Combined effects of increased temperature and microplastics on the population dynamics of a harpacticoid copepod

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Global warming and plastic pollution are prominent anthropogenic stressors which can impact ocean health. While the ubiquitous presence of microplastics (1 µm – 5 mm) in marine environments is well-established, our understanding of their effects at organism and population level, particularly in the context of a warmer marine environment, remains limited. In this study, our goal was to assess the combined effects of microplastics exposure and global warming (increased temperature) on the harpacticoid copepod *Nitokra spinipes,* a benthic copepod with a key role on aquatic food webs, and estimate the impact at population level. To do so, we adopted a two-step approach: we exposed the copepods to Poly (lactic-co-glycolic acid) (PLGA) microbeads (5 µm) at both control (22 °C) and elevated (25 °C) water temperatures [+3°C, according to the 8.5 Shared Socioeconomic Pathways (SSPs) projection of the Intergovernmental Panel on Climate Change (IPCC)]. To assess the effects on individual *N. spinipes*, we analysed shifts in filtration rates on microalgal prey, which served as a proxy for energy assimilation. Subsequently, we simulated the dynamics of *N. spinipes* populations under projected global warming conditions (+3 °C), i.e. the empirical filtration rate data were incorporated into an individual-based model based on the dynamic energy budget theory (DEB-IBM model) to infer potential theoretical population-level effects. Preliminary results indicate that PLGA microbeads at 0.1% food content significantly reduced the filtration rate of *N. spinipes* at elevated water temperatures (25 °C) ($P < 0.05$, ANOVA). Notably, all *N. spinipes* exposure treatments at increased water temperatures exhibited a higher filtration rate compared to the control temperature (22 °C). Our results indicate that the combined exposure to microplastics and elevated water temperatures can lead to reduced energy assimilation, especially in a high-emission scenario (RCP 8.5, IPCC). These findings contribute to assessing the vulnerability of marine populations in the face of both current and future environmental conditions, in particular of climate change and microplastics exposure.

Keywords
Microplastics; Population Effects; DEB Model; Global Warming; *Nitokra Spinipes*