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Can marine reserves help counteract climate change?

8 June 2017 / [Kim Smuga-Otto](#)

A new paper makes the case that protecting marine areas from fishing and human development may buffer the oceans against rising carbon dioxide levels.

- *Even if the nations of the world manage to meet their most ambitious goal to limit global warming to 1.5°C by 2100, elevated carbon dioxide levels will continue to stress and damage the oceans for the next half-century.*
- *A new paper contends that marine reserves protected from fishing and other human exploitation can reduce the damage from acidification, rising sea levels, storm intensification, and other effects of climate change.*
- *By sequestering and storing carbon, these protected areas can also benefit the whole planet, according to the paper.*
- *The Convention on Biological Diversity and Sustainable Development calls on coastal nations to protect 10 percent of their waters by 2020, but the authors argue that 30 percent may be required to effectively counter the effects of global climate change.*

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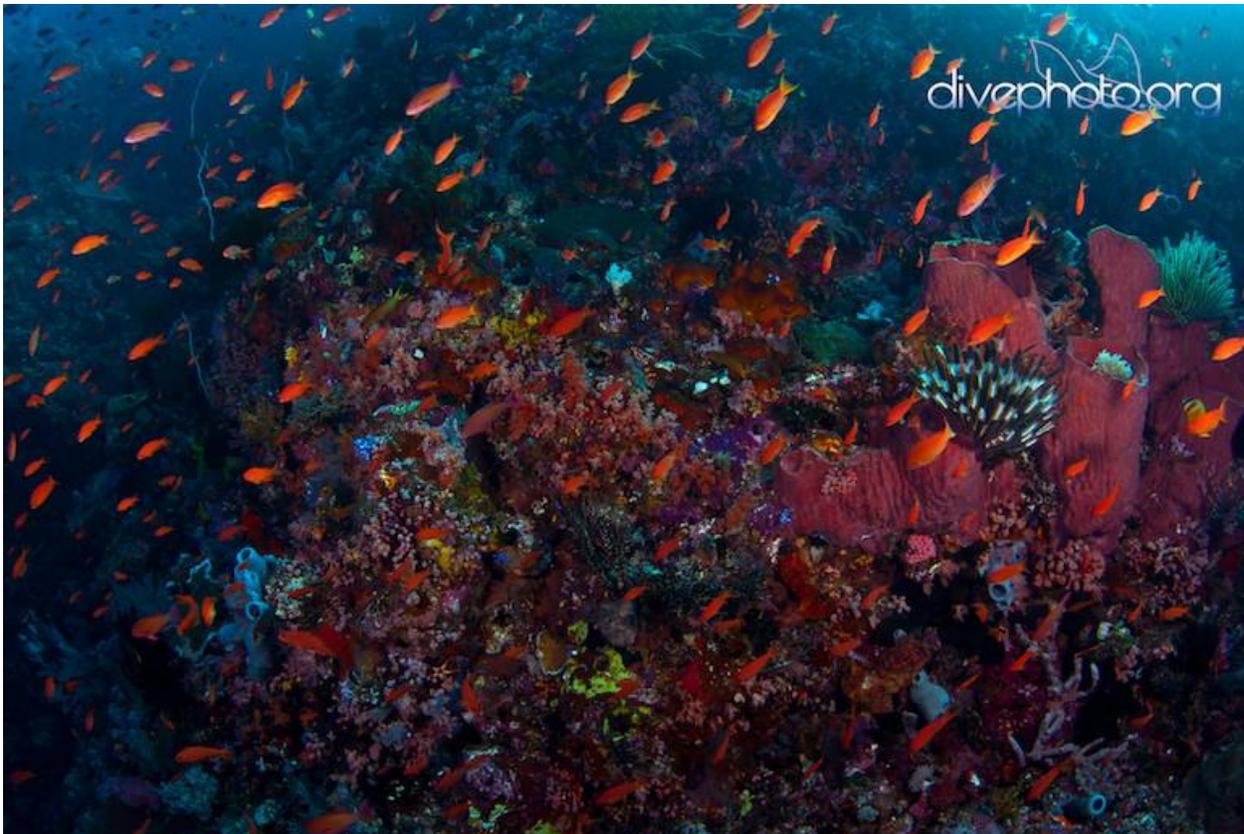
Even if all the world's nations fully cooperated to reduce carbon emissions and limit climate change, elevated carbon dioxide levels will continue to harm our oceans in the coming decades. A new paper makes the case that marine protected areas (MPAs) are a cost-effective way to mitigate the worst oceanic consequences of climate change.

MPAs, where fishing and human development are prohibited or greatly reduced, are usually touted for their ability to improve fish stocks and marine biodiversity. But the new paper, published this week in the journal PNAS, examines a different suite of positive effects.

It points to evidence that MPAs decrease seawater acidification and buffer the effects of rising sea levels and storm intensification. They can also provide safe havens for species whose original habitats no longer suit them and nurseries to repopulate areas damaged by low oxygen and lack of nutrients. The paper also highlights how MPAs store and sequester carbon, helping to offset global carbon emissions.

"Marine ecosystems have been sequestering carbon over the millennia; it's why we have oil and coal," Daniel Pauly, one of the paper's authors and the principal investigator with the Sea Around Us project at the University of British Columbia, told Mongabay.

