ABSTRACT

Microbial dynamics in lakes of the McMurdo Dry Valleys during the transition to polar night

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Heterotrophic bacterial activity and its relationship to primary productivity have been studied previously in the ice-covered lakes of the McMurdo Dry Valleys. Owing to logistical constraints, this research has traditionally been confined to the austral spring and summer, thus the unique aspects of ecosystem functionality in the dark months of winter remain unknown. We collected the first data on microbial activity during the transition from continuous sunlight to the polar night (November - April) in lakes of the McMurdo Dry Valleys (Fryxell, Hoare, and Bonney) as part of an IPY project focusing on microbial adaptation to the cold and dark. Bacterial and phytoplankton productivity were measured weekly throughout the water columns of lakes in the Taylor Valley, the site of a US-funded long term ecological research project. As the season progressed, ambient light and light-driven carbon dioxide fixation decreased by an average of 93% and 90%, respectively, while dark carbon dioxide fixation decreased by an average of only 11% in all lakes. Assuming that phytoplankton extracellular carbon release is 5% of primary productivity, the supply of dissolved organic carbon to the water column from this source would decrease with decreasing light. Despite the reduction in the supply of organic carbon from phytoplankton release, heterotrophic bacterial productivity changed by < 5% during this period in Fryxell and Bonney. Our data imply that dark carbon dioxide fixation by chemolithoautotrophic bacteria may be an important year-round source of new carbon to these ecosystems, supplementing the supply of carbon derived via phytoplankton photosynthesis.