REGULATION OF PLANKTONIC MICROBIAL COMMUNITIES
BY NUTRIENTS AND HERBIVORES

MICHAEL L. PACE AND ELIZABETH FUNKE
Institute of Ecosystem Studies, Cary Arboretum, The New York Botanical Garden,
Box 4B, Millbrook, New York 12546-0129 USA

Abstract. We conducted a series of single-factor and factorial experiments in two north-temperate lakes (Peter and Paul lakes, Gogebic County, Michigan, USA) to study regulation of heterotrophic microbial communities. In single-factor experiments large Daphnia were added to enclosures, and these were compared to enclosures without Daphnia. These treatments contrast the major food-web configurations that occur in these lakes as a consequence of cascading trophic interactions. Bacterial abundance and the incorporation of methyl [3H]-thymidine into DNA by bacteria were similar in treatments with and without Daphnia. Ciliates were significantly reduced while heterotrophic flagellates were only marginally reduced by Daphnia additions in the Peter Lake experiments. Protozoans were not affected by Daphnia additions in the Paul Lake experiment. Factorial experiments compared the relative significance of large daphnids and nutrients as regulators of bacteria and protozoa. Treatments included controls, Daphnia additions, nutrient (N plus P) additions, and a combined Daphnia–nutrient treatment. Bacteria responded to nutrient additions but not to Daphnia. Protozoa, on the other hand, were strongly affected by Daphnia and to a lesser extent by nutrients. These experiments suggest that the trophic cascade is truncated at the level of protozoans. Protozoa appear to be partially regulated by predators, whereas bacteria show no response to changes in either Daphnia or protozoa.

Key words: aquatic food webs; bacterial production; bottom-up vs. top-down control; ciliates; heterotrophic flagellates; heterotrophic microbial communities; plankton; protozoa; trophic cascade; zoo-plankton.