Remotely operated CUCUMBERS

Ian Hudson reports on the first industrial collaboration project using remotely operated vehicles to investigate the feeding behaviour of deep-sea sea cucumbers in a West of Shetland oil field.

As science and technology move hand in hand, more and more scientists are using cutting edge equipment to sample the deep-sea. This equipment is very expensive, and so is often only used on larger science missions, but there is a gold mine of these resources out there, waiting to be tapped by the scientific community. Much of it is owned by the oil industry, which uses deep-sea technology every working day, all around the world. One of its most versatile vehicles is the ROV (Remotely Operated Vehicle), which the industry uses in every working oil field to carry out visual surveys, pipeline construction and general maintenance.

In the seas to the west of the Shetland Isles, called West of Shetland by the oil industry, BP operates one of its largest and most productive oil fields. The Scheihallion and Foinaven fields, which adjoin each other, turn out over 270,000 barrels of oil per day through a unique floating production and storage system. Within this field, BP's main contractor, Subsea 7, runs ROVs around the clock. As part of a normal working day they may be left standing idle on the seabed for many hours. Spotting this waste of an expensive resource, BP's environmental advisors persuaded the company to offer the spare ROV time to environmental scientists.

The Centurion *remotely operated vehicle.*

Ian Hudson

A deep-sea sea cucumber feeding on the sea bed.

BP

Collaboration

They contacted Tammy Horton, a BP-funded fellow at Southampton Oceanography Centre (SOC), and set up a collaboration project to use the ROVs. As part of my PhD project investigating mud-eating sea cucumbers (*Holothurians*) within SOC's DEEPSEAS Benthic Biology Group, I designed an experiment to use ROVs equipped with specifically made traps to look at the feeding rates of the common sea cucumbers (*Stichopus tremulus*) living in the oilfield.

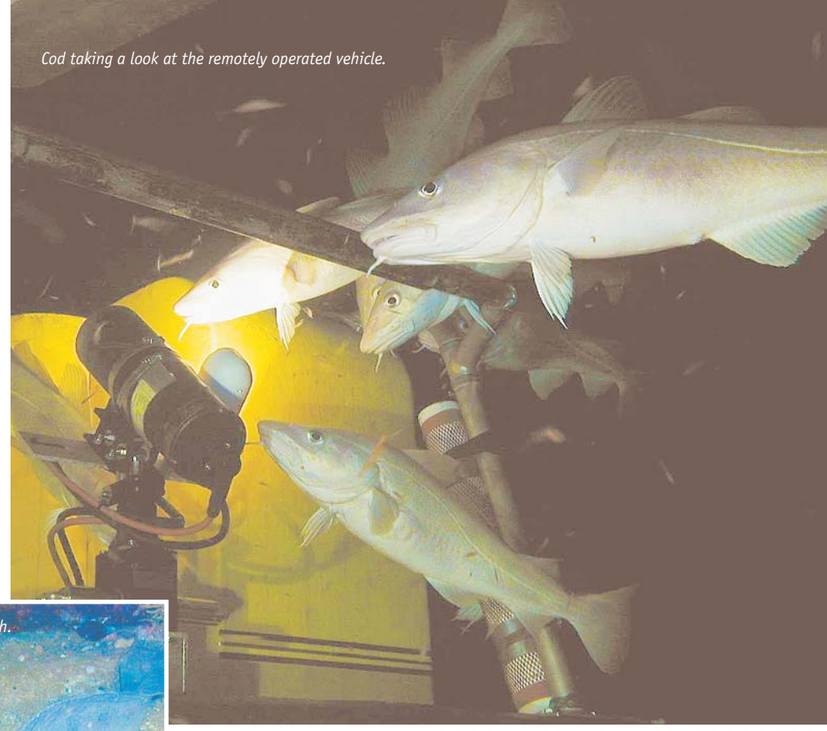
The ROV manipulator arm placed the traps into the seabed and put a suitable sea cucumber inside. The trap contained a mixture of different sized glass beads, sand impregnated with an inert fluorescent dye and mud and sand on which the animal would feed. The idea was to later count the glass beads, and also, using a fluorescent microscope, the added sand particles to determine the feeding rates of these animals.

