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TITLE: Alleviation of hypoxia by biologically generated mixing in a stratified water column

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ABSTRACT:

Abstract Daily vertical migrations of zooplankton have been shown to affect nutrient distributions and dissolved gas concentrations in lakes and oceans via active internal transport and metabolic consumption. Additionally, mixing generated by these migrations has been shown to have the capacity to alter the physical structure of a water column, with potential further implications for its biogeochemical structure. In this work, we use laboratory experiments to investigate the importance of biologically generated mixing relative to other processes in determining the biogeochemical structure of a water column inhabited by migrating zooplankton. Specifically, we consider oxygen, a highly ecologically relevant scalar, and the competition between metabolic consumption and biogenic mixing in a stably stratified water column with a hypoxic layer. Using laboratory experiments and a one-dimensional model informed by those measurements, we illustrate the potential for migrating animals to alleviate hypoxia, introducing complex feedbacks between the presence of animals and the biogeochemical state of their surroundings. Furthermore, we demonstrate the feasibility of oxygen as a potential indicator of biogenic mixing for future in situ investigations given its low diffusivity and higher signal-to-noise ratio.

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