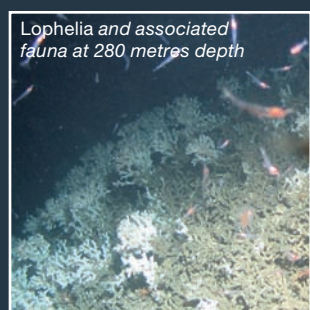


WHERE IS LOPHELIA?

DEEP SEA CORAL INVESTIGATION OFFSHORE NORWAY

Corals exist even in the temperate waters of our Northern seas but are threatened by man's offshore activities. Offshore Norway, Fugro's environmental scientists have investigated drilling locations to detect the presence of vulnerable species.

Commenting on the importance of coral species in maintaining biodiversity and equilibrium in the health of our oceans, Paul Collins, Fugro's Environmental Report Manager remarked, "The deep sea coral, *Lophelia pertusa*, is a cold water, reef building coral found in deep water, typically between 200 and 3000 metres depth. Reef habitats are extremely important in maintaining biodiversity within the oceans, as well as acting as larval reserves for the fishing industry. Deep-sea corals are extremely slow growing and are vulnerable to disturbance. Hence there is a need to ensure their habitats are well protected."



Lophelia and associated fauna at 280 metres depth

Lophelia lives where there is no sunlight, and temperatures range from about 12°C to 4°C. Reefs can grow 35 metres high, and develop to widths of hundreds of metres. The largest recorded reef lies off the Lofoten Islands in Norway and extends to around 100 square kilometres. In the context of estimated growth




rates as low as 1 millimetre per year, the great age of these reefs becomes obvious. If damaged, such reefs will take centuries, if not millennia to recover. The greatest potential threats are destructive fishing practices and oil exploration and extraction.

'Red List' Species

Operators seeking to drill offshore Norway are required to identify colonies of *Lophelia pertusa* as part of the permitting process. The coral is on a 'Red List' of vulnerable species



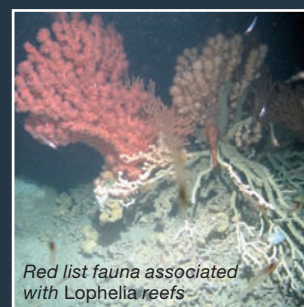
Seabed features summary chart

-  Silty sand
-  Iceberg scour marks
-  Areas of coral

circulated to Norwegian offshore operators. On recent drill site survey projects, Fugro has acquired and examined multibeam bathymetry and side scan sonar data to interpret features that might correspond to aggregations of the 'Red List' species.

One particular survey detected numerous iceberg scour marks, with exposed coarse sediment and boulders on the mounds surrounding the seabed scars. Side scan sonar data, collected along the edges of the scour marks, revealed the presence of numerous areas of seabed with a highly mottled texture. These correlated with zones of raised topography and were interpreted as possible coral features.

Digital photographs and video images of the seafloor revealed that the interpreted features comprised large stands of *Lophelia*. Correlation with bathymetric data and side scan sonar mosaics indicated that these coral stands occurred frequently across the southern region of the survey area. It was possible to identify three distinct *Lophelia* coral zones – reef, intermediate zone and coral gravel – and to delineate these from video and stills data.



Red list fauna associated with Lophelia reefs

Living *Lophelia* coral ranges in colour from white to orange-red. Fugro's subsea imagery showed areas of substantial healthy coral as well as areas where *Lophelia* was absent. This enabled the offshore operator to consider drilling locations that would avoid the risk of disturbing or damaging the precious and vulnerable underwater coral habitat.

Fugro has based a team of twenty fulltime marine biologists, oceanographers and other survey specialists in Great Yarmouth, UK and Abu Dhabi, UAE, specifically to address the growing number of environmental assessment and habitat mapping campaigns being commissioned worldwide by oil and gas clients. Projects have recently been successfully completed in the Middle East, South East Asia, Africa and the Mediterranean, in conjunction with Fugro's traditional geophysical surveys and geohazard investigations.

Examples of the hard coral *Lophelia pertusa*, both alive and dead, with red-pink soft corals *Paragorgia arborea* and *Primnoa resedaeformis* and various anemones and sponges