Structural Features and the Feasibility of Lotka-Volterra Food Webs without Omnivory: a Systematic Analysis

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We study the effect on feasibility [1] of structural features of Lotka-Volterra food webs (number of species, connectance, number of trophic levels and number of basal species). We include webs with more species on a given trophic level than on the trophic level below (lopsided webs). Additionally, all webs with a maximum number of five species without omnivory are studied (Figure 1), the effect of each feature on feasibility is isolated and convergence of the Monte Carlo distributions of return times is guaranteed. Productivity of each web is also calculated and related to feasibility and resilience [2].

Due to its low values in all webs (not more than 30%), feasibility is shown to be significantly demanding for Lotka-Volterra food webs, demonstrating that it has been understudied in previous studies. Local stability [3] is almost irrelevant (nearly all- feasible food webs are locally stable). Relations between structural features and feasibility are not strong, since allowing other features to vary additionally other than from the feature under study often changes the relation. Existing relations are all inverse (an increase in every feature is associated to a decrease in feasibility).

So the interplay of feasibility and resilience must be relevant for the existence of webs in the real world. However, results indicate no relation between productivity, feasibility and resilience. Together with the low values of feasibility obtained, this contradicts previous results [4]. One of the explanations for this fact may be the effect of isolation of a single species in the second trophic level, resulting from the increase in number of basal species, and tending to cause extinction of basal species. But other features are certainly involved.

The effect on feasibility of the invasion of an existing web by a top predator will almost certainly be negative, since both numbers of species and of trophic levels will increase.

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The limitation in this study of species number to five has the consequence that some of the relations with only one feature varying are analysed based on a relatively small number of webs; therefore, future work will include webs with greater number of species.

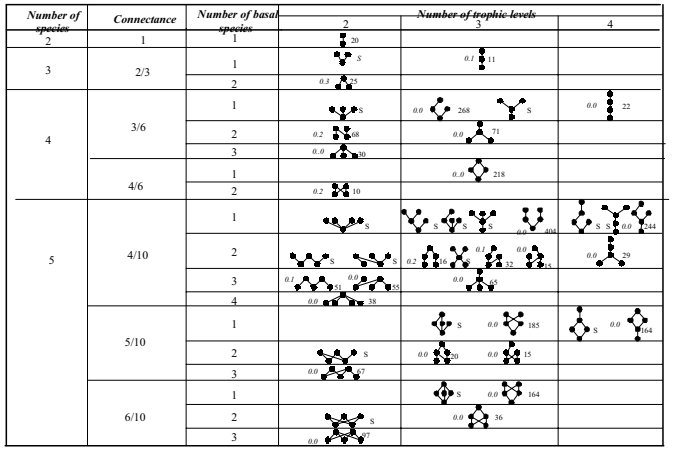

Figure 1: Characteristics of Food Webs studied. Feasibility of each web is on its left and median maximum return time (or an "S" in the case of singular webs) is on its right.

References

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