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Industry helps science drill for knowledge

A collaboration between Southampton Oceanography Centre, Subsea 7, Transocean and BP is helping to further our understanding of the deep-sea environment. Daniel Jones and Ian Hudson report.

BP's Schiehallion and Foinaven oil fields, situated in water depths of 400 to 600 metres 190 miles west of the Shetland Isles, are two of the most technologically demanding offshore drilling projects within the UK oil and gas industry. Drilling wells in more than 500 metres of water in changeable currents and large swells is problematic, especially as this is well beyond the depths at which divers can operate.

Operations rely heavily on ROV support, which is provided – as is the case for many west of Shetland operations – by Subsea 7. A comprehensive drilling programme for BP is being undertaken in the area over the next several years by a fleet of drilling platforms operated by Transocean.

As part of the SERPENT (Scientific and Environmental ROV Partnership using Existing iNdustrial Technology) project, a collaboration between the UK's Southampton Oceanography Centre, Subsea 7, Transocean and BP, an opportunity was identified to allow the use of a permanent Subsea 7 *Pioneer HD* work-class ROV on board the deepwater semi-submersible drilling rig *Paul B Loyd Junior* for scientific experiments and observations. Work that could be done during periods of stand-by time between the normal working duties of the ROV crew.

The aim of the project was to investigate the benthic animals and their distribution in relation to the drilling platform using the existing tools available on the ROV.

The seabed environment of the west of Shetland area, as with much of the deep-sea, is relatively understudied, with little information available on the ecological diveristy of the area. ROVs provide a unique opportunity to obtain quantitative in situ ecological information on the diversity of larger animals (>1cm), or megafauna.

Valuable

As the identified opportunity was to be the first time a scientific ROV project had been carried out on an active drilling platform, the the visit was conceived as predominantly a feasibility study. However, due to the help of the highly skilled ROV team, supported by the BP and Transocean crews onboard, it became clear that valuable quality scientific data could be collected, amongst the normal daily work routines onboard.

The project generated a keen interest from the ROV team and support crews who, interested to learn more about their working environment, helped undertake detailed video surveys and observations of animal behaviour as well as designing and testing tools for future sampling and experimental studies. Over the duration of the project numerous successful dives were undertaken, providing a valuable insight into the animal communities living under and around the drilling platform.

The ROV, with its high-quality Remote Ocean Systems zoom video cameras and Kongsberg OE14-108 digital stills camera, was used to take video footage and still pictures, providing a reference for the measurement of diversity and abundance of the animals present. The video capabilities also allowed in situ observations to be made on a range of unique animal behaviours. A large variety of species were identified around the platform, from large metre-long anglerfish to small amphipod crustaceans.

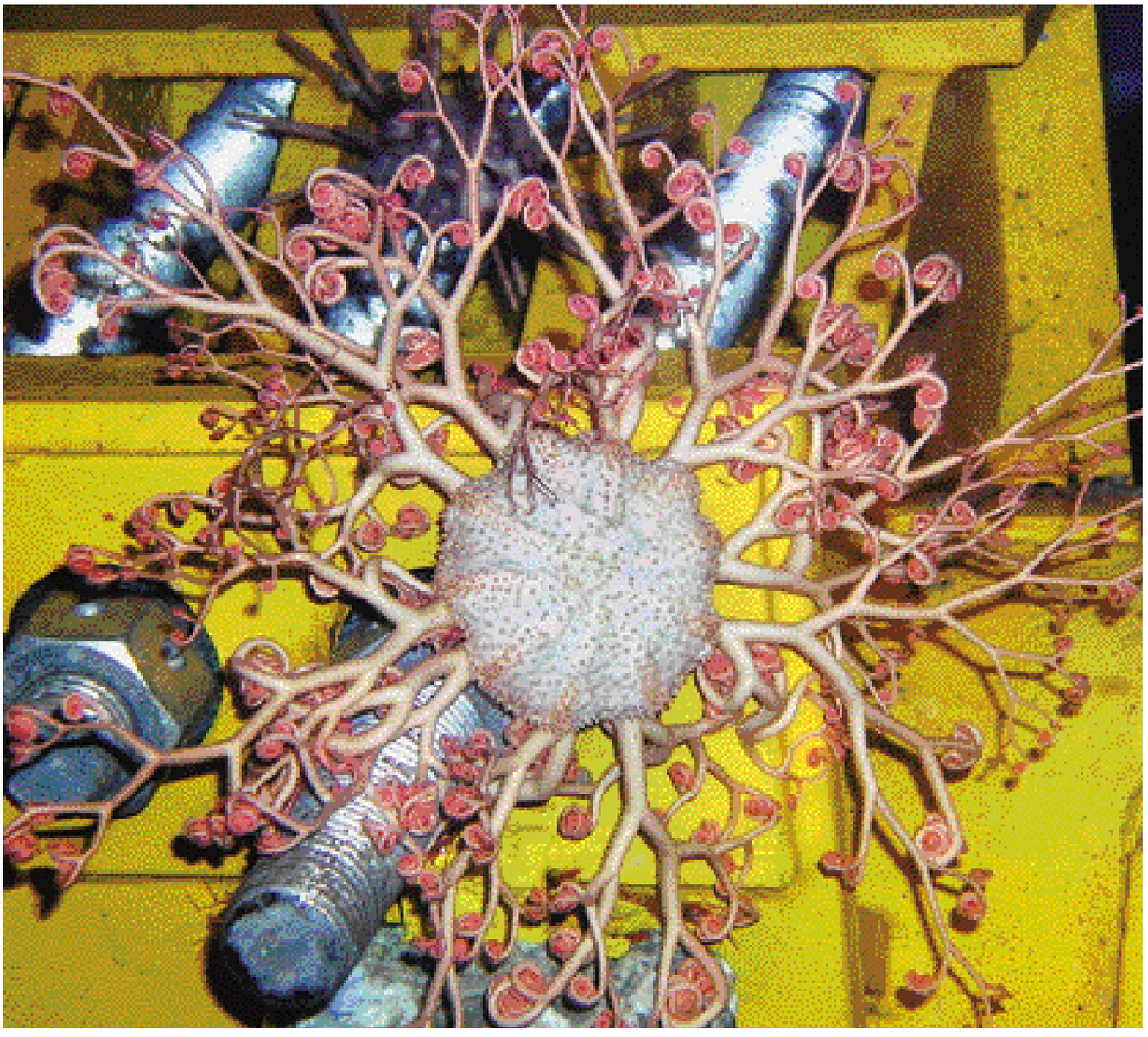
To allow quantification of these animals, a series of straight-line video transects radiating from the drill site were used to elucidate changes in species diversity and abundance as seabed characteristics changed. Analysis of these transects revealed two distinct seafloor zones.

