



## Response of Southern Ocean phytoplankton and bacterioplankton production to short-term experimental warming

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**ABSTRACT:** We examined the potential response of Southern Ocean pelagic ecosystems to warming through changes in total primary production (particulate plus dissolved = PPP + DPP) and bacterial production (BP), determined simultaneously at ambient temperature (-1.4 to 0.4° C) and at 2° C in eight experiments performed near the Antarctic Peninsula in late spring 2002. Short (<6 h) time course experiments of radiocarbon uptake and photosynthesis-irradiance relationships consistently showed that a significant amount of photosynthate appeared as dissolved substances, with a mean 35% extracellular release (PER). Whereas PPP remained virtually unchanged (0.7 mg C m<sup>-3</sup> h<sup>-1</sup>), DPP increased significantly at 2° C from 0.5 to 0.9 mg C m<sup>-3</sup> h<sup>-1</sup>. The corresponding increase in PER (54% on average) was significantly and positively correlated with the temperature difference among treatments, suggesting that an increase in DPP could be expected with a temperature rise in the Southern Ocean. BP, estimated via [<sup>3</sup>H]leucine incorporation, tended to increase at 2° C only at low absolute values, and this increment was inversely related to PPP. However, our results show that the estimated bacterial carbon demand (BCD) was generally well below concurrent DPP at both treatments (mean BCD:DPP ratios of 0.60 and 0.27 at ambient temperature and 2° C, respectively), indicating that temperature-related extra inputs of organic substrates were not fully and immediately processed by bacteria. To the extent that these results reflect general ecophysiological trends, warming of Southern Ocean surface waters could produce changes in plankton-mediated biogeochemical processes leading to a greater importance of dissolved organic matter fluxes.

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