Greenhouse gas emissions from wetlands with different vegetation type

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Introduction

Area of free-floating plants on wetlands is increasing

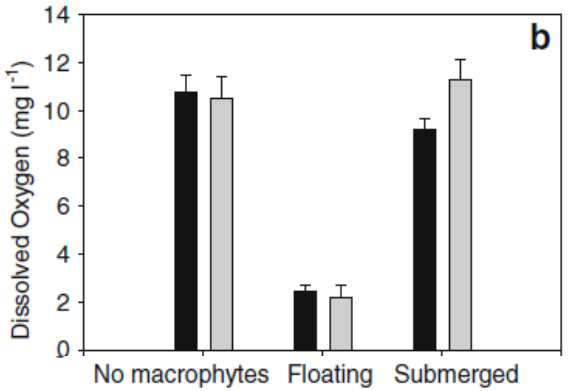
→ effect on fluxes of CO_2 and CH_4

Introduction

(Contrasting) mechanisms of floating plants on GHG emission

- Oxygen depletion under floating vegetation:
  → Anoxic decomposition; more CH4

Veraart at al. 2010 Biogeochemistry



- Temperature increase
  → lower oxygen (decomposition more enhanced than production)

- However, with floating plants less exchange with atmosphere
  → entrapment and oxidation of CH4 bubbles in rootzone

Air/Water gas exchange rate

Contents lists available at ScienceDirect

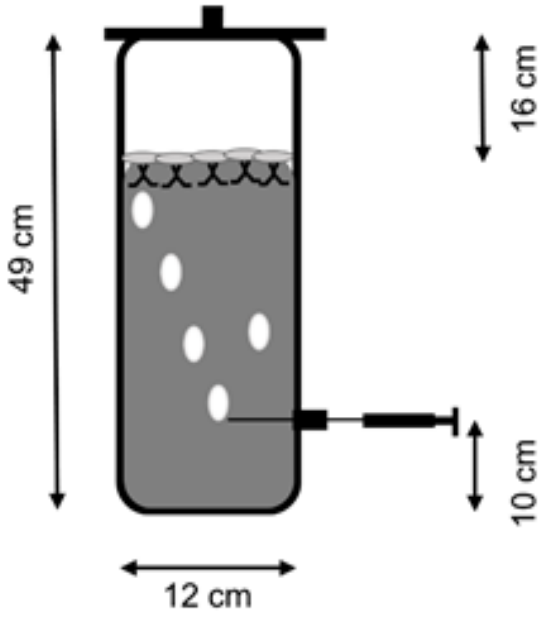
Water Research

journal homepage: www.elsevier.com/locate/watres

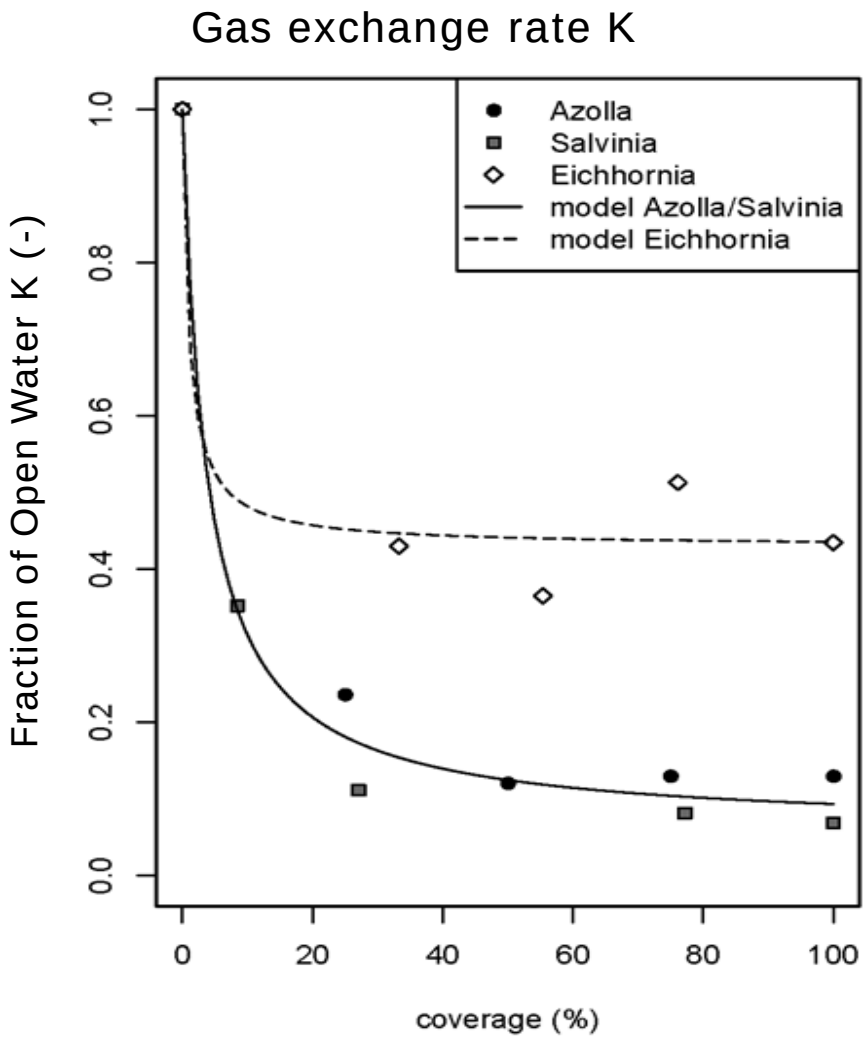
Fate of methane in aquatic systems dominated by free-floating plants

