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Sea of possibilities: the underwater gardeners restoring marine forests

By involving local communities, EU-funded researchers aim to restore marine ecosystems and turn citizens into ocean stewards.

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Beneath the deep blue waters of Tenerife lies a dramatic seascape shaped by ancient volcanic eruptions. Submerged lava tubes and jagged basalt formations create an underwater world unlike any other.

This unique marine environment, just off Spain's Canary Islands, teems with life. Divers may encounter endangered sea turtles, graceful eagle rays, elusive sharks, and even whales. Remarkably, one third of all marine mammal species on Earth have been spotted around Tenerife.

Equipped with professional scuba diving gear, marine biologist Isabelle Peeters glides through these waters, which are some of the clearest she has ever seen.

Peeters is a senior marine biologist who is helping organise and lead diving trips to carefully collect samples and data from the ocean floor as part of an EU-funded research initiative called OCEAN CITIZEN.

Marine forests

OCEAN CITIZEN brings together leading research experts and ocean conservation specialists from Denmark, Germany, France, Israel, Ireland, Italy, Norway, Spain and the UK.

Their work, which will run until the end of 2026, focuses specifically on the regeneration of marine forests – underwater areas populated by seagrass, seaweed, sponge grounds, corals and soft corals called gorgonians.

"Given the state of the world and the environmental degradation we are witnessing, we have reached a point where conservation alone may not be enough," said Peeters.

Active restoration of underwater life is, therefore, what the OCEAN CITIZEN team is focusing its efforts on.

Their goal is to develop a flexible, scalable model to regenerate, protect and manage marine forests across five pilot sites in the Atlantic Ocean, the Mediterranean Sea, the Red Sea, the Barents Sea and the Inner Danish Waters.

Not unlike forests on land, marine forests are rich, complex ecosystems that support a wide variety of life. These diverse marine habitats have a crucial role in maintaining ocean biodiversity and resilience. They also play an important role in the environment by helping store carbon.

“Marine forests aren’t just clusters of species living side by side – they are built on intricate biological relationships,” said Spanish marine biologist and environmental educator Juanita Zorrilla-Pujana.

Tipping point

While crucial for life as we know it, these underwater ecosystems have been significantly damaged by human activity and global warming.

“Our oceans are under stress,” said Zorrilla-Pujana, who is the science communication officer for OCEAN CITIZEN. “For centuries, we have taken everything from the ocean and given nothing back except for plastics and pollution.”

Sergio Rossi, a marine scientist at the University of Salento in Lecce, Italy, and coordinator of the OCEAN CITIZEN team, also stressed that we are in a time of profound ecological change.

“Species that have been here for millennia are disappearing.”

This shift results in biodiversity loss, depleted resources, and a breakdown of complex food webs, endangering communities that rely on fisheries. In addition, marine forests, which act as natural barriers against storms and extreme weather, are disappearing.

“It is a huge problem, and we cannot foresee what the implications might be in a few years or decades,” Rossi warned.

Fast action needed

Working at their five pilot sites, the OCEAN CITIZEN team has been studying different ecozones at depths ranging from 25 metres all the way down to 100 metres below sea level.

Their aim is to better understand the ecosystems, but also to design effective solutions to restore and protect the local marine forests in a range of conditions.

“Because it is not just about placing a piece of coral in the water. It’s much more complex,” said Zorrilla-Pujana.

Each location has faced its own specific challenges.

In Denmark, the removal of millions of stones from underwater habitats has left some areas without substrate for species to settle on. The seas of Norway are struggling with a rise in sea urchin populations, which devour everything in their path.

In Spain, the waters are being polluted to such a degree that protected turtles can be seen swimming through dark sewage water, said Peeters, who is based in Tenerife and has witnessed the troubling situation firsthand.

For Rossi, it is clear that the degradation is happening so fast that we need to act quickly. “Our goal is to accelerate the restoration of these marine forests and create the right conditions for them to expand in areas where they are already established.”

Citizens as underwater gardeners

However, restoring the ocean’s forests is a huge endeavour that scientists cannot tackle alone. That is why the OCEAN CITIZEN team is enlisting the help of not just marine biologists and professional divers, but also local communities.

The initiative introduces the concept of “gardeners of the sea” – community members who actively support restoration projects. Some will dive to “plant” marine life on the seabed, while others will help nurture organisms on land in aquariums.

Beyond the ecological benefits, this approach should also help boost local economies. In Tenerife, for instance, a business model is being developed where tourist participation helps finance restoration activities.

Marine forests could also serve as natural carbon sinks. While the precise carbon capture potential is still being studied, Rossi estimates it could range from 1.5 to 5 tonnes of carbon per hectare annually.

Transplantation and artificial reefs

After two years of data collection and evaluation, the OCEAN CITIZEN team is now moving on to its next step: actively restoring its pilot sites.

Divers like Isabelle Peeters will begin transplanting macroalgae, seagrass, gorgonians and black corals. In parallel, custom-designed artificial reefs will be installed to support regrowth.

By 2026, the OCEAN CITIZEN team aims to have established a flexible, replicable set of protocols to guide future restoration efforts across Europe and beyond.

Still, as Zorrilla-Pujana pointed out, “the ocean is the mirror of human actions over the course of centuries. Our work is just one piece of a much larger solution.”

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- OCEAN CITIZEN
- OCEAN CITIZEN project website
- EU Mission: Restore our Oceans and Waters