

Trophic levels colonize sequentially but effects of habitat size and quality are transient.

Acta Oecologica (accepted – Nov 2012)

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Abstract

Ecologists study assembling communities to understand mechanisms of community-level patterns such as trophic structure. During assembly, the incidence of each trophic level is conditional upon available resources such as prey, area and productivity. Larger, more productive habitats may have more resources to attract and to support greater species diversity, abundance, and more trophic levels. Predator trophic breadth and prey incidence may influence colonization order because obligate specialists have stricter prey dependencies than generalists do. In a system of stacked specialists, colonization may occur sequentially by trophic level because prey must colonize before the next higher trophic level. Sequential colonization ordered by trophic level and by breadth were tested with a field experiment and a Monte Carlo simulation. Community assembly was observed for an aphid food-web module composed of nine specialist and generalist predators colonizing plots seeded with California native annuals. To test the importance of habitat quality and resources, plots were manipulated for size (1 m² and 10 m²) and productivity (+/0 fertilizer), and sampled for colonists many times during the growing season of 2003. Specialists from higher trophic levels colonized after their prey had arrived in the field experiment only, providing field support for the hypothesis of sequential colonization ordered by trophic level during community assembly. Intriguingly, generalist predators colonized later than specialists, despite the high and early availability of aphid prey. This finding contradicts the assumption that specialists are disadvantaged by a narrow trophic breadth. Initially, predator and prey densities increased on fertilized plots, but later this pattern was observed only on small plots. Patterns of sequential colonization order by trophic level and breadth were demonstrated during community assembly, but the transient responses of colonizers to habitat size and productivity suggests that habitat resource effects deserve further study to determine their influence on trophic structure during community assembly.