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Role of turbulent history on phytoplankton nutrient uptake

M. Schapira (1), **L. Seuront** (1,2)

(1) School of Biological Sciences, Flinders University, Adelaide 5001, Australia, (2) Ecosystèmes Littoraux et Côtiers, CNRS FRE 2816 ELICO 8013, Station Marine de Wimereux, Université des Sciences et Technologies de Lille-Lille 1, Wimereux, France

Turbulence is a commonplace process widely acknowledged for its role on the ecology of marine systems. Little is still known, however, on the potential effect of the interplay between small-scale turbulence, nutrient patchiness and phytoplankton uptake rates. Under the assumption that turbulence intensity controls small-scale nutrient patchiness, this note introduces and supports the hypothesis that under nutrient limitation, 'turbulent history', i.e. the turbulence conditions experienced by phytoplankton cells in their natural environments, conditions the efficiency of phytoplankton cells to uptake ephemeral inorganic nitrogen patches of different concentrations. Phytoplankton cells exposed to high turbulence intensities (i.e. homogeneous nutrient distribution) were more efficient to uptake high concentration nitrogen pulses (2 μm). In contrast, under low turbulence conditions (i.e. heterogeneous nutrient distribution) uptake rates were higher for low concentration nitrogen pulses (0.5 μM). These results suggest that under nutrient limitation, natural phytoplankton populations respond to high turbulence intensities through a decrease in affinity for nutrients and an increase in their transport rate, and vice versa.