Abstract

[Project Information]

Project Title :	Evaluation of Ecosystem Functions of Vegetated Coastal Habitats and Their Use for Environmental Restoration of the Coastal Ecosystem and Reconstruction of Coral Reefs
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[Abstract]

Coral reefs often harbor characteristic vegetated habitats, such as seagrass/macroalgal beds and mangroves, within the lagoons they enclose. The objective of this study was to demonstrate the role of such vegetated coastal habitats in protecting corals from anthropogenic stressors imposed from land and to explore ways in which those habitats could be used to conserve and reconstruct coral reefs. Using field observations at some fringe reefs and aquarium experiments with naturally occurring model organisms, we demonstrated the importance of habitat-forming plants in mitigating anthropogenic nutrient and sediment loading from land and local ocean acidification due to elevated CO_2, which deteriorates corals. In case studies conducted at reef sites in Japan and Palau, the capacity of seagrass beds to remove excess nutrients from the water column and suppress sediment resuspension was determined quantitatively. Additionally, the potential consequences of seagrass loss, which is an ongoing worldwide problem, on the sediment-stabilizing and carbon-sequestering capacity was evaluated (Miyajima et al. 2025). A tandem-aquarium experimental system was constructed and used to examine the potential metabolic effects of seagrasses and macroalgae on the health and growth of corals (Listiawati and Kurihara 2023). We also demonstrated by incubation experiments the high capacity of seagrasses to change and regulate the microbial community in surrounding seawater, which was presumably attributable to the rapid turnover of the microbial loop driven by seagrass-derived organic matter. This intervening function of seagrasses in the seawater microflora contributes to sanitizing the reef

environment by removing potential pathogens. Furthermore, we successfully developed a three-dimensional hydrodynamic-ecosystem model of an actual fringing coral reef, with the capacity to quantitatively track the fate of terrestrially loaded nutrients and sediments and to visualize the spatiotemporal distribution of the stress-mitigating effects of the vegetated habitats and associated benthic systems. This model will help organize ecosystem management plans to enhance the resilience of coral reefs by manipulating associated vegetated habitats as an environmental buffer. Such a strategy will be useful for conserving natural sanctuaries, such as coral reefs, and can be applied as a nature-friendly and cost-effective way to environmentally manage aquaculture facilities, such as fish farms, toward sustainable operation.

[References]

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