

Joint probability of abundance ( $n$ ) and  
metabolic rate ( $\varepsilon$ )

$$R(n, \varepsilon) = \frac{1}{Z} e^{-\lambda_1 n} e^{-\lambda_2 n \varepsilon}$$

$\lambda_1$  and  $\lambda_2$  are Lagrange multipliers from  
constrained entropy maximization

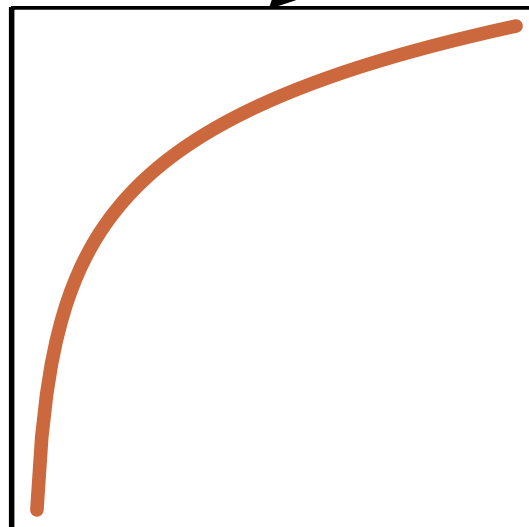
$$S_0 \sum_n \Pi(0|n) \int R(n, \varepsilon) d\varepsilon$$

$\Pi$  comes from entropy maximization  
across space

$$\int R(n, \varepsilon) d\varepsilon$$

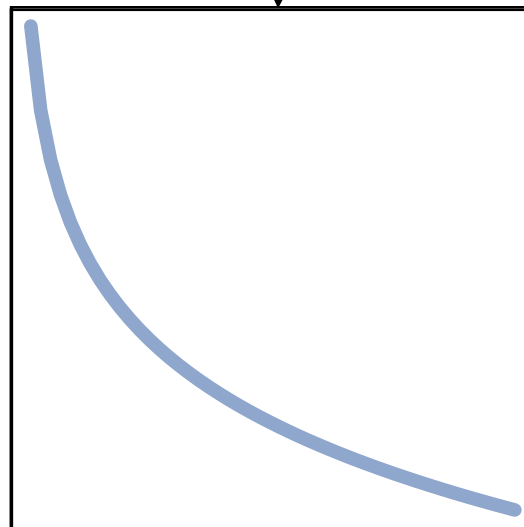
$$\frac{S_0}{N_0} \int n R(n, \varepsilon) dn$$

Species



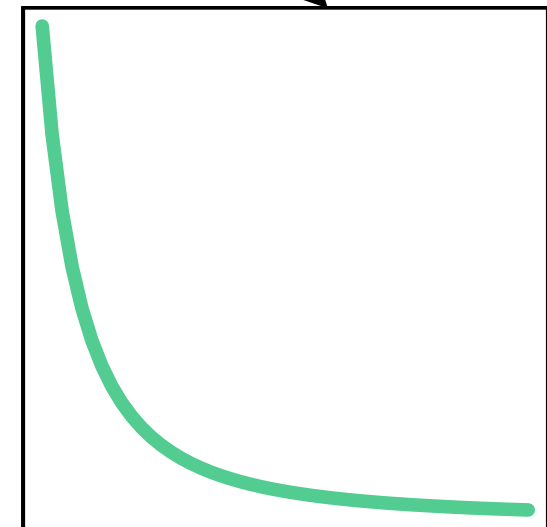
Area

Probability



Abundance

Probability



Metabolic rate