Species diversity along the Celtic Margin Canyon systems. June 2013

Dr. Louise Allcock, Felim O'Toole, Sorcha Cronin O'Reilly
School of Natural Sciences, Ryan Institute, NUI Galway, University Road, Galway, Ireland

Introduction

Cruise 13008 on board the R.V Celtic Explorer provided us with the opportunity to sample and observe benthic species for use in genetic studies and community structure analysis respectively.

Sixteen dives were executed in two canyon systems of Ireland's continental slope. The Holland 1 ROV ascended canyon branches sampling sediment, rocks and macrofauna with constant high definition video and photography In operation.

Holland 1

Holland 1 is a scientific deep water ROV system designed for deployment from the RV Celtic Explorer.

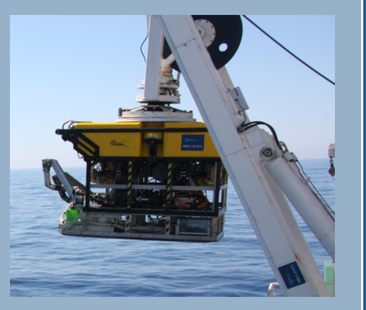
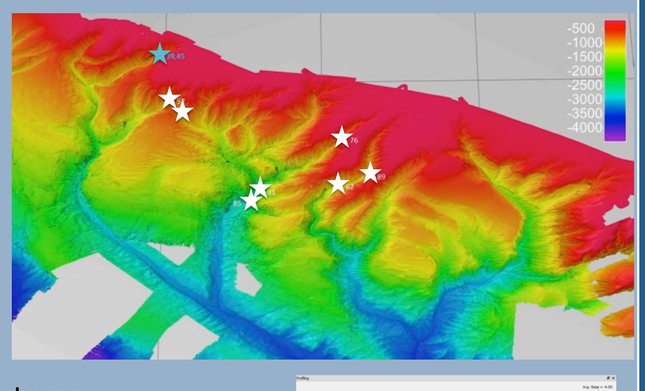


Fig 1: Holland 1 ROV

The quasar work class hydraulic ROV has a tether management system, an A-Frame launch and recovery system with a winch of 3000 meters. Dives during the CE13008 expedition operated at depths between 400 and 2700 meters.

Fledermaus

Using the 3D visualization ocean mapping software Fledermaus, bathymetric representations were created of the topography of both canyon systems.



This depiction of the canyon systems enabled more targeted dive sites to be selected. Slope profiles of different transects along the canyons were generated with aligning GPS coordinates. Varying slope areas from gradual inclines to vertical walls were chosen.

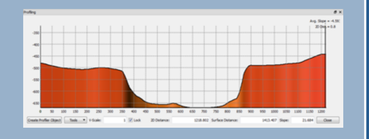
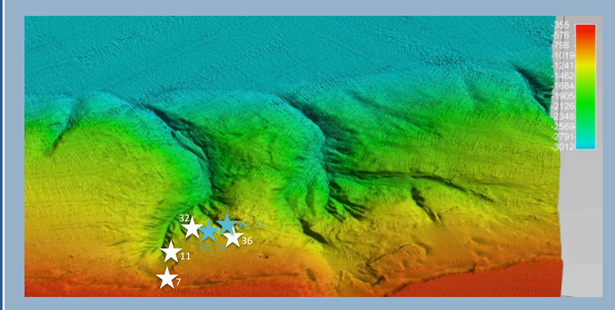


Fig 2: Fledermaus map of Whittard Canyon system.
Fig 3: Slope profile of two opposite walls dived during events 39 & 45 reaching 666 meters



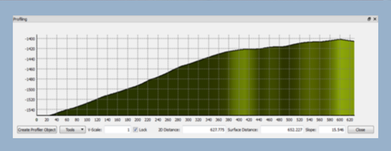


Fig 4: Fledermaus map of the north canyon system
Fig 5: Slope profile of dive event 32 reaching depths of 1579 meters

Fig 6: Map of Ireland showing the two canyon systems sampled

Methods

Cameras: A high definition video and still camera are fitted to the Holland 1 as well as several other angled cameras used in piloting the vehicle. Visibility ranged from one meter to over ten meters depending on marine snow and sediment clouds.

