New Zealand seafloor needs protection from deep-sea mining

December 14 2016

Rachel Boschen touring a deep-sea submersible during a research voyage along the Kermadec Volcanic Arc. Credit: Victoria University

Seafloor communities within New Zealand's Exclusive Economic Zone (EEZ) need better protection against deep-sea mining, according to a Victoria University of Wellington researcher working with NIWA scientists to investigate the environmental effects of deep-sea mining.

Rachel Boschen, who graduates with a PhD in Marine Biology today, says although there is interest in mining for Seafloor Massive Sulfide (SMS) deposits within the EEZ, little is known about the seafloor communities that are found there and potentially at risk from mining activities.

SMS deposits are mineral-rich ore deposits that form on the seabed. Within the New Zealand EEZ, deposits form at submarine volcanos at 1000–2000m depth along the Kermadec Volcanic Arc.

Part of Rachel's research involved reviewing 70 hours of video footage covering more than 50 km of seabed across three seamounts on the Kermadec Volcanic Arc. From the footage, she was able to characterise the structure and distribution of seafloor communities.

"Seafloor Massive Sulfide deposits are formed by hot springs on the seafloor, which are known to be important habitat for specially adapted animals. What I didn't expect was that not only did the areas with active hot springs support unique communities, but areas where springs are no longer active also hosted unique communities. These communities have complex distributions, with each of the studied seamounts supporting communities not found on the other seamounts.

"The action of the hot springs causes SMS deposits along the Kermadec Volcanic Arc to be rich in copper, zinc, lead, gold and silver, and there has been interest in mining them. If mining occurs, the unique communities found in my study could be at risk.

"To mitigate the impacts of any future mining, it's important to designate protected areas that conserve seabed hosting unique or particularly sensitive communities to ensure they are not lost from the region."

Animal collections taken during the study also allowed her to determine

the connectivity of populations of a deep-sea mussel species found at seafloor areas at risk from mining. Rachel examined the DNA of seven populations of a mussel species endemic to active hot springs along the Arc, to assess the populations' genetic connectivity across the species' 830 km range.

"By looking at their DNA I was able to determine how connected different populations are along the Arc. The results suggest that although connectivity is generally high amongst populations, some central populations may play an important role in maintaining connectivity in the region. Another population at the northern extent of the species' range is less connected and may be more at risk from deep-sea mining disturbance.

"The results indicate that to preserve the connectivity and health of these deep-sea mussel populations, we need multiple protected areas of seabed, designed as a network."

Rachel adds that a protected network should include SMS sites that are both thermally active and inactive to protect the range of communities and include sites key to population connectivity.

She says while the New Zealand Government's proposed 620,000 km2 Kermadec Ocean Sanctuary, announced in 2015, was "a big step towards protecting areas potentially at risk from deep-sea mining", it may not be enough to safeguard unique communities from mining activities.

"There are many SMS deposits south of the proposed sanctuary that are not offered adequate protection, including the seamounts in this study and some other sites on the Arc that are important to regional population connectivity."

Rachel's supervisors Professor of Marine Biology Jonathan Gardner at

Victoria, and Dr Ashley Rowden and Dr Malcolm Clark from NIWA agree her research provides valuable information that can safeguard the future of this ecologically important area.

Professor Gardner says: "Her research highlights the threats posed by deep sea mining before it begins, giving us a much better idea of how we need to set up areas for both mining and conservation."

More information: The Ecological Impacts of Mining at Seafloor Massive Sulfide Deposits on Megafaunal Assemblage Structure and Population Connectivity. URI: hdl.handle.net/10063/5175

Provided by Victoria University of Wellington