Non deterministic modeling of food web dynamics

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Abstract: A conventional way to build numerical models of multiple species and their trophic interactions is to assemble a food web topology, where species are nodes and trophic interactions are flows, and subsequently define rules and parameters which characterise individual species dynamics and the flows of mass (or energy) between them. While early models of this kind were build on purely deterministic principles, current models generally incorporate a stochastic component in addition to a deterministic skeleton.
In the present contribution, we show that it is possible to construct such models without need for a deterministic skeleton. Instead, the flows of mass (or energy) between species can be considered to be purely stochastic if they are bounded according to rules pertaining to thermodynamics and physiology.
This model construction based on 'chance and necessity', requires a minimal amount of assumptions and parameters, and is capable of reproducing patterns of population variability while accounting for balance of mass/energy at the food web level. This can serve as a reference against which the performance of deterministic models can be evaluated.