

Shocking gaps in basic knowledge of deep sea life

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Juvenile of an unknown species of octopus from 1200m depth on George Bligh Bank off the west coast of Scotland. Credit: JC136/Deeplinks/NERC/Univ of Plymouth / Univ of Oxford

Human interference in the deep sea could already be outpacing our basic understanding of how it functions.

As a result, without increased research and an immediate review of deep

ocean conservation measures, the creatures that live there face an uncertain future, Oxford University scientists have warned.

Vibrant, mysterious and often referred to as the 'final frontier', the deep sea floor is the largest habitat on Earth. This vast area, which lies below 200m and which accounts for 60% of the surface of the planet, is home to an array of creatures. However, very little is known about how it functions and, in particular, how populations of deep sea creatures are interconnected.

In a new review published in *Molecular Ecology*, scientists from the Department of Zoology at Oxford University have considered all knowledge published to date of deep sea invertebrates. The paper highlights the disparity between our basic knowledge of the ecology of deep sea animals and the growing impact of humans on the deep ocean.

Over the last thirty years there have only been 77 population genetics studies published on invertebrate species, the type of animals that dominate these deep areas. This includes [deep ocean](#) coral gardens, snails and urchins. The majority of these papers, which cover just 115 species, have focused on commercial species at the shallower end of the depth range (200-1000m). Only one study has been conducted on creatures that live deeper than 5000m—which accounts for a quarter of the planet's seafloor. Only nine papers account for 50% of the planet's surface (depths below 3500 m). As a result, life in the depths of the ocean remains a relative mystery.



The animal is a Eumunida lobster - Credit is M Taylor JC094/ TROPICS/ERC/Univ of Bristol. Credit: M Taylor JC094/ TROPICS/ERC/Univ of Bristol

Oxford's review attempts to use what little information there is to paint a cohesive picture of how populations of [deep sea creatures](#) are connected over depth and distance. Often animals are disconnected over a few hundred metres of depth but relatively well connected over a few 1000 km distance.

The effects of human activity, such as pollution, destructive trawl-fishing, deep sea mining and climate change, appear to be intensifying, and increasingly affecting populations of seafloor invertebrates. The impacts on fragile, slow-growing coral gardens are of particular concern. As ecosystem engineers, corals are biodiversity hotspots, potentially as vital to the seabed as the rainforests are to the Earth.

Christopher Roterman, co-author and postdoctoral researcher in

Oxford's Department of Zoology, said: 'Today humans have an unprecedented ability to effect the lives of creatures living in one of the most remote environments on earth—the deep sea. At a time where the exploitation of deep sea resources is increasing, scientists are still trying to understand basic aspects of the biology and ecology of deep sea communities. Population genetics is an important tool that helps us to understand how deep sea communities function, and in turn how resilient they will be in the future to the increasing threat of human impacts. These insights can help governments and other stakeholders to figure out ways to control and sustainably manage human activities, to ensure a healthy deep sea ecosystem.'

'Unfortunately, the level of human activity in the deep sea has far outpaced our ability to get this basic knowledge, which is something we're trying to highlight in this review.'

The deep sea is a vast environment that has often been considered stable over time and generally immune to past environmental changes at the surface. The Oxford review shows evidence that deep sea communities may not be as stable as once supposed.



The animal is a *Desmophyllum dianthus* solitary coral. Credit: M Taylor, JC136/Deeplinks/NERC

Christopher added: 'What we don't know at present is how human activities and climate change will affect these populations in the future, but history tells us that we shouldn't be complacent.

'Currently, deep sea fisheries represent the largest direct human impact on deep sea communities. But, mining for metals is set to grow in the future. What may start off in relative terms, as a pin-prick on the seafloor, may rapidly expand before the long-term detrimental effects are fully understood.'

The researchers acknowledge that getting data from the deep sea is costly and logistically challenging. However, they stress that recent technological developments mean that more genetic information about populations can be collected than ever before.

Michelle Taylor, co-author and senior postdoctoral researcher in Oxford's Department of Zoology, said: 'Next-generation sequencing allows us to scan larger and larger portions of an animal's genome and at a lower cost. This makes deep sea population genetic studies less costly, and for many animals, the sheer volume of data these new technologies create means they can now be studied for the first time.

'As scientists it is our duty to gather as much basic information about these creatures as we can and share it, and work with the people that set the rules of the seas - who have the power to make management decisions. We cannot bury our heads in the sand and think that people are not going to try and exploit resources in the [deep sea](#) so science needs to catch up.'

More information: Taylor, M.L.1 and Roterman, 'Invertebrate population genetics across Earth's largest habitat: the deep sea floor' C.N.1 *Molecular Ecology* (2017). [DOI: 10.1111/mec.14237](https://doi.org/10.1111/mec.14237)

Provided by University of Oxford

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