Complex

An inner zone, where the seabed comprised fine drill cuttings, included complex seabed infrastructure. Within this zone were large shoals of redfish, cod and saithe – all using this area as a haven from predation and potential fishing operations.

Moving 10-15 metres away from drilling activity, the seabed changes in composition to a natural sand and gravel base littered with occasional larger life-encrusted rocks. In this zone a highly diverse surficial epifauna was observed including sponges,

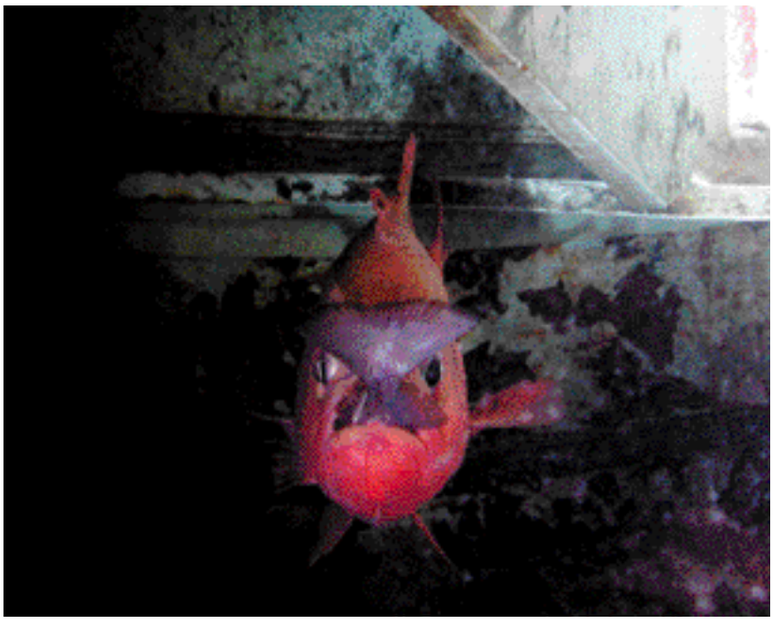
Left: The Transocean Paul B Loyd Junior *deepwater semi-submersible drilling rig is capable of working in harsh environments and water depths up to 600 metres. Top right: A basket star clings to a piece of subsea machinery. Bottom right: Subsea 7 work-class* Pioneer HD *ROV connected to its tether management system for deployment. It is equipped with seven and five function manipulator arms, camera systems on moveable pan and tilt unit and high-power subsea lighting. All these tools make it an ideal vehicle for scientific operations.*



decapod crabs, starfish, scallops, urchins, sea cucumbers and other species of smaller fish. The larger megafaunal animals found on the seabed around the drill centre provide a good indicator of the condition of the seabed. For a complete understanding of these systems, it is vital to focus on all size classes of marine animals and their diversity and distribution.

Accurate

There is a huge potential for the use of work-class ROVs for projects such as this on offshore drilling installations. The majority of work-class ROVs are suitable for scientific work as they are equipped with high quality zoom video cameras, ▶



Above left: Redfish like this are a common sight near the seabed west of Shetland. They are often seen resting in and around subsea structures. Here the redfish is feeding near the blast out preventer. Above right: There is a high diversity of life around the rig. A Geryon crab is seen sheltering under a pipeline. Diverse sponges and squat lobsters are a common sight, living on the natural seabed alongside.

▶ manipulator arms and often with highly accurate navigational equipment. Subsea 7 alone has a fleet of 112 ROVs in operation globally, many on drilling platforms and support vessels.

Good quality scientific research can be achieved using typical work-class ROVs during periods of stand-by time without negative impact to typical operations, additional costs to the users or additional safety risks. The benefits of such collaborative projects can only help to improve our knowledge and understanding of deepwater environments, and through projects such as SERPENT it is hoped this trial will serve as a valuable baseline for future studies.

We would like to thank Subsea 7, Transocean and BP for their continued support and enthusiasm during past and future SERPENT projects.

● Daniel Jones is a researcher with the DEEPSEAS Group at SOC. Ian Hudson, who is also based at SOC, is the SERPENT project manager. Together with their team in the DEEPSEAS Group, they continue to develop new techniques and projects to further explore the role of work-class ROVs in marine science.