Assessment of the combined effects of plastic pollution and global change on benthic primary consumers, from individual to coastal & estuarine ecosystems level

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Organisms are subject to multiple stressors in estuarine waters, including anthropogenic pollutants such as plastic, and fluctuating physical-chemical parameters due to tidal and freshwater inputs. However, due to global change, physical-chemical water parameters in coastal and estuarine areas are predicted to shift towards new extremes. For example, recurring extreme salt intrusion events will increase in frequency and amplitude due to a higher frequency in heatwaves and draughts (Lee *et al.* 2024), and more acidic water events will take place (IPCC, 2023). Alongside these stressors, estuaries are considered reservoirs of plastic pollution (Van Emmerik *et al.,* 2022), with implications for aquatic organisms. However, the assessment of the combined effects of these factors on primary benthic consumers, across generations, is lacking (Wang *et al.,* 2018). Therefore, we aim to assess the combined effects of multiple stressors (pH, salinity, temperature, plastic particle shape) on two benthic coastal/estuarine primary consumers, *Nitokra spinipes* and *Crassostrea gigas* across multiple generations. In our work, *N. spinipes* will be used as a key organism in the estuarine ecosystem and *C. gigas* for the coastal ecosystem. Three stressors will be tested on the estuarine organism: temperature, salinity and microplastics (density > 1) and two on the coastal: pH and microplastics (neutrally buoyant). The microplastics polymer selection will be based on the most commonly observed polymer types in Belgian waters according to the Scheldt River data, which will be our reference location (PLUXIN and INSPIRE projects' data), and their density (Yuan *et al.,* 2022). First, the stressors will be tested individually and then combined according to best-case, intermediate and worst-case scenario, on both species. Then, the combined stressors will be tested on three generations of N. *spinipes*. In the case of the oysters, we will assess the effects on adult organisms and their offspring. During the tests, ontogenesis abnormalities, physiological parameters, nutritional value (expressed as proteins and lipids concentration) and mortality will be assessed. Finally, thanks to the experimental results and coastal/estuarine ecosystems knowledge, we aim to model these ecosystem responses, already impacted by multiple stressors (e.g. fishery activities, pollutants, global change), to a shift in benthic primary consumers group. We expect to observe a disruption in the organism's ontogenesis and physiology, as well as lethal effects in the worst-case scenario. This project aims to provide an understanding of the ecosystem's functioning and its responses to combined stressors, along with their potential repercussions on economic activities, such as fisheries.

Keywords
Coastal And Estuarine Waters, Crassostrea Gigas, Global Change, Model, Multiple Stressors, Multi-generation, Nitokra Spinipes, Plastic Particles