Spatfall in a changing environment: mind the HAB

De Rijcke Maarten[1], Michiel B. Vandegehuchte[1], Nancy Nevejan[2], Julie Vanden Bussche[3], Lynn Vanhaecke[3] and Colin R. Janssen[1]

[1] Laboratory of Environmental Toxicology and Aquatic Ecology
Ghent University, J. Plateaustraat 22, B-9000 Ghent, Belgium
E-mail: maarten.derijcke@ugent.be

[2] Laboratory of Aquaculture and Artemia Reference Center
Ghent University, Rozier 44, B-9000 Ghent, Belgium

[3] Laboratory of Chemical Analysis,
Ghent University, Salisburylaan 133, B-9820 Merelbeke, Belgium

Due to the combined effect of overfishing, climate change, eutrophication and the dispersal of invasive species in the marine environment, harmful algal blooms (HABs) are steadily increasing in frequency, intensity and geographical scale. Yet to date, our understanding of the effects of HABs on the recruitment of marine organisms is limited. As shellfish farming is expected to play a crucial role in the fulfilment of the future global protein demand, a better understanding of the risks that HABs pose to the reproduction and development of bivalves is needed. This research therefore aimed to investigate the acute toxic effects of harmful algae and marine toxins on the larval viability, development and innate immune response of bivalves. To this end, embryos of the model species *Mytilus edulis* (blue mussel) were exposed for 48 hours to a concentration series of the marine toxins domoic acid (DA) and okadaic acid (OA) as well as their respective toxin-producing algae *Pseudo-nitzschia multiseries* and *Prorocentrum lima*. We found that neither bloom concentrations of domoic acid, nor bloom densities of *P. multiseries* displayed acute toxic effects on the viability and development of *M. edulis* larvae. Okadaic acid on the other hand significantly reduced the viability of veliger larvae at concentrations as low as 37.8µg.l^{-1}, which is a concentration range likely to occur during dense blooms of OA producing algae This effect may be related to a significant inhibition of larval protein phosphatases by OA as observed *in vitro*. *P. lima* was not found to affect the larval development or viability but induced an increase in the phenoloxidase innate immune activity which could not be attributed to the occurence of OA in the algae. A similar increase in PO activity was detected for *P. multiseries.* This effect was strain dependent and could partially be attributed to the presence of DA. As this is the first study to investigate and detect the activation of the phenoloxidase innate immune activity by harmful algae and marine toxins, the consequences of these increases for the larval resilience to other stressors are unknown. Yet the change of the immune activity combined with the reduced viability associated with OA warrants closer investigation as HABs could possibly influence natural recruitment as well as the hatchery-cultured production of bivalves.