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Predator-prey biomass relationships: a role for predator density dependence?

Abstract

Recent empirical research has shown that increasing ecosystem productivity leads to an increase in the proportion of biomass at lower trophic levels. Thus as prey species increase in abundance/biomass their consumers also increase but at a much reduced rate. Indeed the general empirical results link predator biomass (P) to prey biomass (N) as $P \sim N^k$, where $k < 1$ for most ecosystems studied. Surprisingly, ecological theory does not provide an immediate answer as to how this relationship may occur. I will consider the potential roles for density dependence operating at the level of the predator/consumer to generate these sub-linear increases in biomass at higher trophic levels. Through analyses of simple ecological models I will outline some criteria for generating the empirical pattern and compare these predictions to the rare cases where the models have been applied to data.