**Cover letter**

Dr. Tim Coulson

Editor-in-Chief, Ecology Letters

DATE

Dear Dr. Coulson,

We are writing to submit the manuscript [ms title] by Renata Diaz, Hao Ye, and S.K. Morgan Ernest as a Letter for your consideration.

The species abundance distribution (SAD) is one of the most well-known patterns in ecology, exhibiting a nearly ubiquitous ‘hollow curve’ shape with few abundant species and many rare species (McGill et al. 2006, *Ecology Letters*). This pattern has played a central role in the comparison of ecological theories (e.g., refs), but its utility has been questioned based on accumulating evidence that the ‘hollow curve’ is actually a statistical artefact that emerges from simply dividing individuals into species (Locey & White 2013, *Ecology Letters*). While the primary structure of the SAD may be a statistical artifact, ecological processes could still shape more subtle aspects of the SAD, providing an empirical signal of ecological processes overlaid on the statistically generated hollow-shaped curve.

In this paper, we develop novel methods to explore whether ecological SADs exhibit consistent deviations from their expected statistically-generated shapes that reflect ecological processes. We build on pioneering work by Locey and White (2013, *Ecology Letters*) by developing novel approaches to efficiently characterize the full distribution of shapes that would emerge from statistical processes for 24,500 empirically sampled communities, and evaluate (1) whether observed SADs consistently deviate from these statistical baselines, and (2) how our statistical power to detect deviations between observations and the baseline differs between small and large communities. We show that empirical SADs for large communities deviate consistently from the SADs that emerge from strictly statistical processes. However, we find that small communities exhibit high variation in their statistical baselines, which greatly reduces the power to detect deviations between empirical SADs and the statistical expectation. This work highlights two novel avenues for studying and interpreting the SAD, and macroecological patterns more broadly. First, our method isolates the ecological signal in the SAD, which will allow the ongoing use of the SAD as a test of ecological theories. Second, while we can leverage statistical baselines in macroecology to isolate ecological signals from statistically generated patterns, this approach is sensitive to the size of the system being studied and will therefore be more useful in larger communities with high abundances and large numbers of species.

Thank you for your time and consideration.

Sincerely,