Along with the trapping experiment, we used the video camera systems on the ROV to film the natural feeding behaviour of a range of bottom dwelling animals, sea cucumbers, as well as urchins and crabs.

The work vessel

At 35,000 tonnes, 360 berths and four working ROVs, the BP-contracted MSV *Regalia* is a one of kind diving support vessel. BP uses the *Regalia* as its principal vessel within this oil field. She is the largest of her kind in the world and has a running cost of £160,000 per day. The *Regalia* was the perfect work platform on which to carry out a two week pilot study on the scientific uses of industrial ROVs.

Onboard *Regalia* are two general work class ROVs designed and operated by Subsea 7, called *Centurion* 21 and 30. There are also two tooling class ROVs, which have large platforms on the front for mounting a range of heavy-duty tools. These are *Hercules* class vehicles. The *Centurion* ROV has features in common with a science-class ROV, manipulator arms, video live cameras that pan sideways and vertically, and zoom and tilt, as well as a range of digital still cameras. These can all be used to carry out simple science tasks.



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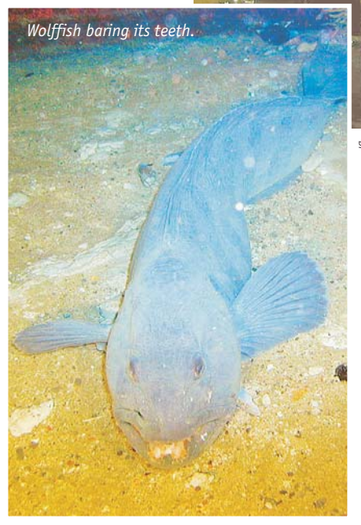
Cod taking a look at the remotely operated vehicle.



Wolffish baring its teeth.

New footage hooked

During the two-week pilot study, I co-piloted some of the missions and took video footage and still pictures of all kinds of animals living within the oil field. We found some strange and new species, including an anemone species that is probably new to science. We also saw some once familiar species. Here cod, the fast disappearing mainstay of our fish and chip shops, enjoys a life free of the perils of trawling. No trawlers are allowed in the West of Shetland oil field exclusion zone, and the cod thrive on rich stocks of krill. We saw cod over a metre long, and probably three or four years old.

Perhaps the strangest thing we saw was the feeding behaviour of a small bottom dwelling squat lobster. Sitting in a burrow the lobster was using its claws like pincers to catch the krill that swarmed around the seabed before it. When it had caught a krill, it put it into its mouth to eat whole, but the krill escaped and swam back out again. We continued watching, and the lobster seemed to realise its feeding strategy wasn't working. The expert hunter swapped its technique. It used it claws to pull apart the next krill, and passed to its mouth in pieces, earning it the nickname of the murderous crab. This behaviour is certainly new to science, according to Dr Tony Rice. This shows how using ROVs can give us new insights into deep-sea animal behaviour.

We also discovered new insights into the feeding behaviour of the sea cucumber. The cucumber uses it tentacles to pick up particles from the sea floor, but this has rarely been observed close up. Through the ROV video camera we watched the cucumber place each individual tentacle on the seabed, spreading them out like fingers on a hand and grasping at the sediment. As a group at SOC, we've examined many specimens of sea cucumbers from a range of places, but we've never been able to sit right next to them on the deep-sea floor and watch them feed. We'd theorised that they used their tentacles in this manner, and now here was the proof.

Tapping the resources

This project demonstrated how industry and academic science can benefit each other, in terms of sharing resources and useful scientific findings. The oil companies' untapped gold mine of resources, offered to science, needs to be exploited further, so that other people may benefit from their resources, locally and perhaps around the globe. We at SOC's DEEPSEAS group are setting up another project, this time to examine deep-water sites in the Gulf of Mexico. The lessons we learned from our two-week trial project in the North Atlantic will no doubt make going deeper a success and we hope to see more new footage and make more exciting findings, including ones new to science.

Thanks and Acknowledgements

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