Sarian Kosten [a, *], Marcia Piñeiro [a], Eefje de Goede [a, 1], Jeroen de Klein [b], Leon P.M. Lamers [a], Katharina Ettwig [c]

- Effect of floating biomass on air/water gas exchange rate
- Effect of floating biomass on CH4-ebulition
- 3 free-floating species (Azolla, Salvinia, Eichhornia)



Air/Water gas exchange rate

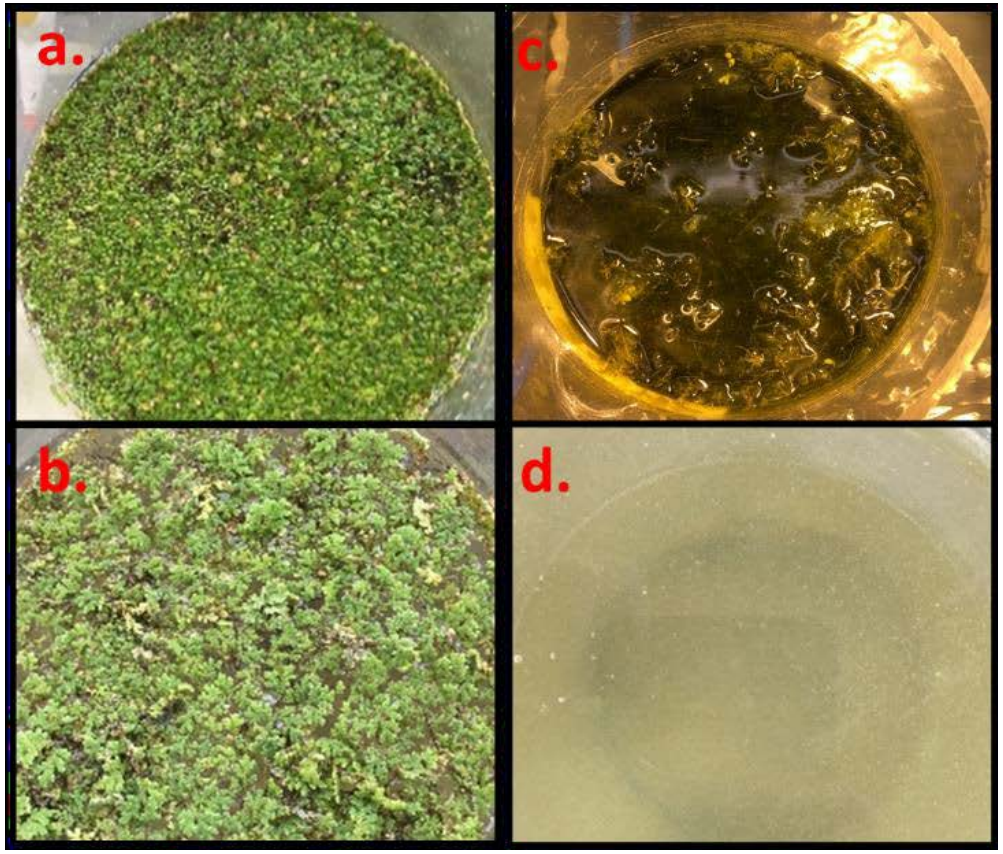


Eichhornia

Azolla

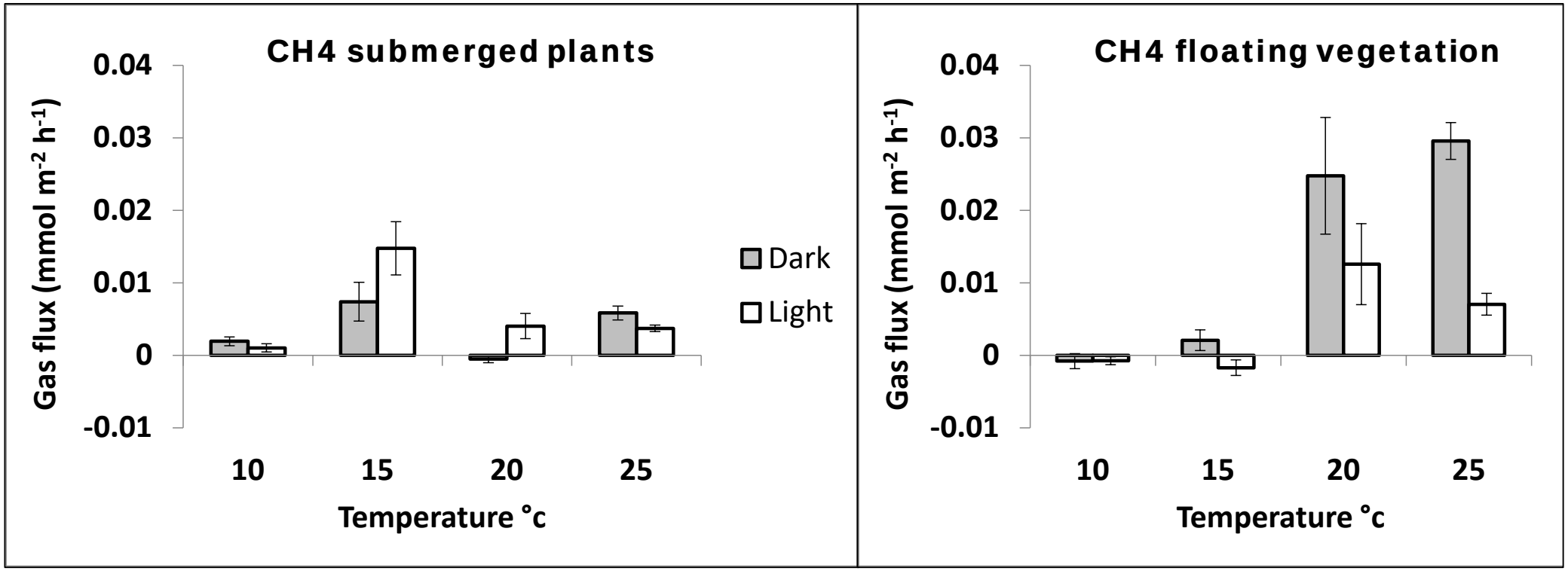
Micro-cosms experiments

- Microcosms (submerged, floating (Azolla, Lemna), controls, n=4)
- Temperature range 10-25 °C (measured in light and dark; 12/12h)
- Gasfluxes measured with Innova TGA



