

RESEARCH PAPER

Short-term effects of increased CO₂, nitrate and temperature on photosynthetic activity in *Ulva rigida* (Chlorophyta) estimated by different pulse amplitude modulated fluorimeters and oxygen evolution

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This paper is dedicated to Jacco Kromkamp in memoriam.

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Abstract

Short-term effects of pCO₂ (700–380 ppm; High carbon (HC) and Low carbon (LC), respectively) and nitrate content (50–5 μM; High nitrogen (HN) and Low nitrogen (LN), respectively) on photosynthesis were investigated in *Ulva rigida* (Chlorophyta) under solar radiation (*in-situ*) and in the laboratory under artificial light (*ex-situ*). After six days of incubation at ambient temperature (AT), algae were subjected to a 4 °C temperature increase (AT+4 °C) for 3 d. Both *in-situ*

Abbreviations: A, Absorbance; AT, Ambient temperature; ETR, Electron transport rate; Fv/Fm, Maximal quantum yield; HC, High pCO₂; HN, High nitrate concentration; LC, Low pCO₂; LN, Low nitrate concentration; NPQ, Non photochemical quenching; PAM, Pulse amplitude modulated; PAR, Photosynthetic active radiation; PSI, Photosystem I; PSII, Photosystem II; RLC, Rapid light curves; Y(II), Effective quantum yield.

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