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TITLE: Both rare and common species make unique contributions to functional diversity in an ecosystem unaffected by human activities

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ABSTRACT:

Abstract Aim Rare species typically contribute more to functional diversity than common species. However, humans have altered the occupancy and abundance patterns of many species?the basis upon which we define ?rarity.? Here, we use a globally unique dataset from hydrothermal vents?an untouched ecosystem?to test whether rare species over?contribute to functional diversity. Location Juan de Fuca Ridge hydrothermal vent fields, Northeast Pacific Ocean. Methods We first conduct a comprehensive review to set up expectations for the relative contributions of rare and common species to functional diversity. We then quantify the rarity and commonness of 37 vent species with relevant trait information to assess the relationship between rarity and functional distinctiveness?a measure of the uniqueness of the traits of a species relative to traits of coexisting species. Next, we randomly assemble communities to test whether rare species over?contribute to functional diversity in artificial assemblages ranging in species richness. Then, we test whether biotic interactions influence functional diversity contributions by comparing the observed contribution of each species to a null expectation. Finally, we identify traits driving functional distinctiveness using a distance?based redundancy analysis. Results Across functional diversity metrics and species richness levels, we find that both rare and common species can contribute functional uniqueness. Some species always offer unique trait combinations, and these species host bacterial symbionts and provide habitat complexity. Moreover, we find that contributions of species to functional diversity may be influenced by biotic interactions. Main conclusions Our findings show that many common species make persistent, unique contributions to functional diversity. Thus, it is key to consider whether the abundance and occupancy of species have been reduced, relative to historical baselines, when interpreting the contributions of rare species to functional diversity. Our work highlights the importance of testing ecological theory in ecosystems unaffected by human activities for the conservation of biodiversity.

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