Results CH4 fluxes cosm-experiments

Temperature experiment

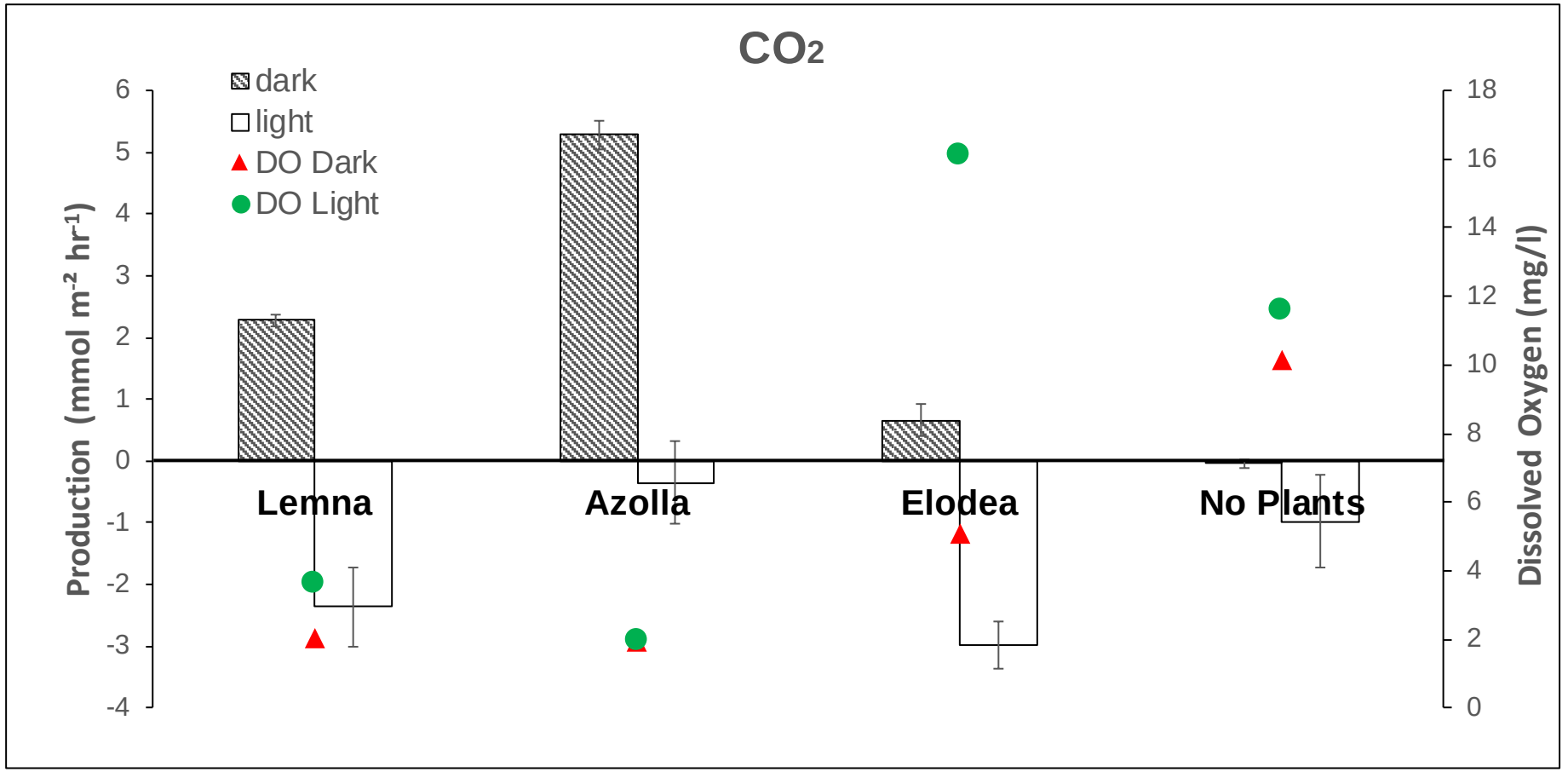


Accelerated effect of temperature on DO

Veraart A.J. and de Klein J.J.M. (2011), PLoS ONE, 6(3), 2-7

Results gas fluxes cosm-experiments

continuous experiment (average fluxes 13 weeks, 20-25°C)



