



Plenary Speech III

Vulnerability of global coral reef habitat suitability to ocean warming, acidification and eutrophication

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Abstract

Coral reefs are increasingly threatened by global and local stressors, with their responses varying based on environmental conditions. This study used coral reef occurrence data, representing long-term adaptation, combined with global environmental datasets to evaluate the impact of global stressors (sea surface temperature rise and ocean acidification, represented by aragonite saturation state, Ω_{arag}) and local stressors (nutrient enrichment from nitrate and phosphate) on coral reef habitat suitability. By determining the relative distance of coral communities to their regional environmental optima, we estimated changes in habitat suitability across the tropics in response to incremental stressor increases: a 0.1 °C rise in temperature, a 0.02 $\mu\text{mol/L}$ increase in nitrate, a 0.01 $\mu\text{mol/L}$ increase in phosphate, and a 0.04 decrease in Ω_{arag} . Our findings indicate that only 6% of coral reefs globally are resilient to both local and global stressors and could serve as temporary refugia. Local stressors threaten 22% of reefs, while global stressors affect 11%. The majority, 61%, are vulnerable to both types. Effective wastewater treatment could mitigate local eutrophication and expand temporary refugia to 28%, providing a crucial buffer while global efforts to address broader environmental changes continue.

Keywords

Coral reefs, eutrophication, global warming, habitat suitability, ocean acidification