

Technical development and adaptation strategy to define local environmental threshold for coral reef conservation in an era of high CO₂.

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[Abstract]

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Coral reef ecosystems, one of the major ecosystems in tropical and subtropical coastal areas, are threatened with degradation due to various environmental changes in addition to the effects of climate change. In this study, we performed field studies, laboratory experiments, molecular analysis, and statistical modeling to elucidate the response mechanisms of corals to environmental stresses and to elucidate the threshold of calcification limit for coral skeletal development. Our research aimed to geographically visualize the effects of combined stresses of climate change and local environmental loads on coral calcification, and to propose local environmental load thresholds required in each region.

The accumulated nutrient assessment developed in this study revealed the phosphate loading status of each region. The results showed that coral recruitment was also low in areas with high levels of accumulated nutrients due to anthropogenic impacts, leading to the establishment of thresholds that would ensure healthy coral growth. Using hydrological methods, we also succeeded in showing the threshold of phosphate loading required for terrestrial use, with consideration for future increases in CO₂. Molecular analysis also revealed the details of the environmental response of corals to nutrient loading and other environmental factors, as well as the actual bacterial load in the field. Furthermore, we have created a nutrient loading hazard map for coral calcification, which is expected to be a useful decision-making tool for future climate change and land use.

[References]

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