Impact of ocean acidification and warming on sub-polar shelled pteropods
(BIOACID subproject 3.2.1)
Jan Büdenbender¹, Silke Lischka¹, Tim Boxhammer¹, Ulf Riebesell¹
¹IFM-GEOMAR, Kiel, Germany

Increasing global CO₂ concentrations and temperatures impact biogeochemical processes in
the world’s oceans. Rising CO₂ concentrations make the water corrosive for CaCO₃ shells and
skelet ons thereby negatively affecting a variety of marine calcified organisms. Most
pronounced effects are expected for the Arctic Ocean. The thecosome pteropod Limacina
helicina has a key function in the Arctic epipelagic food web. Due to their aragonitic shell,
pteropods are expected to be among the first major group of calcifying organisms to be
adversely affected by undersaturation in CaCO₃.
We investigated ocean acidification and warming effects on physiological aspects of different
life stages of L. helicina. During three expeditions to Ny-Ålesund, Spitsbergen, we focused on
pre-winter juveniles in Sept/Oct 2009, on overwintering juveniles in Jan/Feb 2010 and on
adults in June/July 2010. Laboratory experiments were carried out at three different
temperatures (3–8°C) and four pCO₂ concentrations (180–1150ppm). Principally, we
investigated, growth, calcification/dissolution, shell preservation, lipid content, respiration
and mortality.
First results from a 29 days experiment in Sept/Oct 2009 revealed a clear temperature and
pCO₂ effect on mortality, but temperature was the overriding factor. Shell diameter, shell
increment and shell preservation were significantly impacted by pCO₂ but not by temperature.
More detailed, mortality was 46% higher at 8°C compared to 3°C (in situ), and 14% higher at
1150 ppm CO₂ as compared to 180 ppm CO₂. Shell diameter and increment were by 10% and
12% reduced at 1150 ppm CO₂ as compared to 180 ppm CO₂, respectively, and shell
preservation was 41% lower.