SCCWRP #1483

Fish community trait dissimilarity dampens synchronizing effect of environmental fluctuations

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ABSTRACT

Spatial synchrony, defined as the synchronized temporal fluctuations in species or community abundances across different locations, has implications for ecological persistence and stability and has received renewed attention in the context of rapid environmental changes. It is shaped by both biotic and abiotic drivers, with shared environmental fluctuations expected to promote synchrony in population dynamics, and dissimilarity in species composition expected to enhance asynchrony. Exploring spatial synchrony using trait-based approaches may provide new insights into the underlying drivers of community dynamics. Here, we investigated the drivers of spatial synchrony in the thermal affinity of fish communities (i.e., thermal community synchrony) within river basins in Europe, Australia, and the United States using multi-membership mixed models accounting for spatial, environmental and community dissimilarity. Our results show that synchrony in fish community thermal affinity decreases with watercourse distance, similar to spatial decays documented for spatial synchrony in population abundance. Thermal community synchrony also increases with synchrony in air temperature, emphasising the role of environmental forcing. However, community composition moderated this forcing, such as greater trait dissimilarity dampened the synchronizing effect of temperature. These findings highlight the interconnected influence of environmental synchrony and community trait composition and the importance of integrating both environmental and community-level factors to better understand metacommunity responses to spatially synchronized environments.