Buying time for coral reefs by reducing local threats

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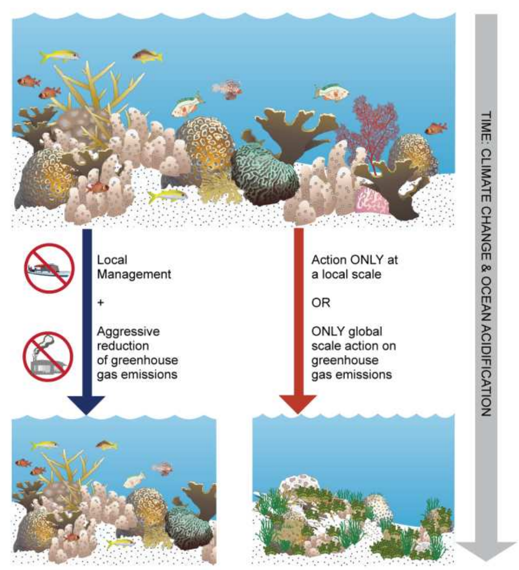
Coral reefs provide ecosystem services, such as coastal protection, fisheries and tourism that are vital to the livelihoods of millions of people. These services are dependent upon healthy living corals and the structure they create. Corals generate skeletons of calcium carbonate (limestone) as they grow which provide a natural breakwater and the complex three dimensional habitat that is essential to support the high biodiversity of coral reefs. Other processes (e.g., cementation by coralline algae) also add to the growth of reef structure, while bioerosion helps further create complexity and is essential in determining the balance between reef growth and disintegration.

Climate change is expected to reduce the ability of corals to form reef structure. Rising ocean temperatures are projected to disrupt growth rates for many corals and increase the frequency of coral bleaching. Ocean acidification will also slow coral growth and weaken reefs, at the same time as increasing the rate of bioerosion. In the face of such impacts, local efforts to improve reef health might seem hopeless. However, recent research has shown that local management of reefs is vital to maintain the continued net production of reef structure, and therefore the provision of the important ecosystem services that reefs provide.

The evidence

A modelling study of Caribbean coral reefs examined the effects of different scenarios of climate change and local management on the net growth of reefs. Two climate change scenarios were examined: one 'business-as-usual', where little attempt is made to reduce global greenhouse gas emissions, and an alternative scenario of aggressive cuts in greenhouse gas emissions. Local management scenarios involved protecting herbivores and reducing nutrient run-off onto the reef. Results showed that only a combination of local management action and aggressive greenhouse gas reductions resulted in reefs continuing to grow in the future. In all other scenarios, reef growth began to decline before the end of the century. Coral cover of 10% may represent a threshold, below which reefs shift from net growth to net erosion.



Both local management of reefs and global action to lower greenhouse gas emissions are needed to maintain structurally complex reefs and the important services they provide.

Reef growth

Caribbean reef growth (in terms of kg's of limestone generated per m2 of reef area per year) simulated until 2080. Under 'Business as usual' climate scenarios (top panels), all 20 simulated reefs went from growing at 1-2 kg/year in 2010, to eroding by 3 kg/year by

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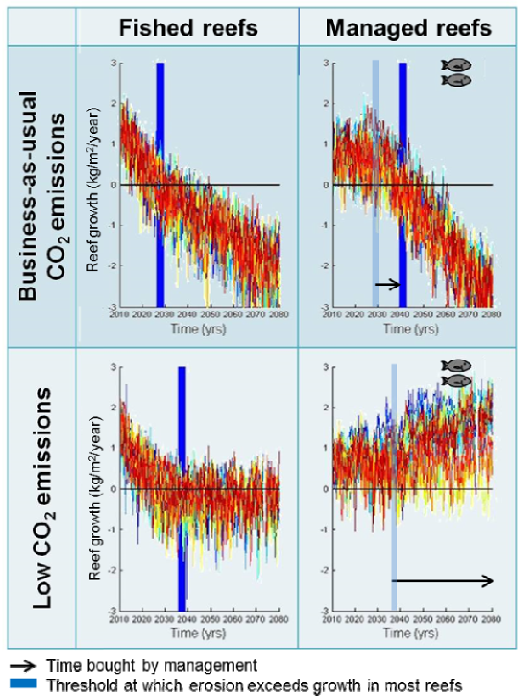
2080. However, the point at which reefs stopped growing (dark blue line) was delayed when reefs were locally managed to protect herbivorous fish and improve water quality. Where action was taken to limit GHG emissions (bottom panels), only managed reefs were able to maintain their growth rates until 2080.



Management implications

Effective local management is essential Protection of herbivores is vital for reefs to withstand predicted impacts of climate change. Although global action to reduce greenhouse gas emissions is essential to ease the effects of climate change on reefs, such efforts are not sufficient on their own to ensure reefs continue to exhibit net production of three dimensional structure.

Unprotected reefs will degrade quickly due to reduced coral growth and cover, and increased bioerosion. Although improved local management measures alone may not be sufficient to ensure continued growth of reef structure, such measures are vital for buying time for reefs while global action on climate change is negotiated. Local management efforts that protect herbivores and reduce nutrient run-off onto reefs will maximise the chances that healthy reefs and the services they provide are maintained in the future.

References

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