

# Sensitivity of herbivorous zooplankton to phosphorus-deficient diets: Testing stoichiometric theory and the growth rate hypothesis

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ABSTRACT: Stoichiometry and growth rate variation are related aspects of the ecology and evolution of consumer-resource interactions. In zooplankton, these concepts have been explored primarily in a few species of *Daphnia*. We used growth bioassays and changes in animal P content to quantify the sensitivity of four herbivorous cladoceran species to algal resources representing a gradient in C: P ratios ranging from 140 to 1,000, offered at both low and high food levels. Supplements of phosphate, *Synechococcus*, or P-sufficient algae were used to test for P, energy, and fatty acid limitation. Phosphorus assimilation was estimated by isotope techniques (32P) to test the hypothesis of digestion resistance in P-limited algae. The cladoceran species differed in sensitivity to P deficiency at both low and high food levels, although sensitivity was less at low food. The P content of the two Daphnia species changed substantially along the C: P ratio gradient, contradicting the notion of strict homeostasis, whereas the two other cladoceran species showed tight P homeostasis. Consistent with stoichiometric theory, the two species with the highest P content were also more sensitive to P deficiency. Growth rate was related to P content across the four species at the high food level and at low C: P ratios, supporting the growth rate hypothesis. The addition of supplements to P deficient algae improved animals' growth rates, showing both P and energy limitation, but no evidence for fatty acid limitation. Lower assimilation efficiency for P-deficient algae suggests that digestion resistance can be a factor in the food quality of P-deficient resources.

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