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The impact of nanoplastic on embryonic development of Antarctic krill in current and future acidified conditions of the Southern Ocean

Emily Rowlands[1,2], Tamara Galloway[2], Matthew Cole[3], Ceri Lewis[2], Victoria Peck[1], Sally Thorpe[1], and Clara Manno[1]

[1]British Antarctic Survey, Cambridge, United Kingdom of Great Britain – England, Scotland, Wales (emirow@bas.ac.uk)
[2]University of Exeter – Streatham Campus, University of Exeter, North Park Road, Exeter, UK EX4 4QF, United Kingdom
[3]Plymouth Marine Laboratory – Prospect Place, The Hoe, Plymouth, PL1 3DH, United Kingdom

Antarctic krill (*Euphausia superba*), hereafter krill, are pivotal to the Antarctic marine ecosystem, forming the base of a highly productive system and contributing significantly to the biogeochemical cycle. The negative effects of anthropogenic climate stressors amplified in the Southern Ocean such as rapid warming and ocean acidification (OA) have been acknowledged for krill. Less explored is the impact of increasing plastic pollution, particularly in conditions that reflect the likely future Southern Ocean environment. We hypothesise that krill have heightened vulnerability to multi-stressor scenarios due to their physiological and behavioural traits coupled with rapid environmental changes of their Antarctic habitats. Here, we investigate the single and combined effects of nanoplastic (NP; spherical, aminated (NP-NH_2), yellow-green, fluorescent polystyrene nanoparticles) and OA (pCO_2-manipulated seawater, pH 7.7) on the embryonic development of krill eggs. Krill were collected in the Scotia Sea within the Atlantic sector of the Southern Ocean in austral summer 2019. Eggs from a single female were incubated in seawater at 0.5 °C for 6 days with three treatments: (i) with 0.16 µm NP, (ii) in acidified conditions, and (iii) with a combined treatment of NP (0.16µm) and acidification. All NP treatments were at a concentration of 2.5µg/ml. We found that exposure to the NP-OA multi-stress treatment negatively impacted the development of embryos, decreasing the probability of reaching the limb bud stage by 9% compared with the control, whilst no significant difference was observed for the singular NP or OA treatments. This preliminary study supports our hypothesis regarding the potential impacts of multiple stressors on vulnerable embryonic stages of this ecologically critical Antarctic species.