

Artificial reefs in seagrass meadows could help protect against climate change

July 26 2023, by James Ashworth



Credit: AI-generated image ([disclaimer](#))

Artificial reefs might help to restore the ocean's ability to fight against climate change.

The reefs boost the productivity of seagrass meadows by attracting fish, which can improve the ability of these habitats to lock up more carbon

dioxide beneath the waves.

Breeze blocks placed in one of the ocean's most endangered habitats provide an unexpected lift for fish.

Seagrass meadows are found across the world, reaching from the tropics up into the lower reaches of the Arctic circle. They are incredibly valuable habitats, providing a nursery for young fish as well as sucking vast quantities of carbon dioxide from the atmosphere.

However, with an area of seagrass the size of a football pitch being lost every 30 minutes, it's more important than ever to find out how to turn things around. A new study in the Caribbean has shown that [artificial reefs](#) can help to bolster their growth in the tropics, even as threats such as fishing and [nutrient pollution](#) continue.

Dr. Jacob Allgeier, a co-author of the paper, says, "By attracting fish, whose feces provide concentrated nutrients for the seagrass, the artificial reefs increase the primary production of the entire ecosystem."

"We are now investigating how this cascades up the food web. The new energy has to go somewhere, so we are quantifying how it affects invertebrates and fish with our evidence suggesting that it is fueling increases in both."

The findings of the study were published in *Proceedings of the Royal Society B*.

What is seagrass?

Seagrasses are a group of flowering plants that grow exclusively in marine environments. In total, there are around [60 seagrass species](#), made up of five different families that are not closely related but have a

similar appearance and lifestyle.

These families all descend from terrestrial plants that, like whales, gradually returned to the water over millions of years. To survive, seagrasses have developed a distinct way of life that allows them to thrive in nutrient-poor environments by extracting nutrients from the sediment and water.

Today, seagrasses are found around the coasts of more than 80% of the world's countries, including shallow waters and the intertidal zone. In the [northern hemisphere](#), the most common species is eelgrass, or [Zostera marina](#), while [Halophila and Posidonia](#) species tend to be more common in the southern hemisphere.

Together, it's estimated that all seagrasses cover an area of around 300,000 square kilometers, which is around the same size as the Great Barrier Reef. These plants support thousands of [fish species](#) and many more invertebrates, mostly as a source of food and shelter.

They also punch above their weight as a carbon sink, locking up many tons of [carbon dioxide](#). Though seagrasses cover only about 0.1% of the ocean floor, the plants are responsible for as much as [18% of its carbon storage](#), a service worth [hundreds of billions](#) of pounds.

Despite their value, the seagrass meadows have been in decline for [almost a century](#). Since 1930, a combination of disease, nutrient pollution and unsustainable fishing have caused populations to shrink, with a UN report estimating that seagrass meadows are [declining by around 7% a year](#).

In addition to making countless animals homeless, this decline in seagrass is also causing them to release their carbon stores, with disturbances in [seagrass meadows](#) thought to emit emissions equivalent

to around 3% of deforestation globally, despite a vast difference in scale.

But the potential for seagrass to help mitigate climate change has meant there has been a great deal of interest in how it can be restored. Research has shown that restored seagrass is [just as good](#) at storing carbon as undisturbed meadows, making it a promising 'blue carbon' strategy.

This is not, however, easy as seagrass currently has to be planted by divers which makes it [a time-consuming process](#). It can also be difficult to stop the root causes of seagrass decline while this restoration is ongoing, meaning dead plants often need to be replaced.

Artificial reefs and seagrass

One of the biggest issues affecting seagrass is nutrient pollution, often from [the release of human sewage](#). While the influx of nutrients can initially boost the growth of the meadows, it also promotes the growth of algae which reduces the amount of sunlight getting to the seagrass and harms it in the long run.

Alongside fishing which causes levels of the fish feces that fertilize the meadows to drop, it was thought that the combination of these two issues might work in unexpected ways to hinder the growth of seagrass.

But the current study has revealed some surprising results. It has found that the productivity of seagrass in both disturbed and undisturbed meadows was increased by the presence of an artificial reef, while algae didn't actually seem to pose an issue, even in areas where nutrient pollution was high.

Mona Andskog, the Ph.D. student who led the research, explains, "Artificial reefs built in seagrass create a positive feedback loop. They attract fish that use the reefs for shelter which, in turn, supply new

nutrients from their feces that fertilize the seagrass around the reef."

"This increased primary production can increase invertebrate production by providing more food and shelter for invertebrates, which in turn provide more food for fishes."

Experiments in Haiti, at some of the most fished sites included in the study, also showed that the artificial reefs were providing additional benefits to the fish. Large numbers of small fish were found at the site because of the difficulty in using nets around the reef, meaning that the overall biomass of fish was at times larger than in unfished areas measured elsewhere in the study.

While artificial reefs present a promising option for tropical seagrasses, they're likely to have a much more limited impact on temperate meadows. These waters already tend to have higher nutrient levels, meaning that any contribution the reef would make to overall growth would be small.

The scientists now hope to explore how the placing of artificial reefs can affect seagrass ecosystems, as well as expanding their research to the Dominican Republic.

"We will be testing how different configurations of artificial reef clusters can affect the production and fish community composition," Jacob says. "This includes the number of artificial reefs in each cluster, as well as their arrangement."

"As with this research, we hope to simultaneously use the reefs to test fundamental questions about production in these highly impacted ecosystems as well as optimizing the positive feedback that is initiated by the artificial reefs."

More information: Mona A. Andskog et al, Seagrass production around artificial reefs is resistant to human stressors, *Proceedings of the Royal Society B: Biological Sciences* (2023). [DOI: 10.1098/rspb.2023.0803](https://doi.org/10.1098/rspb.2023.0803)

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