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# The interplay between population stability and food-web topology predicts the occurrence of motifs in complex food-webs

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## ABSTRACT:

In this paper, we analyzed the occurrence of motifs (modules) in empirical food-webs from different ecosystem types. Differently from previous studies, our analysis did not rely on randomized networks with specific a priori assumptions, which has been demonstrated to produce inconsistent patterns. We aimed to evaluate the interplay between population dynamics and food-web topology, and its consequences to module occurrences in complex food-webs. We evaluated 13 arrangements of three-species modules and 199 arrangements of four-species modules. For each module, we assembled a corresponding Jacobian predation matrix, and evaluated the arrangements expected to persist after a disturbance in the equilibrium of the populations dynamics (local stability). Our general results were that (1) a limited set of stable arrangements occurs most frequently; (2) the omnivory module is the only three-species module expected to occur both in the stable and unstable region; (3) connectance and omnivory affects the proportion of stable modules; and (4) the type of ecosystem influence the proportion of stable modules. Further, we demonstrated that food-web topology and

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