

Species abundance distributions: moving beyond single prediction theories to integration within an ecological framework

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Abstract

Species abundance distributions (SADs) follow one of ecology's oldest and most universal laws—every community shows a hollow curve or hyperbolic shape on a histogram with many rare species and just a few common species. Here, we review theoretical, empirical and statistical developments in the study of SADs. Several key points emerge. (i) Literally dozens of models have been proposed to explain the hollow curve. Unfortunately, very few models are ever rejected, primarily because few theories make any predictions beyond the hollow-curve SAD itself. (ii) Interesting work has been performed both empirically and theoretically, which goes beyond the hollow-curve prediction to provide a rich variety of information about how SADs behave. These include the study of SADs along environmental gradients and theories that integrate SADs with other biodiversity patterns. Central to this body of work is an effort to move beyond treating the SAD in isolation and to integrate the SAD into its ecological context to enable making many predictions. (iii) Moving forward will entail understanding how sampling and scale affect SADs and developing statistical tools for describing and comparing SADs. We are optimistic that SADs can provide significant insights into basic and applied ecological science.