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Herbivory on freshwater macrophytes

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ABSTRACT

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Conventional wisdom holds that live macrophytes are rarely consumed and are functionally unimportant in aquatic food webs. With a review of the literature, I first demonstrate that macrophyte biomass, productivity, and species composition is often influenced by a variety of vertebrate and invertebrate grazers. Many grazers destroy much more macrophyte tissue than they eat. Contrary to conventional wisdom, live macrophytes are engaged in aquatic food webs, but the functional importance of grazing remains largely untested. Second, I evaluate the hypothesis that macrophytes are a poor quality food (low in protein). Nitrogen content (as a percentage of dry weight), as summarized from published literature, differs little among algae, emergent macrophytes, floating macrophytes, submersed macrophytes, trees, terrestrial forbs, and terrestrial grasses. Thus, nitrogen content could not be a reason to expect low herbivory on macrophytes. Third, I present previously unpublished data on the selectivity of crayfish grazing. A correlational analysis of the grazing hierarchy of crayfish and published hierarchies of other grazers (moose, carp, snails, and crayfish) suggest that herbivores have apparently similar selectivities among macrophyte species. Previously unpublished (for crayfish) and published proximate and mineral analyses of macrophytes eaten by grazers suggest no basis for selectivity by crayfish and other grazers, with the exception of a preference by moose for high sodium and protein. However, a correlational analysis of independently published grazer preferences and plant tissue phenolic and alkaloid concentrations suggests that phenolic, but not alkaloid, content is negatively related to grazing preference. Finally, I point out the need for unifying approaches in the study of freshwater herbivory. To understand the influence of herbivory (relative to other biotic and abiotic factors) on macrophyte populations and assemblages, extensive comparisons of grazing damage across environmental gradients and across macrophyte and grazer species must be made. Susceptibility to grazers must be evaluated in light of the contrasting life history strategies evident in different macrophytes. Reasonable starting points for general approaches to macrophyte–herbivore interactions may include the apparency and resource availability models developed for terrestrial plant–herbivore interactions. Given the apparently negative relationship between grazing preference and phenolic content of macrophytes, more investigation of the role of secondary compounds is necessary.