTM			**16**	2500		TC, FISH
5	BTM		TC, FISH	**17**	2000		TC, FISH
6	BTM			**18**	1200		
7	BTM			**19**	1200		
8	BTM			**20**	1200		
9	BTM		DNA (28L)	**21**	1200		TC, FISH
10	BTM		DNA	**22**	1000		TC, FISH
11	BTM	10mab	DNA, TC	**23**	500		TC, FISH
12	2960	20mab	TC	**24**	150		TC, FISH

General Comments:

BTM (10mab) = 2971 cable out, 3003db.

Depl. 106

Date	31/05/10		
Time	06:56		
Lat	54°03.680		
Lon	12°33.102		
depth	1275	1362db	1352 cable out

Bottle	Depth	comment	other	Bottle	Depth	comment	other
1	BTM			**13**			
2	BTM			**14**			
3	BTM			**15**			
4	BTM			**16**			
5	BTM			**17**			
6	BTM			**18**			
7				**19**			
8				**20**			
9				**21**			
10				**22**			
11				**23**			
12				**24**			

General Comments:

BTM(10mab) =1352 cable out, 1362db

Depl.	111		
Date	31/05/10		
Time	20:10		
Lat	54°03.486		
Lon	12°32.891		
depth	1350	1363db	1352 cable out

Bottle	**Depth**	**comment**	**other**	**Bottle**	**Depth**	**comment**	**other**
1	BTM			**13**			
2	BTM			**14**			
3	BTM			**15**			
4	BTM			**16**			
5	BTM			**17**			
6	BTM			**18**			
7	43m			**19**			
8	Surf.			**20**			
9				**21**			
10				**22**			
11				**23**			
12				**24**			

General Comments:

BTM(10mab) =1352 cable out, 1363db

APPENDIX 2

Report from Marine Biodiscovery laboratory

(Caroline Cusak)

Objective:
The primary purpose of the survey for the MI biodiscovery laboratory was to collect deep water biotic samples in collaboration with taxonomists for the Beaufort Marine Biodiscovery Project.

Sampling Method:

Samples were collected during daylight employing the ROV. Samples for the purpose of culturing phytoplankton were collected at the last station of the survey using a conventional CTD (2 x Calibrated SBE911), in-situ fluorometer, oxygen probe integrated to the CTD console and rosette sampling equipment. Depths selected were based on the vertical profile of relative fluorescence. A live phytoplankton sample was also taken via a vertical net haul (with mesh size of 25 μm).

Sample Processing Steps:
When the samples arrived on deck the following steps were followed:

1. A taxonomic voucher was taken by project partners with expertise in this area. The biotic sample was given a biodiscovery database number, photographed and then fixed in 100% ethanol.
2. Any remaining sample was weighed and divided between the other partners (MI/NUIG and UCC). These biodiscovery samples were placed in plastic zip lock bags and stored at - 80˚C.
3. The details of all samples collected were logged and stored in an electronic database. The survey samples collected with regard to the MI/NUIG biodiscovery element are listed in Table 1.

Table 1. Samples collected during survey CE10004 to be processed in the MI biodiscovery laboratory. These samples will be screened for potential bioactives.

Sample No.	Weight (g)	Description
79.1	-	Sea Fan
81	278	Urchins
87	28	Purple Starfish
98.1	-	White sponge with some orange flecks
100.2	-	Dead sponge
126.3	-	Sponge
129.2	140	Brown fuzzy sponge
137.2	580	Lophelia-coral
142.1	-	Urchin - Hard test
146.2	-	Arm of sea star burnt orange
150.2	-	Cho-ascidian
188.3	100	Large white cream sponge. Soft cream fan shaped sponge.
190.2	130	Ascidian dark colour
192.2	100	Urchin. Echinus species?
199.2	-	Pink soft coral
200.3	-	A pink soft coral slightly thinner and spindlier than 199.
201.2	-	Lophelia coral
202.2	-	Massive brittlestar
205.2	-	Stylaster Branced white Hydrozoan
206.3	-	Sediment sample forminifera and humic substances that settled on sediment surface
211.2	-	Brittle star
213.2	30	White Sea anemone
217.2	-	Hydrozoan pale pink
221.2	-	Galathea
222.2	-	Small sea cucumber
223.2	-	Sea starfish. Legs broken off. Orange colour
230.3	100	Bearded sponge
232.3	-	Small pink-orange sea cucumbers
233.2	-	A load of muck- with the possibility of extracting worms

