Much to do about nothing? Assessing the toxicity of realistic marine contaminant mixtures

Everaert Gert[1], Frederik De Laender[2], Michiel Claessens[3], Jan Baert[2], Els Monteyne[4], Patrick Roose[4], Peter L.M. Goethals[1], and Colin R. Janssen[1]

[1] Laboratory of Environmental Toxicology and Aquatic Ecology, Ghent University, Ghent, Belgium
E-mail: Gert.Everaert@UGent.be

[2] Research Unit in Environmental and Evolutionary Biology, Université de Namur, Namur, Belgium

[3] DuPont de Nemours, Mechelen, Belgium

[4] Management Unit of the North Sea Mathematical Model, Royal Belgian Institute of Natural Sciences, Ostend, Belgium

Although the anthropogenic pressure on the marine environment has increased during the last decades, the effects of hazardous chemicals on marine primary production remain unknown. A complex mixture of organic chemicals is present in the Belgian coastal and estuarine waters of which the ecotoxicological risk is poorly understood. Routine monitoring focuses on detecting and measuring of - so called - priority substances, but some chemicals of concern may be overlooked. The use of passive sampling and dosing is a promising technique in monitoring and assessing as they allow exposure at freely dissolved environmental concentrations and realistic mixtures of organic chemicals. In the present research, passive samplers were attached to stainless steel cages and deployed along the Belgian coast at sampling station MOW1 (51° N 21.644', 3° E 6.992') between 10 December 2013 and 27 March 2014. Subsequently, we studied the specific growth rate of a marine diatom, *Phaeodactylum tricornutum,* in an algal growth inhibition experiment using a full factorial design with three nutrient regimes, two water temperatures, three illumination conditions and three chemical exposures. By using the deployed passive samplers we exposed *P. tricornutum* to natural concentrations of realistic mixtures of organic chemicals and compared growth curves under exposed and non-exposed conditions. The total sum of freely dissolved concentrations of fifteen PAHs (Σ_{15}PAHs) and seven PCBs (Σ_{7}PCBs) along the Belgian coast was 39.7 ± 9.8 ng.L^{-1} and 6.8 ± 1.5 ng.L^{-1}, respectively. Although within the expected concentrations range for the Belgian coastal environment, these levels did not alter the specific growth rate of *P. tricornutum* in the first 72h of the experiment. The moment of sampling, the nutrient regime and the water temperature explained about 80% of the observed variability in the experimental data. The contribution of organic chemicals was estimated to be 1%, but was not significant at a 5% level of significance. These results suggest that the natural concentrations of realistic mixtures of organic chemicals present along the Belgian coast do not affect the growth of marine diatoms.