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Establishing Ecological Redundancy Baseline for Hong Kong Mangroves Using Compound-specific Stable Isotopes

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Mangrove forests play a crucial role in nutrient and carbon cycling within coastal ecosystems, providing coastal protection and aiding in global climate mitigation. However, these vital ecosystems in Southeast Asia are facing threats from various anthropogenic stressors, such as urbanization and pollution caused by inadequate water management. Additionally, the ecological redundancy of mangrove forests is low due to limited species diversity and high functional richness, suggesting they can be vulnerable to minor losses in species diversity. This vulnerability can undermine their ecosystem services and lead to cascading effects in adjacent ecosystems.

Determining the food web is the first step in understanding species interactions and habitat functions within the ecosystem. Bulk stable isotope analysis (BSIA) of nitrogen and carbon isotopic composition has traditionally been used to assess trophic niches; however, reconstructing food webs with this method is challenging due to the complexity of nitrogen sources available to primary producers and consumers, particularly omnivores, which exhibit broad trophic spectra. Notably, omnivorous crabs are a prevalent invertebrate group in mangrove habitats. Recently, the emergence of compound specific isotopic analysis (CSIA) has facilitated more precise food source identification compared to traditional approach. Using this new technique, our previous study revealed that the ecological redundancy of Tung Chung mangroves, located on the west side of Hong Kong, could be lower than expected.

In this study, we expanded our sampling to include sites across both western and eastern regions of Hong Kong and collected additional floral and faunal samples. Our aim was to create a comprehensive database of mangrove fauna ecological redundancy. Integrating amino acid nitrogen isotopic analysis with traditional carbon and nitrogen isotope method enhances our resolution of the food web within mangrove habitats and improves our understanding of mangrove vulnerability to anthropogenic impacts. Such information will provide valuable insights for developing more effective conservation and restoration strategies for mangrove forests in Hong Kong.