Sampling devices: Three (ROV) operators each controlled either flight, the manipulator arm or the suction arm. A chief zoologist and an assistant were at hand to select items for collection and direct flight route. Samples were deposited in containers, some of which were retractable for safe storage.

Fig 9 & 10 (left) : ROV digital stills taken during sampling operations

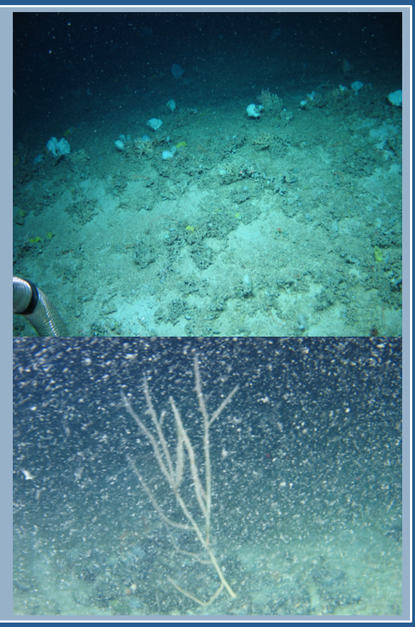
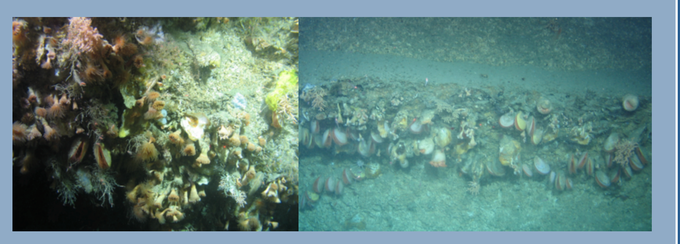


Fig 7 & 8 (right) : ROV digital stills varying in visibility measures

Diversity Conclusions

The diversity of epifauna was seen to be highest on the irregularities in substrates of both flat and steep slopes. Dead coral, boulders and protrusions in cliff strata yielded among the most complex and healthy communities.



A huge variety of sessile specimens spanning a broad range of taxa was most easily collected. Many species were apparently randomly dispersed while more often communities gathered in high numbers around complex structures such as coral. An apparent correlation between epifaunal diversity and the substrate's spatial heterogeneity exists. Through genetic work and video analysis the true diversity and community structures can be more definitively determined.

Fig 12: A collage of biodiscovery sample photographs illustrating the high diversity found in Echinodermata species

