Could an artificial coral reef protect marine biodiversity against climate changes?

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The reef is made of small plastic structures that mimic natural coralline algae. Credit: University of Portsmouth

Climate change from rising levels of carbon dioxide (CO_2) is having two major effects in our seas – global warming and ocean acidification – and the combination of these threats is affecting marine life from single organisms to species communities.

Researchers from the University of Portsmouth are helping to build an artificial reef that could protect vulnerable marine ecosystems in the Mediterranean Sea against climate change.

The reef is made of small plastic structures that mimic natural coralline algae (algae with calcium carbonate structures), which have a similar ecological function to corals. Coralline algae form reefs that are able to host different species to create highly diverse and complex environments.

Due to their calcium carbonate structures, coralline algae are extremely vulnerable ocean acidification, since their skeleton is very soluble to low pH conditions. Their survival and the survival of their associated species is at risk.

In the long run, the aim is to see if organisms can survive in an artificial reef in case the coralline algae disappear in the future due to ocean acidification. The team also expects to be able to make artificial carbonate reefs from biodegradable plastic that would gradually disappear, leaving only natural coralline structures in place.

Researchers will deploy the 'mimics' close to existing coralline algae reefs in the Mediterranean Sea over a 12 month period. The aim is to see if they are able to host species, similar to their natural counterparts, and protect them against the effects of climate change, as well as acting as scaffolds for natural coralline algae reefs to grow.

Project co-ordinator Dr Federica Ragazzola, Senior Lecturer in Marine

Biology at the University of Portsmouth, said: "In a small and confined seas like the Mediterranean, these potential 'buffers' are among the dominant organisms. Coralline algae belong to these groups of organism that may play an important role in buffering the pH decrease thus creating a micro-environment that may help some species to resist future climate changes.

Dr Chiara Lombardi, from the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) and project partner, said: "Our research will allow us to clarify the function of the coralline algae reef as a buffer for diversity, abundance, reproductive, ecological and structural characteristics of the associated fauna. As a consequence, our results will be important for the planning of future protection and management strategies involving coralline algae bioconstructions."

The project is a collaboration between the University of Portsmouth, the National Research Council (Italy's largest public research institution), and MedClimaLizers, an international research collaboration that will lead to improvements in our understanding of biomineralisation in the changing waters of the Mediterranean.

Funded by the Royal Society, the project aims to study the mitigation effects of the coralline algae reef in the Gulf of La Spezia, on the north-western coast of Italy.

The 90 synthetic mini reefs, 10cm in diameter, each with 20 fronds made of a highly elastic rubber material, known as silicon elastomer, will be anchored in clear resin.

The first mimics have been put in place this month. After 12 months, the natural reefs and mimics, along with their associated fauna, will be exposed to future climate change scenarios projected for 2100 (IPCC

2014) under controlled conditions.

Provided by University of Portsmouth