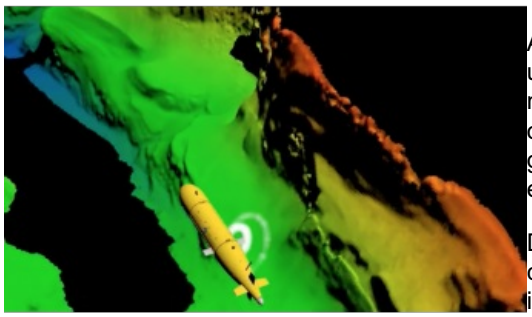
High-resolution Mapping of Deep-sea Vertical Walls Using AUVs and ROVs



A study published by the National Oceanography Centre (NOC) combines autonomous underwater vehicle (AUV) and remotely operated vehicle (ROV) mapping and imaging methodologies to reveal the complex 3D terrain of deep-sea vertical cliffs and the diversity of species associated with them. AUVs and ROVs can get much closer to the seafloor and generate higher-resolution maps than would be possible with ship-mounted multibeam echosounders.

Deep-sea cliffs associated with submarine features such as canyons and escarpments, can host a wide range of species including a particularly high number of ecologically important cold-water corals. The complex habitat created by these corals provides other animals with living space, improving access to food and offering protection from predation.

Understanding the localities and the environmental drivers of these cold-water coral habitats is of considerable interest. Owing to their steep nature, these vertical habitats provide natural protection from bottom-trawling activities and these corals therefore have the potential to be an important source of larvae for recolonisation of previously damaged cold-water coral reefs.

Traditional Survey Techniques Limited

However, for many deep-sea environments, only coarse resolution ship-derived maps are available and in most cases, the finer details of seafloor features, such as vertical walls, are absent. Traditional seafloor mapping and surveying techniques are usually restricted to downward looking approaches and as a result, these vertical habitats are often overlooked.

Commenting on the study, which is published in *Nature Scientific Reports*, NOC researcher and lead author Dr. Katleen Robert explains that to map the seafloor, ship-mounted multibeam echosounders are used. These sonar estimate the depth below the ship and provides the first map at approximately a 50m pixel resolution. But to get more detail, the researchers have to get closer to the seabed. This is where AUVs and ROVs come into play as they can fly much closer to the seafloor and the maps that these vehicles generate, are of much higher resolution.

Under 50cm Resolution for Vertical Wall Mapping

To examine the vertical walls, the researchers worked with NOC engineers to mount the multibeam echo sounder sideways on the AUV. Forward-looking ROV multibeam and high-definition videography surveys were also conducted at two locations in the North Atlantic. This allowed the team to map these vertical walls at <50cm pixel resolution and, using photogrammetry techniques, 3D reconstructions of the habitats were created, allowing the precise location of individual animals.

As the 3D image reconstructions of the coral habitats also retained colours, the researchers were able to quantify the amount of live coral colonies versus the amount of dead coral framework and the individual animals associated with the coral reefs. The combination of these new technologies has allowed them to map the physical 3D structure of previously inaccessible habitats and demonstrates the complexity and importance of these vertical walls in the deep-sea environment.

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