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Top-down and bottom-up controls on sediment organic matter composition in an experimental seagrass ecosystem

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ABSTRACT: We tested the singular and interactive effects of resource availability (light) and community composition (food chain length and herbivore species richness) on eelgrass (*Zostera marina*) ecosystem properties and functioning with an experimental mesocosm system. Food chain length was manipulated through the presence or absence of blue crab (*Callinectes sapidus*) predators, whereas grazer species richness varied across three levels (zero, two, or four crustacean species). We found important and interacting effects of bottom-up and top-down forcings on sediment organic matter (SOM) composition. Light increased eelgrass and algal biomass and sediment organic carbon and nitrogen content. Increasing grazer diversity generally decreased algal biomass and ecosystem production but interacted with food chain length (i.e., presence of predatory crabs) and light. Predators generally increased algal biomass and ecosystem production through a trophic cascade, which was stronger at high grazer diversity and under ambient light. SOM composition, determined with fatty acid (FA) biomarkers, was sensitive to all manipulated variables. Increasing grazer species richness often decreased the contributions of FAs derived from plant and algal sources, whereas increasing light had the opposite effect. Food chain length was generally a less important determinant of SOM composition than light, although predators did increase FAs representative of heterotrophic bacteria. Overall, resource availability and epibenthic community composition strongly influenced organic matter cycling, SOM composition, and the bacterial community in seagrass-bed sediments.

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