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Diversity consequences of oviposition: applying coexistence theory to aquatic insect communities

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Many insects make specific choices in where and how they lay eggs, and this produces strikingly variable patterns in egg distribution across landscapes. Hydrobiosid caddisflies lay eggs on emergent rocks in streams, with high variation in numbers of egg masses per rock and differing oviposition preferences among species. Such distinctive life-history differences are often hypothesised to help species coexist but are not, in themselves, sufficient, and theoretical links to empirical patterns are often absent. Here, we apply coexistence theory to caddisfly communities using community dynamics models. We illuminate the mechanisms by which oviposition patterns can affect the maintenance of diversity, identifying the critical role of interactions with life-history characteristics in later life stages.

The influence of oviposition on coexistence hinges on how patterns of egg distribution influence density-dependent feedback loops in later life stages. Highly variable and species-specific oviposition patterns result in spatial separation of eggs. However, other life history determines the coupling of those patterns with density-dependence and so their impact on diversity maintenance. For example, low larval dispersal away from natal rocks strongly couples egg inputs with the competitive environment experienced by larvae. This coupling promotes coexistence when species have different oviposition preferences, separating their larvae in the benthos. However, in scenarios with increased larval dispersal, larval interactions are less influenced by egg inputs, limiting the effects of oviposition on coexistence. Our approach illuminates the circumstances under which oviposition may affect coexistence and demonstrates the utility of a coexistence theory approach for investigating life histories in new communities.