Results gas fluxes cosm-experiments

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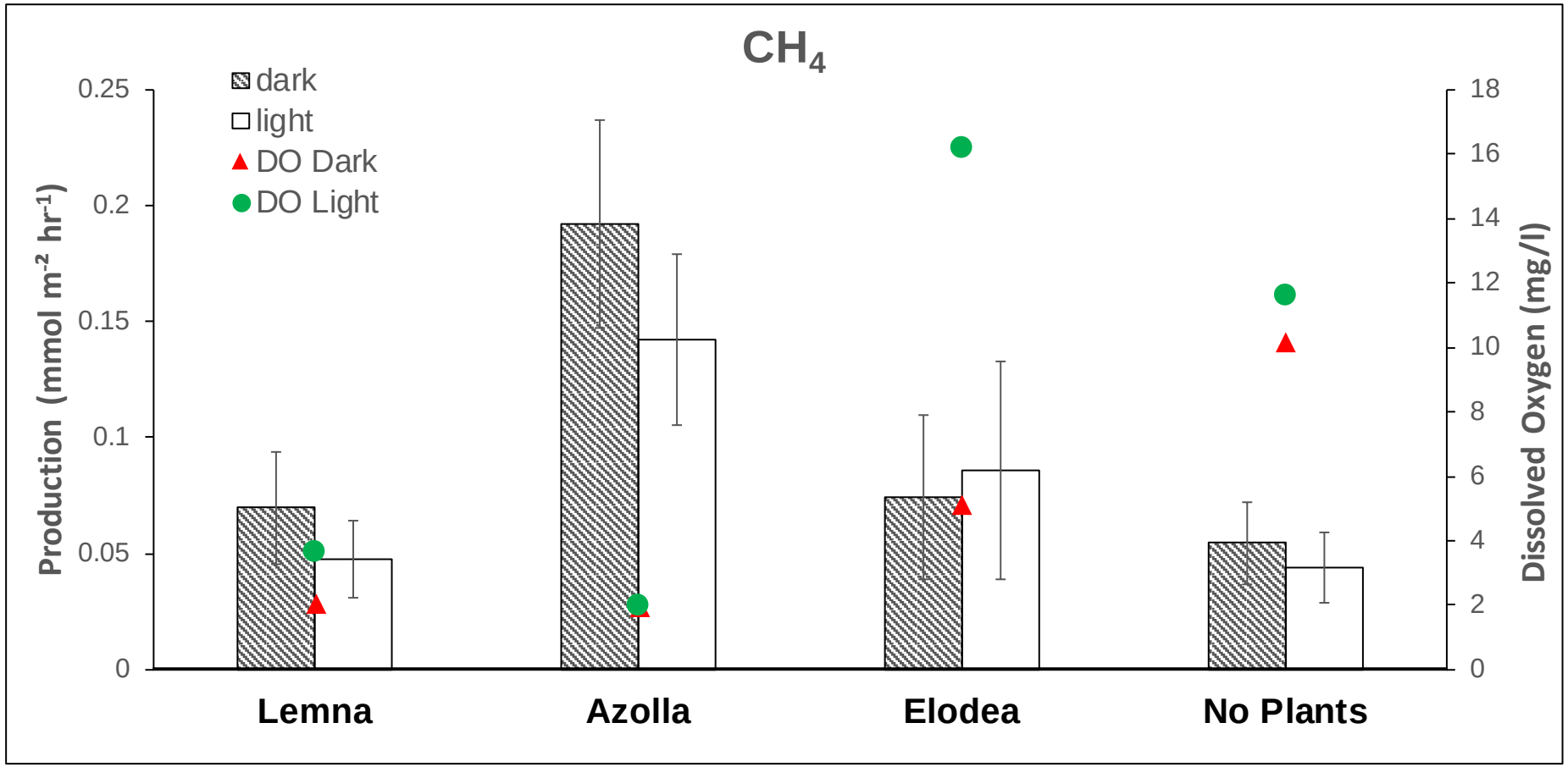
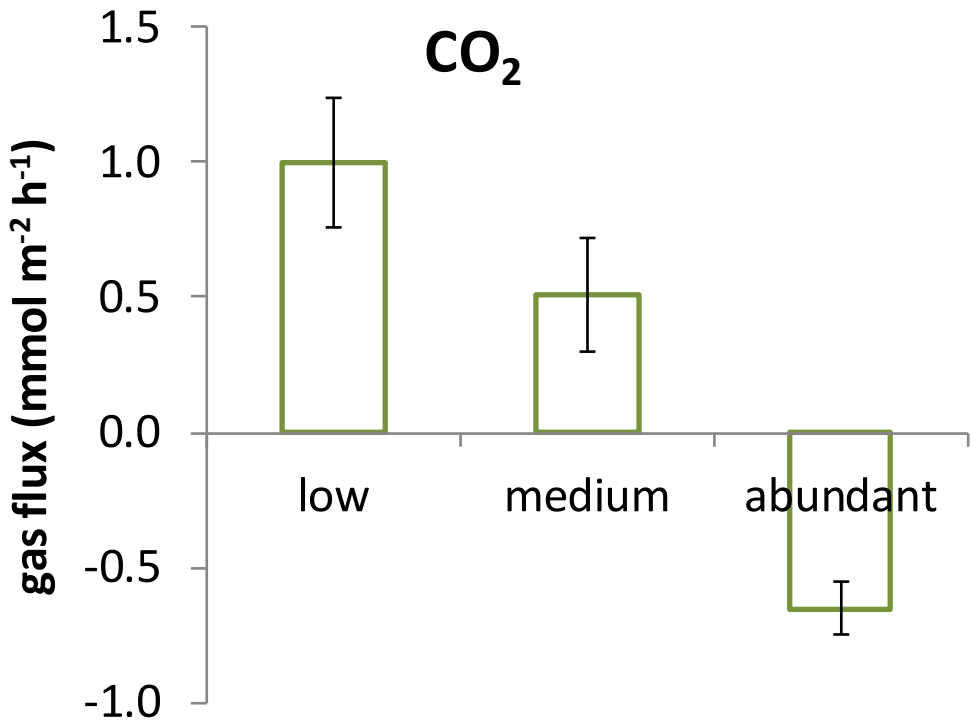


