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TITLE: Impact of ocean acidification and elevated temperatures on early juveniles of the polar shelled pteropod *Limacina helicina*: mortality, shell degradation, and shell growth

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ABSTRACT:

Abstract. Due to their aragonitic shell, thecosome pteropods may be particularly vulnerable to ocean acidification driven by anthropogenic CO<sub>2</sub> emissions. This applies specifically to species inhabiting Arctic surface waters that are projected to become temporarily and locally undersaturated with respect to aragonite as early as 2016. This study investigated the effects of rising partial pressure of CO<sub>2</sub> (pCO<sub>2</sub>) and elevated temperature on pre-winter juveniles of the polar pteropod *Limacina helicina*. After a 29 day experiment in September/October 2009 at three different temperatures and under pCO<sub>2</sub> scenarios projected for this century, mortality, shell degradation, shell diameter and shell increment were investigated. Temperature and pCO<sub>2</sub> had a significant effect on mortality, but temperature was the overriding factor. Shell diameter, shell increment and shell degradation were significantly impacted by pCO<sub>2</sub> but not by temperature. Mortality was 46% higher at 8 °C than at in situ temperature (3 °C), and 14% higher at 1100 µatm than at 230 µatm. Shell diameter and increment were reduced by 10 and 12% at 1100 µatm and 230 µatm, respectively, and shell degradation was 41% higher at elevated compared to ambient pCO<sub>2</sub>. We conclude that pre-winter juveniles will be negatively affected by both rising temperature and pCO<sub>2</sub> which may result in a possible decline in abundance of the overwintering population, the basis for next year's reproduction.

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