"In this paper we restate something that should be obvious, if we set up a marine protected reserve where nature can reaffirm itself, it will be good for the [larger] ecosystem," he said.



Increases in atmospheric carbon dioxide levels have raised the acidity of surface ocean water on average 26 percent since pre-industrial times — a problem for many forms of marine life. The paper speculates that fish may be helping to counteract that problem. Fish are known to absorb calcium from seawater, binding it to carbon and excreting it as a carbonate molecule that can form a weak base capable of neutralizing ocean acidity. Fish occupying the ocean's mesopelagic zone (between 200 and 1,000 meters of depth) swim daily between the deep sea, where calcium is abundant, and the surface, where they release the carbonate. The paper argues that creating more MPAs in the open ocean to protect these kinds of fish could help mitigate ocean acidification.

MPAs can also help with rising sea levels and the increasingly violent and energetic storms that form over warmer waters, according to the paper. MPAs that include coastal wetlands, salt marshes, or mangrove forests protect the land behind them by absorbing the storms' energy and lessening flooding.

"Mangroves are cheaper than building dykes," Pauly pointed out.

Rising water temperatures are altering some marine ecosystems, turning them inhospitable and causing some species to relocate. The paper posits that regionally networked MPAs can act as stepping-stones for this dispersal and reduce the risk of species flickering out locally or populations becoming isolated.

MPAs may also be able to counteract increasing incidences of nutrient-poor "ocean deserts" and depletion of oxygen in areas of the upper ocean, both of which are linked to climate change,

according to the paper. Healthy MPAs not only provide a refuge from these dead zones, but may help repopulate bordering regions. The paper describes how high egg production of abalone within MPAs in Baja California, Mexico, led to faster recovery in nearby areas struck by increasingly frequent low-oxygen episodes.

On a global scale, marine plants like seagrass consume carbon dioxide and convert it into plant matter. Marshes then sequester this captured carbon. The paper points out that destruction of seagrass habitats and marshes not only removes this form of carbon sequestration but also releases already-stored organic carbon into the carbon cycle — an effect that protection in MPAs would counteract.



A parrot fish on a coral reef. Photo by Cory Fuchs/Oregon State University via [Wikimedia Commons](#).

All that is good reason to grow the size and number of MPAs worldwide, according to Pauly and his coauthors. Currently only 5.7 percent of the ocean area is classified as some sort of reserve and many reserves require better management, Christiana Pasca Palmer, executive secretary of the UN's Convention on Biological Diversity, said in a press release. Her organization's current target is for coastal countries to convert 10 percent of their waters into MPAs. The paper's authors argue that the goal should be closer to 30 percent.

The paper "makes a powerful argument at a time when people are looking to make a difference in terms of climate action," Sarah Lester, an assistant professor of geography at Florida State University who was not involved with the paper, told Mongabay.

Lester, who works with MPAs in the Caribbean, said that in reserves where fishing is prohibited, the difference is striking. “We need to preserve these ecosystems because human well-being is so reliant on healthy well-functioning systems,” she said.

However not everyone agrees that MPAs are the way to go, and the paper acknowledges that scientists are still actively debating their efficacy.

Ray Hilborn, a professor at the University of Washington’s School of Aquatic and Fishery Science and a self-identified MPA critic, told Mongabay that fisheries can be carefully managed to promote fish breeding and population growth while minimizing the environmental damage caused by fishing gear. He believes that unlike MPAs, which protect just certain areas, this approach can protect all of a country’s critical ocean habitats and species while continuing to provide a stable food source for people.

It is important to “think beyond the marine ecosystem and [remember that] fisheries are connected to the global food supply,” Hilborn said. Setting aside 30 percent of the oceans as no-take MPAs would mean more terrestrial food production, he argued, and the extra forests converted to farmland and livestock would generate a significantly larger carbon footprint than fishing.

Hilborn acknowledged that in places like Southeast Asia with few to no fishing regulations a country might find it easier to police designated MPAs than its entire territorial waters, but he doesn’t think MPAs make sense in regulated nations like the U.S., Canada, or Australia.

Pauly takes issue with the argument that MPAs limit the food supply. “MPAs allow you to fish less, but overall catch more,” he said, adding that people often think that “biodiversity is something we maintain at the cost of catching fish, but actually biodiversity is needed to produce fish.”

Nevertheless, the paper accepts that limiting fishing and other measures can give some of the benefits of MPAs and recognizes that their success is “highly contingent” on how well they are implemented and managed. It also acknowledges that MPAs are not a substitute for reducing greenhouse gas emissions. But it emphasizes the important role protecting marine ecosystems can play and encourages further research in the less understood mechanisms of what it calls “a relatively simple nature-based solution.”

“We are so used to modifying and transforming [our] world that we think it’s always a beneficial thing,” said Pauly, “but actually, [it’s] our intervention that [is] devastating for ecosystems.”

Citations

Roberts, C.M., O’Leary, B.C., McCauley, D.J., Cury, P.M., Duarte, C.M., Lubchenco, J., Pauly, D., ... Castilla, J.C. (2017). Marine reserves can mitigate and promote adaptation to climate change. PNAS. doi: 10.1073/pnas.1701262114.

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Sodwana Bay, South Africa. Photo by Greg Asner/www.Divephoto.org.

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