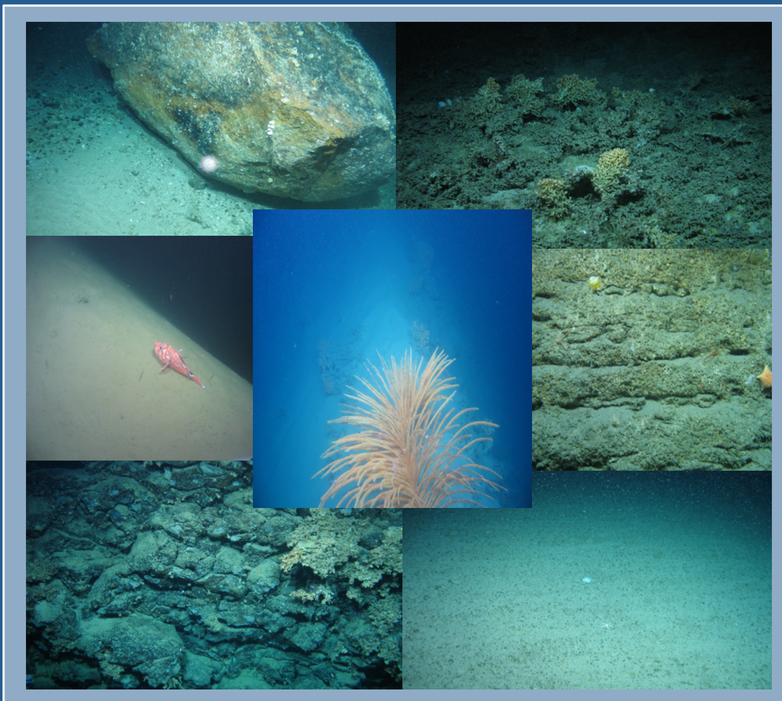


Fig 11: A collage of photos taken during CE13008 depicting the different array of substrates present ranging from sand dune structures to vertically stratified walls

Environmental Diversity

A large variety of benthic substrate was observed during the expedition in both canyon systems.

Flat canyon floors varied in composition from cold-water coral rubble to soft featureless silt.

Steep sections of the canyon were composed of uniform dune-like sediment hills in some areas, and uneven debris littered slopes in others. Cliffs encountered had differing degrees of overhangs, strata width and varying texture.

Boulders were a common sight on both sloped and flat terrain. Environmental heterogeneity ranged from stark sediment bottoms to highly diverse and spatially complex cold-coral reef systems composed of many taxa.

Discussion

The footage and photographs collected from the Holland 1 cameras provide a valuable platform to develop a study in deep-sea community ecology. The highly successful dives wielding over a hundred hours of HD recording allows the complexity of species relationships to be analysed.

Sampling has yielded many epifaunal species including mobile species such as fish. Fauna are currently being sent to taxonomic experts for detailed investigations. Possibilities for genetic studies are numerous due to the large numbers of intact species recovered and preserved over the 16 dives. An initial programme of DNA barcoding will identify groups of potential further genetic interest.

RV Explorer Cruise 13008 had an oceanographic component as well as a biological component. Analyses of these complimentary datasets should help us understand the marked spatial heterogeneity noted amongs the arms of the canyon systems.

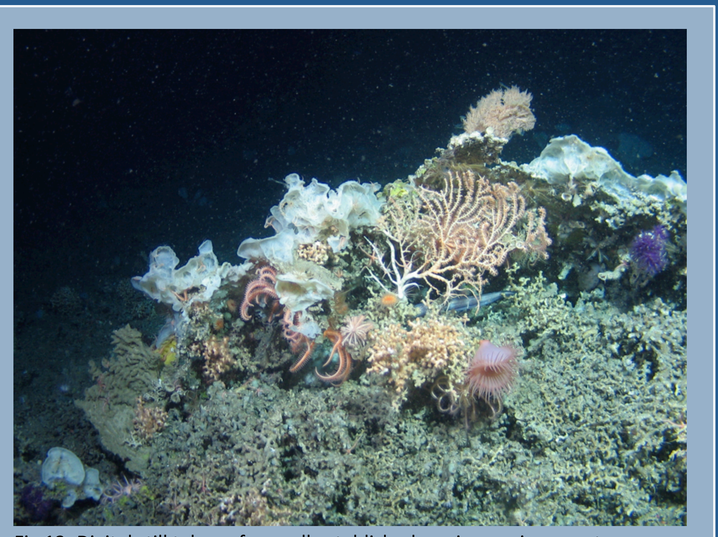


Fig 13: Digital still taken of a small established marine environment structurally supported by a dead sea fan

Acknowledgements

This research survey was carried out under the *Sea Change* strategy with the support of the Marine Institute and the Marine Research Sub-programme of the National Development Plan 2007–2013.
Felim O'Toole and Sorcha Cronin O'Reilly are undergraduates on the NUI Galway Marine Science pathway.