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

So Kawaguchi [1,2], Rob King [1], Natasha Waller [1], Blair Smith [1], Ashley Cooper [1], Kerrie Swadling [2,3], Jake Wallis [3], Paige Kelley [3], Jess Melvin [3], Danielle Mitchell [3], Ruth Eriksen [3], Patti Virtue [3], Jess Ericson [3], Nicole Hellessey [3]

[1] Australian Antarctic Division, [2] Antarctic Climate and Ecosystem Cooperative Research Centre, [3] Institute for Marine and Antarctic Studies

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.

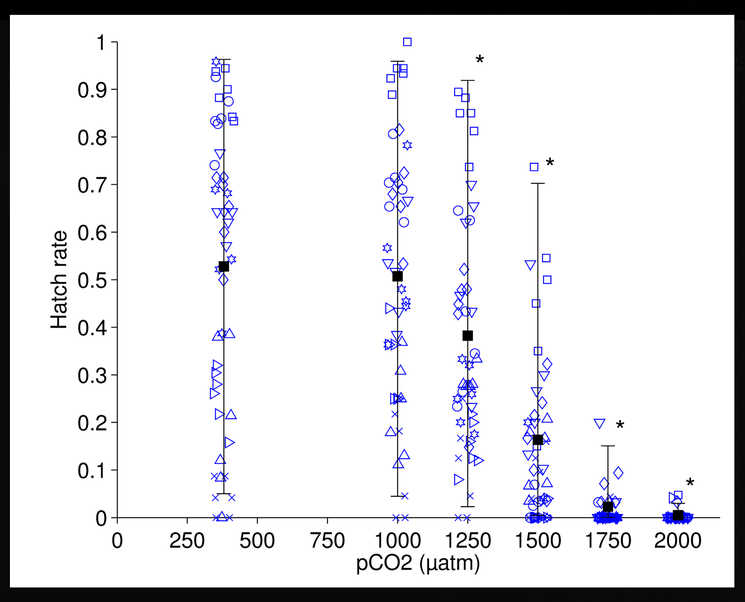
The AAD aquarium has further developed a capacity to conduct studies on effects of ocean acidification on krill, and conducting experiments to assess the sensitivity of krill to ocean acidification.

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.

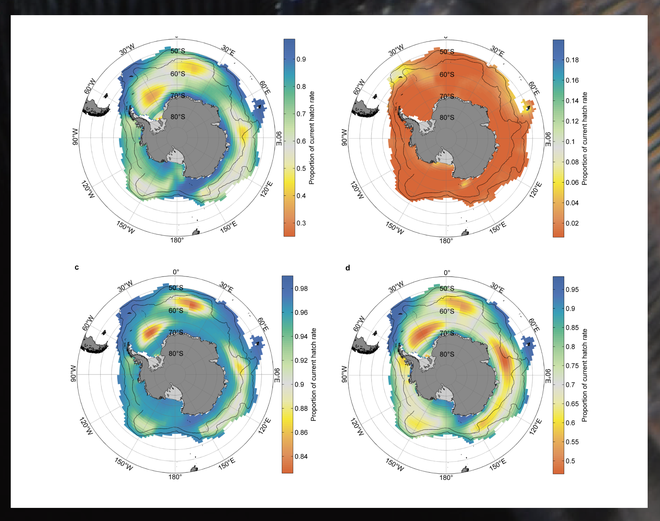
Field Experiments
- Just completed egg hatching experiments using egg batches matured in the wild. The results are currently being analysed.
- Early life stages of krill are found to be vulnerable to increasing CO_2 levels.

