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Sources of Carbon for the Microbial Loop

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Comparative and Experimental Approaches to Top-Down and Bottom-Up Regulation of Bacteria

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Abstract. The regulation of bacterial community biomass and productivity by resources and predators is a central concern in the study of microbial food webs. Resource or bottom-up regulation refers to the limitation of bacteria by carbon and nutrients derived from allocthonous inputs, primary production, and heterotrophic production. Predatory or top-down regulation refers to the limitation of bacteria below levels supportable by resources alone. Large scale comparative studies demonstrate strong correlations between bacterial productivity and biomass, suggesting significant resource regulation. Comparisons of the abundances of heterotrophic flagellates and bacteria, however, imply that in some cases there may be top-down regulation of bacteria in eutrophic environments. Experimental studies in lakes support the importance of resource regulation and reveal little top-down control from protozoans. Increases in bacterial abundance and production with nutrient enrichment were limited in enclosure experiments with high abundances of the cladoceran, *Daphnia*. Regulation of bacteria by *Daphnia* may occur in many lakes seasonally and prevail in some lakes throughout the year where these animals sustain dense populations. In most situations, however, bacteria appear to be limited primarily by resources.