The combined effect of global warming and ocean acidification on the coccolithophore *Gephyrocapsa oceanica*

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Increasing atmospheric CO$_2$ concentrations are expected to impact pelagic ecosystem functioning in the near future by driving ocean acidification and increasing global average temperatures. We examined the effects of these two processes on the growth rate and carbon production of the calcifying coccolithophore *Gephyrocapsa oceanica*. 12 $p$CO$_2$ treatment levels (∼20-2500 µatm) at three temperatures (15, 20 and 25°C) were established in artificial seawater by combined additions of Na$_2$CO$_3$ and HCl (total alkalinity constant in all treatments). Specific growth rate, particulate inorganic carbon (PIC) and particulate organic carbon (POC) production rates showed an optimum curve response to increasing $p$CO$_2$ at all temperatures. Optima were found between $p$CO$_2$ levels of ∼250-650 µatm with a tendency to higher $p$CO$_2$ levels at higher temperatures. Carbon production rates increased with temperature but sensitivity to increasing $p$CO$_2$ remained similar at all temperatures. The PIC:POC ratio was temperature-independent and linearly decreased with increasing $p$CO$_2$. The results obtained here contribute to a better understanding of the responses of coccolithophores to changing environmental conditions and may help to parameterize synergistic effects of ocean warming and acidification in marine biogeochemical models.