Body size expectation of from truncated Pareto with ‘true’ lower bound

James R. Junker1,2,✉, Jeff S. Wesner3, Justin Pomeranz4, and Vojsava Gjoni5

1 Dept. of Biological Sciences, University of North Texas, Denton, TX USA  
2 Advanced Environmental Research Institute, University of North Texas, Denton, TX USA  
3 usd  
4 cmu  
5 ital

✉ Correspondence: [James R. Junker <[james.junker@unt.edu](mailto:james.junker@unt.edu)>](mailto:james.junker@unt.edu)

The expectation (i.e., mean) for the double-truncated Pareto distribution, defined on the interval with shape parameter -1 is:

The expectation, or mean, body size, , can then be described as:

From here we make a few simplifying assumptions to model the estimated total abundance, , mean body size, , and total biomass, for each sample based on the estimated of the community: 1) similar processes structure the community for body sizes below the modeled lower body size threshold (*aka* ) and the lower than anticipated abundance between the biological lower body threshold, , are due entirely to sampling inefficiency, not different ecological factors. From this we can use the estimated from our truncated Pareto model in the range to predict the mean body size from the body size range using equation 2 and replacing with . 2) the sampled density observed between is proportional to the density of individuals in the mass range . From here, we can re-express the total density, , as if we wanted to calculate densities within portions of the range. Specifically, is re-expressed as the density of individuals observed multiplied by the probability density function (eqn. 1). represents the density of individuals over this interval and therefore the pdf sums to 1 by definition. We can then estimate the proportional multiplier to adjust over the new interval by taking the ratio of the pdfs multiplied by the observed density:

From these new estimates, we can also estimate the total biomass, by multiplying our new estimate of abundance by our new estimate of the expected (mean) body size, .