APPENDIX 3

Report from UCC Biodiscovery group

(Robert Phelan & Burkhardt Flemer)

Our objectives for this cruise were to collect deep sea samples of marine sponges of different species for research in U.C.C. for the coming years. We had set out to culture 6 different sponge samples onboard during the ten day cruise. This would allow us to observe the bacterial population present in fresh samples before freezing. We also wished to collect water samples to use as controls, these would be taken from as close as possible from the site where the ROV was collecting material.

Another objective was to collect sponge samples for chemical extraction. These samples would be frozen and processed in UCC. Our main objective was to collect as many different types and species of sponges from various depths, and also to collect as much of each sponge as was possible once they were shared between all parties first. These frozen samples would be useful for functional metagenomics and microbial diversity analysis.

As an aside we were also looking to collect other samples for fixing and following this using them for fluorescent microscopy. All of the above were our general objectives, however we were also interested in collecting other samples that may be useful from a bio-discovery point of view.

Overall we achieved all of our objectives over and above what was needed. We were very happy with the sampling and the amounts we got.

APPENDIX 4

Report from NUIG sponge group

(Carsten Wolff)

Aims:
Carsten participated to assist in the acquisition and field-processing of marine invertebrate specimens for the Beaufort biodiscovery collection
Further specimens of insufficient biomass and thus lower priority to the collection were to be collected in order to establish deep-water biodiversity records for further systematics research. Specimens not retained by Christine Morrow, QUB, were to be given MIIG sample numbers in addition to the Beaufort numbers and provided to Dr Grace McCormack, NUIG, for possible later identification.
He was also to opportunistically collect dictyoceratid sponge specimens for molecular systematics work as part of his PhD studies. These specimens were also to be given corresponding MIIG sample numbers.

Summary:
73 marine invertebrates, collected on 17 events, of a total of about 170 new Beaufort biodiscovery specimens were recorded with MIIG numbers and are kept under ethanol in specimen jars. 5 of these are also cryo-preserved for identification to facilitate molecular systematics analysis.
25 biopsies from 4 events, of preliminarily identified dictyoceratid sponges are retained for molecular systematics as part of Carsten's studies. All of these are stored in cryo-vials for DNA work only, as the specimens found were very small and thus less suitable to provide good morphological vouchers.

APPENDIX 5

Report from QUB sponge group

(Christine Morrow)

I am in the second year of my PhD which is an investigation of the morphology and molecular systematics of sponges in Ireland. My primary objective on this cruise was to collect representatives of deep water species from Irish waters. After initial identifications the specimens will then have the DNA extracted and the appropriate DNA sequenced for phylogenetic analysis. Any species new to science will be described.

The second objective was to keep a voucher a collection of the specimens collected for biodiscovery . The voucher specimens were preserved either in 96% ethanol or 10% seawater-formalin with a subsample preserved in ethanol for taxonomic identification and molecular systematics.

The voucher collection contains 144 specimens. The majority of the collection is sponges which will be identified by me. The remaining groups will be sent to taxonomic experts for the particular group.

APPENDIX 6

Report from TCD biogeochemistry group

(Robert Fitzpatrick)

Embedded into CE10004 was a research project to attempt to model the dynamics of organic matter mineralization in the North Atlantic Ocean off the West Coast of Ireland. Biogeochemical process occurring at the benthic boundary layer consume organic matter and the labile component of organic matter should be depleted relative to refractory matter with increasing advection away from the input source and depth of the overlying water column. Fluorescence spectroscopy will be used to determine the provenance of biogenic material deposited along the ocean margin. The dynamics of mineralization and organic matter recycling as a function of bathymetry will also be investigated. Determination of the nature and dynamics including carbon burial rates of potential anthropogenic organic inputs will provide additional information of the sink capacity of oceans to react to climatic change.

