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Size-related Effects of Physical Factors on Trophic Interactions

Predator and prey interactions are the basis of food web studies and are one of the most important processes acting on the community structure. It is well known now that a given predator feeds on a few prey species, which are only a subset of all available species within the same ecosystem. However, constraints driving prey choice remain challenging to define. Body size is often used as a descriptor of trophic position, but predator and prey body size differences vary widely between aquatic and terrestrial habitats. In this study, we consider how physical aspects of a habitat medium (such as density and viscosity) related to body size can predict the optimal range of prey size for a given predator. Our model leads to several interesting conclusions. First, swimming or flying predators are more constrained than predators living on the floor. Thus, the range of edible prey is narrower for swimming and flying predators. Second, predator strategy (e.g., hunt, ambush, scavenger) influences the range of prey this predator can feed on. Last, the results fit available data, which tends to prove that physical constraints play a major role in predator and prey relationship. The last point is usually neglected in predator and prey studies. These results will be used to parameterize a food web model. It will allow investigating how physical factors can affect the size structure of food webs.