Top-down predation increases species turnover and structural stability in ecological communities

A mechanistic understanding of species coexistence is a central pursuit in ecology. One factor known to enable coexistence is temporal variation of an environmental variable. Prior eco-evolutionary models show that seasonal temperature fluctuation can facilitate coexistence through the *storage effect* – species with differing traits can coexist if their gains in good times exceed their losses in bad times. However, the role of predation in shaping coexistence and diversity is less well understood. We compare two models, with and without predation, to assess its effects on emergent community structure and stability. Our analysis shows that introducing a predator increases species turnover (β-diversity). This effect is mediated by a decrease in average instantaneous species diversity (α-diversity) alongside a relatively smaller decrease in time-integrated species diversity (γ-diversity); the resulting shift in their ratio drives higher average turnover. We also find that predation provides communities with increased structural stability – widening the range of environments under which communities can stably coexist. Interestingly, this increase in turnover does not translate into more species-rich evolutionarily stable communities. Predation supports more species richness at lower temperature amplitudes in our ecological model, but these communities fail to persist once thermal optima are allowed to evolve. Our study implies that predation can foster communities that are more robust to varying amplitudes of temperature fluctuations, raising an exciting empirical question: does predation allow communities to remain qualitatively unchanged as temperature fluctuations intensify?