Pore water was extracted from sample cores taken along a transect from the Irish Shelf into the Porcupine Abyssal Plain. Sediment samples were collected at different water depths using a box corer. Sub-cores were taken from the box core and these were sectioned into smaller slices depending on the length of core successfully extracted. Pore water was extracted through a 0.1 μm filter under vacuum. A sample of sediment prior to extraction was retained for nutrient analysis and porosity determination. Water samples taken using CTD were preserved for chemical analysis.

A major difficulty encountered during sampling was the failure of the box corer to recover samples suitable for sectioning. The corer used depends on gravity to impact into the seabed and the depth of penetration is largely determined by the texture of the substrate. Unfortunately, on a number of casts, the corer failed to penetrate sufficiently into hard sediments producing shallow cores e.g. less than 10cm of useable core. The physical dimensions of the corer also meant that it was sometimes difficult to recover intact sub-cores. In addition, whilst the box corer recovered a large volume of sea water, retained sediment was continuously "washed" by overlying water as it is returned to the surface. Despite these difficulties, it is anticipated that extracted pore water will provide a suitable material on which to test fluorescence spectroscopy as valid technique for the characterisation of the provenance of sedimentary organic material. In addition, the water samples taken using CTD will be analysed for labile/refractory organic matter along with nitrogen species.

APPENDIX 7

Report from TCD biogeochemistry group

(Angela Stevens)

Sea urchins may play an important role in carbon cycling of locally produced material within deep-sea habitats such as coral reefs. The first step in understanding their importance in material cycling at depth is to determine the carbon resources used by deep-sea urchins. More specifically, sea urchins found in sites containing coral are likely to consume material originating from marine snow, but also local production of material such as shells, sponge spicules and decaying organic material, which tend to coincide with coral reefs. On the other hand, sites devoid of coral are likely to possess material mostly originating from marine "snow" since these sites are rather barren compared to deep-sea coral reefs.

In this study, I will use stable isotopes of carbon and nitrogen to determine whether autochthonous material is an important nutritional source for sea urchins residing in deep-sea coral reef habitats. If sea urchins are indeed recycling locally produced material, then the isotopic composition of sea urchin tissues will reflect the δ13C isotopic signature of autochthonous material rather than allochthonous material.

Sea urchins from various depths (ranging between 740-2815) were collected with a mechanical arm and suction tube. Although this was not an ideal method, it was necessary for collections within coral reef habitats. My hypothesis can be tested quite nicely with the material obtained from the cruise since 45 urchins (5 different species) were collected from four sites with coral and four sites devoid of coral. There were 15 urchins collected from coral rich sites and 30 urchins from sites devoid of coral (including one trawl site that had dead coral only).

Sea urchins were dissected on board upon retrieval from the ROV. Gonads, test and gut contents were removed and stored separately in the -80C freezer. Gonads and test will undergo isotope analyses at TCD and gut contents will undergo TOC, TON, C:N analyses and also gut content analyses to supplement the isotope analyses.

APPENDIX 8

Report from NUIG/UCC zooplankton groups

and on adhesion research at NUIG

(Niall McGinty)

Vertical plankton net hauls:
Two vertical net hauls was performed at each ROV station both prior to and immediately after the deployment of the ROV. A WP-2 net was used which has a mesh size of 200µm and a net aperture of .25cm^2. Volume filtered was calculated by means of a back stop flow meter. The hauls were towed vertically from two depths, from both 200m and 600m. And they were deployed in quick succession. The purpose of the net hauls was to collect any gelatinous zooplankton which were present in the water column, in particular *Pelagia noctiluca.* This species has been found along the shelf edge, north of the Porcupine Bank over previous years but the precise timing of these blooms are not yet known. These net deployments were used in conjunction with a downward facing camera placed on the ROV, with the nets providing a means of ground truthing the video footage.

Cirripede collection:
As part of the ROV collection there were four specimens of deep sea cirripede brought to the surface. These were fixed and stored in 100% ethanol solution. These collections will provide samples for two PhD students working at NUI Galway who are looking into protein adhesion and bioadhesives of barnacles.