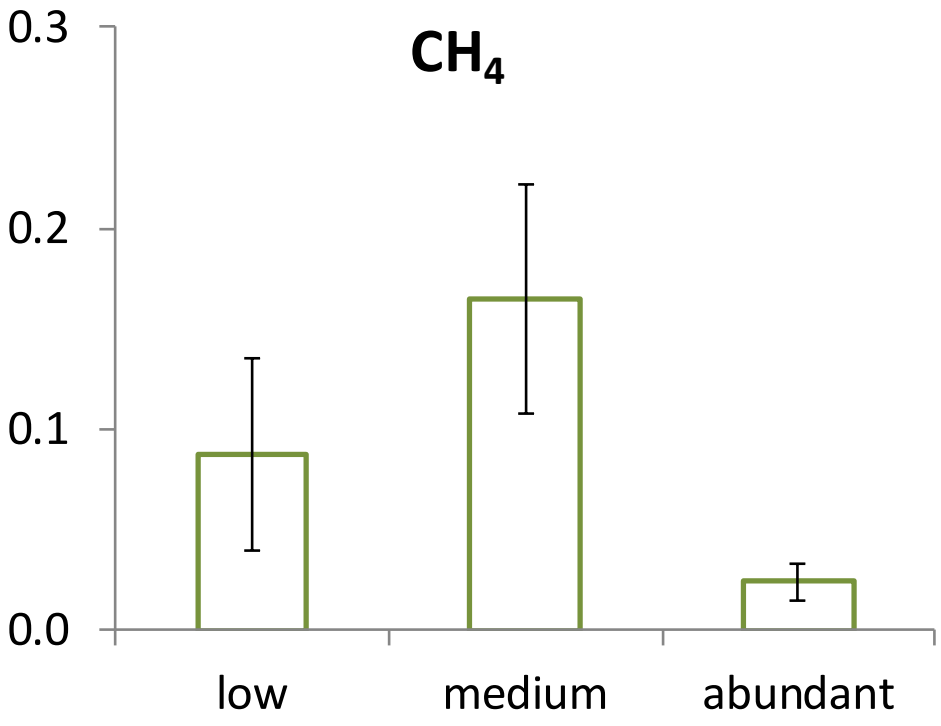
Field measurements Doñana Wetlands

- 9 shallow lakes and ponds in marshland (single measurement, 6 experiments per lake)
- Different cover of submerged and floating vegetation
- Gas fluxes measured with floating chamber (Innova and LGR)

Field measurements Doñana Wetlands

Average gas fluxes (daytime) related to macrophytes density





To summarize

GHG fluxes from microcosms and shallow vegetated lakes

- Clear temperature effect on CH4 with floating plants (temperature threshold ?)
- With increasing floater dominance: shift from carbon sink to source
- In field conditions: highest CH4 emissions with median vegetation cover
- DO depletion effect of floaters seem to prevail above gas exchange limitation
- However, overall effect is variable (species, temperature, local conditions)

GHG potential