



Ocean acidification in the real world – synergetic effects with temperature, toxicants and oil spills

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For decades, humans have caused local damage in many ecosystems by a variety of means including contamination by pollutants, over-fishing, physical destruction of the habitat etc. In the future ocean, ocean acidification (OA) and global warming will operate in concert with these other anthropogenic stressors and at present, very little is known about the potential synergistic effects. 75% of all experimental work on the impact of OA on invertebrates only considers acidification as a single stressor and only 15% combine OA and temperature in their design. All other stressors are ignored or anecdotic. The aim of our work was to address the impact of combined exposure to OA with temperature stress but also other relevant environmental anthropogenic stressors such as toxicants and oil spills.

An assay based on the regeneration capabilities of the keystone brittle star species *Amphiura filiformis* was used to test the impact of toxicants with different pKa-values (the antifungal triclosan with a pKa=7.9 and the antibacterial clotrimazole with a pKa=6.1) in two pH treatments (control: pH=8.1 and a low pH using pH=7.7). As predicted, the toxicity of triclosan, which is a weak acid, was further increased at low pH demonstrating the importance of considering multiple stressors in experiments designed to assess ecological impact of near-future OA.

Two other experiments on the development of the keystone sea urchin *Strongylocentrotus* will be presented. We will show that global warming can exacerbate the negative impact of OA on larval growth and some preliminary data on the combined effect of OA and oil spills.