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Optimal foraging strategies

Nutritional constraints are common as food resources are rarely optimally suited for grazing species. Elemental mismatches between trophic levels can influence population growth and foraging behaviors. Grazing species, such as Daphnia, utilize optimal foraging techniques, such as compensatory feeding. Here, we develop two stoichiometric producer–grazer models, a base model that incorporates a fixed energetic foraging cost and an optimal foraging model where energetic foraging costs depend on food nutritional content. A variable energetic foraging cost results in cell quota-dependent predation behaviors. Analyzing and comparing these two models allows us to investigate the potential benefits of stoichiometric compensatory foraging behaviors on grazer populations. Optimal foraging strategies depend on environmental conditions, such as light and nutrient availability. In low-light conditions, fixed energetic foraging appears optimal regardless of the nutrient loads. However, in higher light conditions and intermediate nutrient loads, grazers utilizing compensatory foraging strategies gain an advantage. Overall, grazers can benefit from compensatory feeding behaviors when the food nutrient content of their prey becomes low or high. At the end of the talk, I will briefly mention a discrete-time version in comparison with the continuous-time version.