



High CO₂ and nutrient fertilization enhance primary production and biomass in subtropical phytoplankton communities: a mesocosm approach

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Subtropical waters represent the most extensive ecosystems in the ocean, contributing nearly one third of oceanic primary production, albeit the low productivity per surface area mostly due to small phytoplankton. Trends in global warming predict enhanced stratification in the oligotrophic ocean but also intensification in cross-shore wind gradients and thus in eddy kinetic energy across eastern boundary regions of the subtropical Gyres. Phytoplankton thriving in a future warmer and acidified oligotrophic subtropical ocean could therefore be patchily fertilized by enhanced mesoscale and submesoscale variability inducing nutrient pumping into the surface ocean. Assuming this hypothesis, we have tested the response of three size classes (0.2-2, 2-20 and >20 [μm]) of subtropical phytoplankton communities -in terms of primary production (PP), chlorophyll (Chl) and cell biomass (B)- to increasing pCO₂ concentrations and nutrient fertilization during an in situ mesocosms experiment in oligotrophic waters offshore Gran Canaria Island. Our results reveal a non-significant CO₂-related effect on PP under oligotrophic conditions, although trends in Chl and B were negative in the larger size-classes. PP, Chl and B showed a marked increase with higher pCO₂ conditions in all groups after nutrient fertilization, although the correlation was stronger with the largest phytoplankton. These results contrast with previous similar studies on temperate and cold waters, where small phytoplankton benefited after nutrient additions at high pCO₂, pointing to different responses to CO₂ increases across plankton communities in the ocean.