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Arctic ecosystem net community production response to increasing ocean acidification

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The Arctic Ocean and associated shelves are expected to undergo rapid ocean acidification over the coming decades due to partial equilibration with an increasing atmospheric carbon reservoir. Modifications of marine carbonate chemistry have been shown to change the biogeochemical forcing potential of marine ecosystems but none have been reported for the Arctic. In the summer of 2010, a mesocosm CO2 enrichment experiment was performed in Kongsfjorden, Svalbard, to study ecosystem responses across a range of ocean acidification scenarios corresponding to eight pCO2 levels ranging from 160 to 1600 μatm, and pH between 8.4 and 7.4. Undersaturation with respect to calcium carbonate was reached in the high CO2 scenarios. Analysis of daily measurements of total dissolved inorganic carbon and total alkalinity allowed estimates of net community inorganic carbon uptake. Nutrient perturbation in the middle of experiment promoted different stoichiometry of elemental consumption between nutrient limited and nutrient enriched communities in the different scenarios. There was insignificant net community calcification across the scenarios. Net community carbon uptake showed the highest rate in high CO2 scenarios reducing with lowered CO2, and carbon uptake under low pCO2 was about 50% of those under high pCO2. Carbon to nutrient consumption ratios showed phasing over the experiment related to changing community speciation and growth. These results extend previous findings about carbon overconsumption in a high CO2 world from intermediate to high latitudes.