Studies of Ocean Acidification impacts on Antarctic krill at the Australian Antarctic Division

The Australian Antarctic Division (AAD) operates the only research aquarium where a large number of krill have been reared and successfully reproduced in captivity for research purposes.

The AAD has been conducting various international collaborative experiments on krill life history, physiology, behaviour etc. using our facility. The AAD aquarium has further developed a capacity to conduct studies on effects of ocean acidification on krill, and conducting experiments to assess the sensitivity of krill to ocean acidification.

**Laboratory Experiments:**
- Successfully generated risk maps for egg hatch rates in the projected future CO2 environment.
- Experiments ongoing to assess CO2 impacts on larval ontogenetic migration.

**Field Experiments**
- Just completed egg hatching experiments using egg batches matured in the wild. The results are currently being analysed.
- Early life stages of krill are found to be vulnerable to increasing CO2 levels.

Our ultimate goal is to undertake a comprehensive risk assessment of rising CO2 levels on the lifecycle of Antarctic krill for the next 100 years.

Hatch rates of krill embryos drastically decline beyond pCO2 level of 1000 ppmv.

Risk maps for hatching success based on the pCO2-hatch rate functional curve using the RCP 8.5 emission scenario for (a) 2100 and (b) 2300, and under RCP 6.0 emission scenarios for (c) 2100 and (d) 2300. Note the different colour scales on each panel. Source: Figure 4 in Kawaguchi et al. Nature Climate Change (2013).

Hatch rates of Antarctic krill drastically decline beyond pCO2 level of 1000 ppmv.

Source: Figure 1 in Kawaguchi et al. Nature Climate Change (2013).

Ontogenetic vertical migration of krill during their early life stage. Eggs laid in the surface layer sink about 1000m and hatch at depth and then swim up without feeding. They will be exposed to changing environment during this migration. For example, based on model projection in 2100 the pCO2 level may reach as high as about 1400 ppmv in Weddell Sea 300m below surface.

Experiments on the Australian Icebreaker Aurora Australis during 2016 field season.

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