Regulation of bacterial biomass and community structure by metazoan and protozoan predation

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ABSTRACT: We performed food web manipulation experiments in three eutrophic *Daphnia*-dominated ponds, to compare the predation impact on planktonic bacteria exerted by metazoan and protozoan bacterial consumers. We analyzed the bacterial morphological composition by image analysis and the taxonomic composition by fluorescent in situ hybridization with group-specific oligonucleotide probes. The removal of *Daphnia* always resulted in a microbial succession in which first free-living bacteria and then heterotrophic nanoflagellates (HNFs) increased. Distinct stages of bacterial grazing either exclusively by *Daphnia* or by HNFs allowed a quantitative and qualitative comparison of their predation impact on the bacterial assemblage. Both bacterial consumers showed a strong size-selective impact that shifted the free-living bacterial community structure toward small cells. Suppression of bacterial biomass below the carrying capacity was similar with *Daphnia* or HNFs in one experiment and was significantly stronger with *Daphnia* as bacterial consumer in two experiments. This was due to the fact that bacteria that were resistant to protozoan predation partially compensated grazing mortality. Bacteria attached to aggregates and detrital particles were more important as grazing-resistant forms than bacterial filaments and constituted up to 50% of total bacterial biomass at the end of the experiments. Changes in predation pressure were also associated with shifts in bacterial community composition. Bacteria belonging to the beta subclass of the class Proteobacteria and to the Cytophaga/Flavobacterium group dominated originally. The latter were most strongly reduced by HNF grazing, whereas other groups, in two experiments the alpha sublass (ALF) of Proteobacteria and in one experiment bacteria hybridizing with the probe for *Archaea*, even increased during HNF grazing. The composition also differed between bacteria associated with aggregates and freely suspended bacteria, the most obvious being the dominance of ALF growing on detrital aggregates. The experiments demonstrated that predation is a major structuring force for planktonic bacterial communities and that changes in predation regime probably have a much stronger impact on the structure of the bacterial community than on bacterial abundance and biomass.