Response of zooplankton dynamics to multiple stressors in the North Sea

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Marine ecosystems are increasingly experiencing multiple disturbances as climatic change leads to changes in sea water temperature, salinity, and pH, while increased nutrient concentration and pollutants are important chemical stressors resulting from human activities. There is still a lack of quantitative data and understanding on how these chemical stressors and stressors resulting from climate change interact in marine ecosystems. In particular, it should be taken into account that physical stressors resulting from climate change can affect contaminant exposure and toxic effects and vice versa. Our study investigated the relative contribution of various environmental drivers, including nutrients and pollutants, to density and diversity dynamics of the zooplankton community in the Belgian part of the North Sea (BPNS).

We applied multimodel inference on generalized additive models to quantify the relative contribution of chlorophyll a, temperature, nutrients, salinity and anthropogenic chemicals (i.e. polychlorinated biphenyls and polycyclic aromatic hydrocarbons) to the dynamics of calanoid copepod species (Copepoda, Calanoida) in the Belgian part of the North Sea. Six calanoid copepod species reaching high abundances in the BPNS were selected, namely *Temora longicornis, Acartia clausi, Centropages hamatus, Paracalanus parvus, Pseudocalanus elongatus* and *Pseudodiaptomus marinus.* Temperature was the only predictor consistently showing a high importance in all models predicting the abundances of the selected copepod species. The relative contribution of other predictors was species-dependent. Anthropogenic chemicals were important predictors for three out of six species (*T. longicornis, A. clausi* and *P. marinus*) indicating that chemical mixtures at low concentrations should not be left unattended when performing risk assessments in a natural environment.

Keywords: multiple stressors; anthropogenic chemicals; North Sea; zooplankton; multimodel inference