

Seagrass meadows provide multiple benefits to adjacent coral reefs through various microhabitat functions

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ABSTRACT

Tropical seagrass meadows and coral reefs often function as interconnected marine habitats, but they are often studied and managed as homogenous units. As macrohabitats, seagrass meadows provide important benefits to adjacent reef ecosystems by acting as natural filters of sediments and nutrients, and by providing critical feeding, nursery, and refuge habitats for reef fishes and other fauna. Whilst the macrohabitat functions of seagrass meadows have been often acknowledged, their microhabitat functions have largely been neglected. The purpose of the study is to explore how seagrass meadows provide multiple benefits to adjacent coral reefs through various microhabitat functions. The paper reveals some of the diversity of microhabitats that seagrass meadows contain, such as macroalgal mats, rubble cavities, sand patches with sparse seagrass, anemone gardens, hard substratum, and sponges mixed with seagrass. We highlight the ways in which reef creatures have diversified and specialized in using these different microhabitats, and postulate that seagrass microhabitat diversity enhances the habitat function and faunal diversity of seagrass meadows.

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Introduction

Seagrass meadows play a critical ecological role in complex coastal food webs that encompass adjacent and interconnected ecosystems such as mangroves and coral reefs (Unsworth et al. 2008; Nagelkerken 2009; Du et al. 2015). However, seagrass meadows are in decline globally, with an about 7% annual loss in surface area, on average, since 1990 (Cullen-Unsworth and Unsworth 2018). Although seagrass meadows are widely considered as important feeding, nursery, and refuge habitats for fishes, invertebrates, and other animals, they have mostly been considered as homogenous habitats (Nordlund et al. 2018; Unsworth, Nordlund, and Cullen-Unsworth 2018). Whilst the effects, and contexts, of the structure components of seagrass meadows on fish assemblages have been studied (e.g. canopy structure, seagrass density, presence of food, shade, and mangrove roots; Verweij et al. 2006; Zarco-Perello and Enríquez 2019), very few studies have evaluated the importance of microhabitats within seagrass meadows for marine fauna. In this study, we reveal the wide range of microhabitats that exists in seagrass meadows, and their function for animals that live as adults on coral reefs, using photos from seagrass microhabitats taken in the South China Sea and the Coral Triangle region. This

provides a deeper understanding of the multiple scales at which connectivity exists between seagrass meadows and coral reefs, and the processes that underpin their exchange of fauna and their biodiversity.

Seagrass meadows are natural filters for adjacent, interconnected ecosystems

Seagrasses plants slow the flow of water as it moves across seagrass meadows (Koch and Gust 1999). This causes sediment particles to settle on the substratum, but suspended particles are also filtered out and settle on the seagrass leaves themselves (Photo 1.1–1.2). As such adjacent coral reefs as well as coral patches within seagrass meadows benefit from the improved water quality (Hemminga and Duarte 2000; Nagelkerken 2009).

Seagrass meadows provide microhabitats that act as nurseries for juveniles

Juvenile fishes and invertebrates are often associated in high abundances with structurally complex habitats like seagrasses (Heck, Hays, and Orth 2003). Seagrass meadows provide different types of microhabitats, such as macroalgal mats, rubble cavities, sand patches with sparse seagrass, anemone

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