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# Is fish response to nanoplastics exposure modulated by neuropharmaceuticals pre-exposure? A case study with zebrafish (*Danio rerio*)s

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## Abstract

Knowledge on the effects of nanoplastics (NPLs) on freshwater biota has progressed greatly in recent years. However, most of the studies have focused on NPLs individual exposures, a condition that lacks environmental relevance as NPLs do not exist alone in the environment. Other environmental contaminants may modulate their behaviour and biological effects. In this sense, it becomes highly relevant to understand how biologically active molecules like neuropharmaceuticals can influence the effects of NPLs, particularly at environmentally and ecologically relevant sub-lethal endpoints, such as behaviour. Accordingly, in this study, the effects of 96h exposure to 1 and 10  $\mu\text{g/L}$  of 50 nm polymethylmethacrylate NPLs (PMMA-NPLs) on zebrafish behaviour (basal swimming activity and response to stressful conditions) was assessed in organisms previously chronically exposed (21 days) to 0, 40, and 400  $\mu\text{g/L}$  of the antidepressant paroxetine (PAR). Overall, chronic exposure to PAR decreased fish basal locomotor activity during both light and dark periods and interfered with stress response. The same pattern was observed in an acute exposure to PMMA-NPLs, with exposed fish swimming less than control, except for 1  $\mu\text{g/L}$  PMMA-NPLs under dark conditions. Finally, when considering fish that were pre-exposed to PAR and then subjected to PMMA acute exposure, a significant interaction between PAR and PMMA-NPLs was found to interfere with fish swimming behaviour under light conditions. These results highlight that effects of NPLs can be modulated by other emerging contaminants and organisms' previous contamination history.

**Keywords:** emergent contaminants, nanoplastics, antidepressants, long, term exposure

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