
Stressor order and repetition shape combined effects of salinisation and nutrient enrichment on aquatic biofilm function

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Résumé

Introduction: Benthic microbial communities underpin vital aquatic ecosystem functions like decomposition and primary productivity, both threatened by climate change-driven stressors such as salinisation and nutrient enrichment. These stressors often co-occur, either simultaneously or in sequence during extreme weather events, yet the influence of stressor timing-particularly order-on microbial function remains poorly understood.

Objectives: We tested three hypotheses: (i) repeated exposures have stronger effects than single exposures, (ii) stressor interactions vary with order of application, and (iii) effects weaken over time, with effects from salinity change (a press stressor) persisting longer than nutrients (a pulse stressor).

Methods: A manipulative experiment was conducted using 1000-L semi-natural freshwater ponds in the field. Biofilms were grown on ceramic tiles for 30 days, then transferred into treatment ponds and exposed to elevated salinity and/or nutrients individually, repeatedly, or in combination in different sequences. Sampling at 1, 21, and 81 days post-treatment assessed 31-carbon-source metabolic profiles, respiration, primary productivity, photosynthetic efficiency, chlorophyll *a*, and microbial community structure via 16S rRNA sequencing.

Findings: The order of stressor application significantly altered functional outcomes. When nutrient enrichment preceded salinity, gross primary productivity was halved, and carbon metabolic activity increased by 50% compared to the reverse sequence.

Conclusion: Stressor order can critically shape the effects of multiple stressors. As global change accelerates, freshwater microbial functions like productivity and carbon cycling may become more variable due to the timing and sequence of interacting stressors.

Mots-Clés: biofilms, environmental stressors, nutrient enrichment, salinisation, carbon metabolism

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