Our ultimate goal is to undertake a comprehensive risk assessment of rising CO_2 levels on the lifecycle of Antarctic krill for the next 100 years

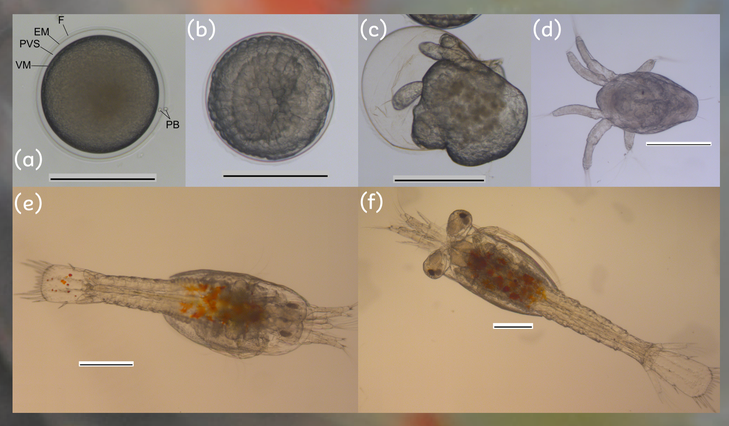
Hatch rates of krill embryos drastically decline beyond pCO_2 level of 1000matm.
Source: Figure 1 in Kawaguchi et al. Nature Climate Change (2013).



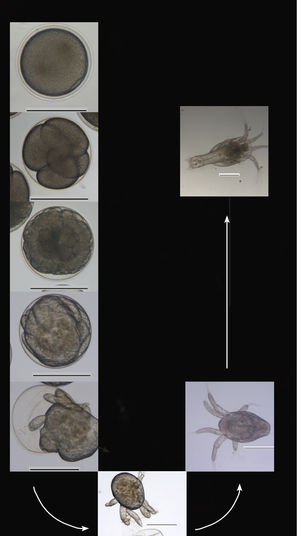
Risk maps for hatching success based on the pCO_2-hatch rate functional curve under the RCP 8.5 emission scenario for (a) 2100 and (b) 2300; and under RCP 6.0 emission scenario for (c) 2100 and (d) 2300.
Note the different colour scales on each panel.
Source: Figure 4 in Kawaguchi et al. Nature Climate Change (2013)

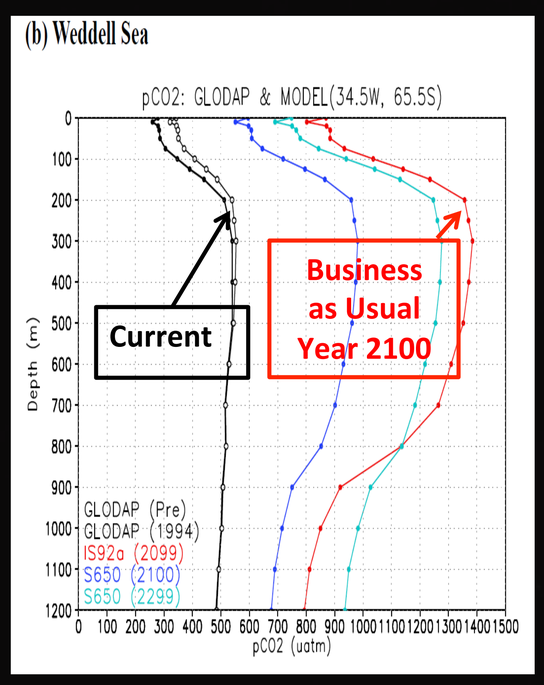


Early life stages of Antartctic krill
(a) Newly spawned egg, (b) late gastrula, (c) hatching larvae, (d) nauplius II, (e) calyptopis II, (f) furcilia I. Scale bars 500um. *Photo source Jia et al. (2014)*



Ontogenetic vertical migration of krill during their early life stage. Eggs laid in the surface layer sink about 1000m and hatch out 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 pCO_2 level may reach as high as about 1400matm in Weddell Sea 300m below surface.





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

Main image: © Rob King/Australian Antarctic Division 2016

www.antarctica.gov.au

Australian Government
Department of the Environment
Australian Antarctic Division

ANTARCTIC CLIMATE & ECOSYSTEMS COOPERATIVE RESEARCH CENTRE

IMAS INSTITUTE FOR MARINE AND ANTARCTIC STUDIES

UTAS

4th International Symposium on the Ocean in a High-CO_2 World • 3 – 6 May 2016, Hobart Tasmania