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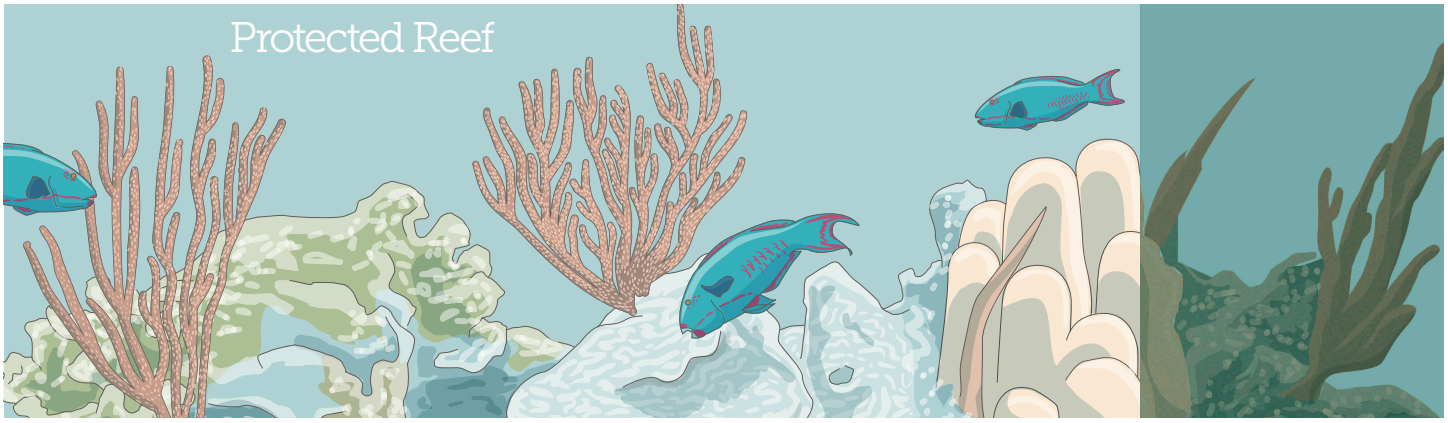
No-Take Marine Reserves Make Coral Reefs More Resilient

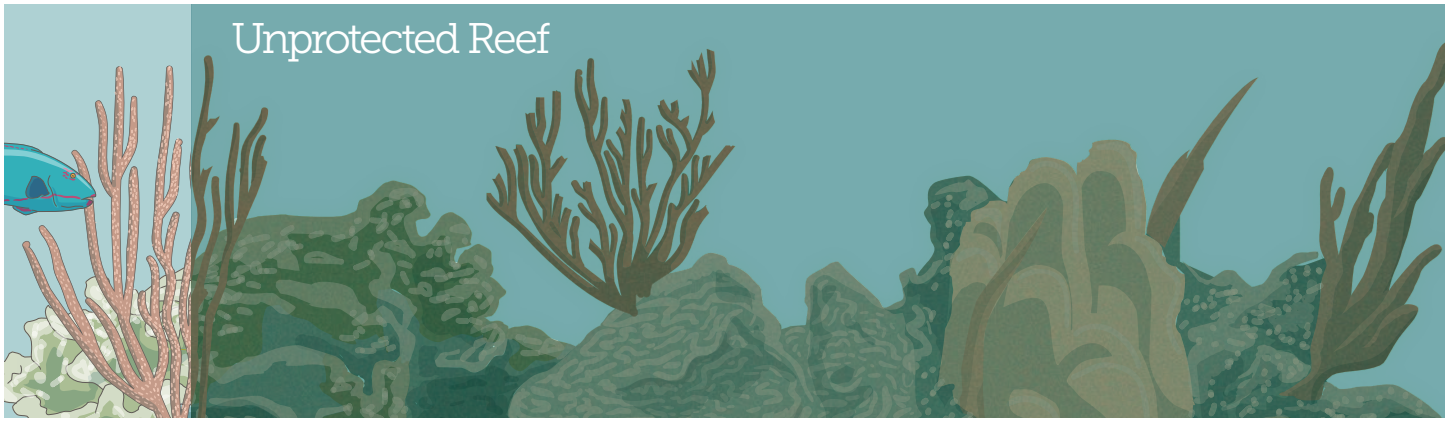
Reducing greenhouse emissions also benefits coral

Research by Pew Marine Fellow Peter Mumby finds that prohibiting fishing for parrotfish—with a no-take marine reserve, for example—may make Caribbean coral reefs six times more resilient to coral bleaching and other disturbances. Reducing greenhouse gas emissions also improves their resilience, but only in the long-term, the study finds. This research is the result of Mumby's three-year fellowship project.

Corals are six times more likely to regrow after a disturbance when protected by a no-take reserve



Chance of coral regrowth: 79%



Chance of coral regrowth: 13%

The study

Dr. Mumby, of Australia's University of Queensland, and four other scientists used a simulation model to study the effects of marine reserves and climate change on the largest coral reef in Belize. They focused on ecological resilience, which they defined as the odds that coral will regrow after a hurricane or coral bleaching event instead of being dominated by algae.

The researchers used the model to test two factors that could affect resilience. The first was the existence of a no-take marine reserve that would prohibit fishing of parrotfish, which eat algae and thereby help coral regrow. The second factor was climate change, which could lead to thermal stress in corals.

Effects of reserves and reduced emissions

The study found that, in the near term, reefs are six times more resilient to disturbance if parrotfish are protected: The probability of corals regrowing by 2030 was 0.13 (or 13 percent) without a reserve but 0.79 (or 79 percent) with one. (A probability of 1 denotes almost certainty.) This resilience is also important because it should increase the ability of corals to adapt to warming oceans. In addition, it should reduce the loss of ecosystem services that reefs provide, such as support for fisheries and coastal protection from storms.

Reductions in greenhouse gas emissions had little effect in the near term, but in the long term, the models showed that aggressive reductions improved coral reef resilience. Combining reductions with a no-take reserve increased resilience even further. With both measures in place, it took the average reef 25 years to degrade to the point where the area covered by live coral was less than 10 percent. In a scenario with no reserve and emissions increasing according to "business as usual," that process took only eight years.

Relevance beyond Belize

Parrotfish are important grazers of algae in many reefs beyond Belize. The study's results are potentially relevant to any reef where they or other key grazers are subject to fishing pressure. Protection could come from either a reserve or curbs on fisheries, such as the national parrotfish fishing ban Belize enacted in 2009.

Reference

Peter Mumby et al., "Operationalizing the Resilience of Coral Reefs in an Era of Climate Change," 2013, *Conservation Letters*, doi: 10.1111/conl.12047.

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