

Portfolio Effects in Nearshore Primary Producers and Their Relation to Environmental Drivers

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Abstract

Ecosystem functions can be amplified or dampened by species responses to biotic and abiotic factors in the environment. In a group of marine primary producers, consisting of phytoplankton and kelp species, we tested for the features indicating Jensen's Inequality and synchronous or asynchronous dynamics that would indicate a Portfolio Effect. Nonlinearities that would drive an effect through Jensen's Inequality were weak and the relationship between environmental drivers and species fluctuations were often highly variable. Asynchrony dominated the multi-species assemblage, providing evidence of Portfolio Effects. The two canopy kelp species, however, showed temporal and spatial synchrony. Canopy kelp species had strong spatial autocorrelation up to 50 km. Spatial synchrony occurred over almost 300 km, with increased strength in spatial synchrony in two recent decades compared to the early 1990s. This potential Moran Effect, where an environmental variable generates large-scale biological synchrony, may increase the vulnerability of kelp populations into the future.

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