ASLO
Association for the Sciences of Limnology and Oceanography

Temperature and nutrient supply interact to control nitrogen fixation in oligotrophic streams: An experimental examination

Marcarelli, Amy M., Wayne A. Wurtsbaugh

Limnol. Oceanogr., 51(5), 2006, 2278-2289 | DOI: 10.4319/lo.2006.51.5.2278

ABSTRACT: We performed two experiments to examine how temperature and nutrients interact to control dinitrogen (N_2) fixation, chlorophyll *a* (Chl *a*) biomass, and community composition of periphyton in subalpine oligotrophic streams in the Sawtooth Mountains of Idaho. We grew periphyton on nutrient-diffusing substrata (NDS) in a cold lake inlet (7° C) and a warm lake outlet (18° C). We then switched substrata between the two stream sites to test the effect of incubation temperature on N_2-fixation rates. Periphyton on substrata grown at both sites exhibited greater N_2-fixation rates when incubated in the warm outlet, which indicates physiologic temperature control. Periphyton on P-enriched NDS grown in the warm outlet had the greatest N_2-fixation rates, largest Chl *a* biomass, and largest percentage of N_2-fixing taxa of any treatment, which indicates that temperature and P interact to influence the community. In the second experiment, colonized rocks and uncolonized NDS were placed in cold (13° C) and warm (18° C) mesocosms. Within 2 days, warm temperature stimulated N_2 fixation by the rock periphyton community two times above cold temperatures, which indicates physiologic temperature control. After 45 days, warm temperatures and P enrichment led to *Anabaena* sp. in the periphyton community and the greatest rates of N_2 fixation observed in the experiment, which also indicates temperature and nutrient control at the community level. This study indicates that N_2 fixation and periphyton community composition in oligotrophic streams are controlled by both temperature and P supply, with temperature modulating the response to P.

Article Links

Download Full-text PDF

Return to Table of Contents

Please Note

Articles in L&O appear in PDF format. Open access articles may be freely downloaded by anyone. Other articles are available for download to subscribers only, or may be purchased for $10 per article. All L&O articles are moved into Open Access after three years.

Association for the Sciences of Limnology and Oceanography © 2013