Decadal trends and dynamics in the abundance and biomass of marine copepods in the Belgian part of the North Sea

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Time-series are fundamental to understand the status of plankton communities and predict future changes that can affect the whole food web. Long-term time series allow us to understand impacts of multiple environmental and anthropogenic stressors, such as chemical pollution and ocean warming, on the marine ecosystems. Here, a recent time series (2018–2022) of abundance data of four dominant calanoid and one harpacticoid copepod species from the Belgian Part of the North Sea was combined with previously collected (2009–2010, 2015-2016) datasets for the same study area. The time series reveals a significant decrease (up to two orders of magnitude) in calanoid copepod abundance (*Temora longicornis, Acartia clausi, Centropages* sp., *Calanus helgolandicus*), while this was not the case for the harpacticoid *Euterpina acutifrons*. We applied generalized additive models to quantify the relative contribution of temperature, nutrients, salinity, primary production, turbidity and pollution (anthropogenic chemicals, i.e., polychlorinated biphenyls and polycyclic aromatic hydrocarbons) to the population dynamics of these species. Temperature, turbidity and chlorophyll a concentrations were the only variables consistently showing a relative high contribution in all models predicting the abundances of the selected species. The observed heat waves which occurred during the summer periods of the investigated years coincided with population collapses (versus population densities in non-heatwave years) and are considered the most likely cause for the observed copepod abundance decreases. Moreover, the recorded water temperatures during these heatwaves correspond to the physiological thermal limit of some of the studied species. As far as we know, this is the first study to observe ocean warming and marine heat waves having such a dramatic impact (population collapse) on the dominant zooplankton species in shallow coastal areas.

Keywords
Climate Change; Marine Heatwaves; Zooplankton; Marine Ecology; Pollution