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# Appendix B from A. C. Iles and M. Novak, “Complexity Increases Predictability in Allometrically Constrained Food Webs” (Am. Nat., vol. 188, no. 1, p. 87)

## Trophic versus Dynamical Connectance

The measure of connectance we report is trophic connectance, or the proportion of all possible direct feeding links ($L$) between species ($S$), $C = L/S^2$. Calculated from the feeding matrix of who-eats-whom, trophic connectance includes only direct feeding interactions of consumers on their resources, including cannibalistic links. Increasing the connectance of a food web results not only in a greater link density but also in a greater proportion of generalist versus specialist consumers. The multispecies functional response describes how the realized fraction of a generalist consumer’s maximum ingestion rate is diffused across its resources. The ingestion rate of each resource species depends not only on the biomass density of the focal resource but also on the biomass densities of a generalist consumer’s other resources. Thus, the multispecies functional response causes an interaction modification (Wootton 1994*b*; Kéfi et al. 2012), in the form of a weak apparent mutualism in which the presence of an alternate prey modifies the strength of predation for the other prey (Abrams and Matsuda 1996; Yodzis 2000).

Although conceptually apparent mutualisms are an interaction modification, they appear as direct effects in the community matrix because they do not require a change in the biomass density of a third, intermediate species. That is, by the mathematical definition of the community matrix (see “Community Matrix”), its elements represent the direct effect of species $j$ on species $i$, with all other species abundances held constant. In the case of apparent mutualism, the intermediate species is the consumer that the prey species share in common. Competition between basal producers also appears as a direct effect between producers in the community matrix, even though, conceptually, competition is an indirect effect. In this case, the intermediate “species” is the system’s overall carrying capacity, which is shared by all producers. Similarly, intraspecific effects do not depend on an intermediate species. Thus, apparent mutualism, producer competition, and intraspecific effects appear as direct effects in the community matrix.

The dynamical connectance of a network is a measure of connectance that includes all effects as encapsulated by the nonzero elements of the community matrix. These include not only consumer-resource effects but also intraspecific effects, apparent mutualisms, and competition between producers. Dynamical connectance thus reflects both the direct links between species (as reflected in trophic connectance) and any other effects that do not require a numerical response from an intermediate species. We use the term “dynamical” connectance because it is the community matrix that encapsulates the dynamical properties of the system. As opposed to trophic connectance, dynamical connectance reflects the actual pathways along which perturbations propagate. In linear Lotka-Volterra models, dynamical connectance and trophic connectance are equivalent. However, in multispecies allometric trophic network models, as trophic connectance increases consumers feed on wider range of resources, and the resulting dynamical connectance increases even faster (fig. B1).

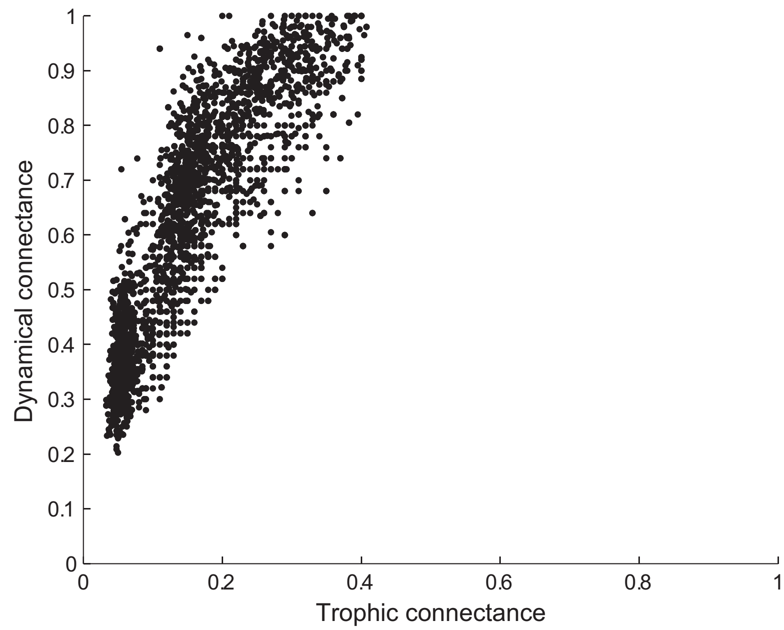


**Figure B1:** Relationship between each network's trophic connectance and its effective dynamical connectance.