

Review

Marine Autotroph-Herbivore Synergies: Unravelling the Roles of Macroalgae in Marine Ecosystem Dynamics

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Simple Summary: Invasive species are a leading hazard to marine ecosystems worldwide, coupled with climate change. Tackling the emerging biodiversity threat to maintain the ecological balance of the largest biome in the world has now become a pivotal part of the Sustainable Development Goals (SDGs). Marine herbivores are generally regarded as biological agents that restrict invasive species, and their efficiency depends on their dietary habits, especially the autotrophs they eat. Many researchers have found contradicting findings on the effects of nutritional attributes and novelty of autotrophs on herbivore eating behaviour. In light of the scattered literature on the mechanistic basis of autotroph-herbivore interactions, we provide a comprehensive review to fill knowledge gaps about synergies based on macroalgae, an important group of photosynthetic organisms in the marine biome that interact strongly with generalist herbivores. We also analyse macroalgal defence measures against herbivores, underlining unique features and potential roles in maintaining marine ecosystems. The nutritional qualities, shape, and novelty of autotrophs can alter herbivore feeding behaviour. Future research should explore aspects that can alter marine autotroph-herbivore interactions to resolve inconsistent results of specific features and the uniqueness of the organisms involved.

Abstract: Species invasion is a leading threat to marine ecosystems worldwide, being deemed as one of the ultimate jeopardies for biodiversity along with climate change. Tackling the emerging biodiversity threat to maintain the ecological balance of the largest biome in the world has now become a pivotal part of the Sustainable Development Goals (SDGs). Marine herbivores are often considered as biological agents that control the spread of invasive species, and their effectiveness depends largely on factors that influence their feeding preferences, including the specific attributes of their food—the autotrophs. While the marine autotroph-herbivore interactions have been substantially discussed globally, many studies have reported contradictory findings on the effects of nutritional attributes and novelty of autotrophs on herbivore feeding behaviour. In view of the scattered literature on the mechanistic basis of autotroph-herbivore interactions, we generate a comprehensive review to furnish insights into critical knowledge gaps about the synergies based largely on the characteristics of macroalgae; an important group of photosynthetic organisms in the marine biome that interact strongly with generalist herbivores. We also discuss the key defence strategies of these macroalgae against the herbivores, highlighting their unique attributes and plausible roles in keeping the marine ecosystems intact. Overall, the feeding behaviour of herbivores can be affected by the nutritional attributes, morphology, and novelty of the autotrophs. We recommend that future research should carefully consider different factors that can potentially affect the dynamics of the marine autotroph-herbivore interactions to resolve the inconsistent results of specific attributes and novelty of the organisms involved.

Keywords: autotroph-herbivore interactions; feeding behaviour; macroalgae; marine herbivores; nutrient acquisition



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