Nestedness of trophic links and biological traits in a marine food web

To understand the consequences of changes in diversity we need to consider the functional characteristics (traits) of species, as well as the trophic setting the taxa are part of. These two approaches have rarely been conducted in an integrated manner, although we know that trophic structure is an important driver of community functioning, and that biological traits, in particular body size, in turn determine which species interact. In this study, we assessed how structural food-web attributes (nestingness, generality, vulnerability) relate to multiple biological traits of interacting taxa. We found that the inherent complexity of a shallow subtidal trophic network of benthic macroinvertebrates and fish in the northern Baltic Sea contained identifiable and specific patterns: the feeding interactions were highly nested, both in terms of prey taxonomy and biological traits, suggesting trophic redundancy rather than trophic complementarity. Both trait diversity and trait redundancy of interacting species increased as a function of predator generality and prey vulnerability. These central food-web metrics, predator generality and prey vulnerability, were dependent on body size, which emerged as a fundamental trait. Body size, environmental habitat and body design were the relatively most important prey traits distinguishing between diets of smaller vs. larger predators, revealing morphological and spatial dimensions of predator trophic niches in the study community. We suggest continued development of an approach integrating functional diversity with the food web to effectively assess community structure, function and species interactions, and ultimately identify ecological impacts in communities undergoing environmental change in the Anthropocene.

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