
Ecotoxicological effects of micro and nanoplastics in gelatinous zooplankton

Elisa Costa^{*†}, Chiara Gambardella, Michela Di Giannantonio, Roberta Miroglio, Roberta Minetti, Veronica Piazza, Silvia Lavorano, Francesca Sbrana, Marco Faimali, and Francesca Garaventa

¹Institute for the study of anthropogenic impacts and sustainability in the marine environment, National Research Council (CNR-IAS) – Via De Marini 16 16149 (GE), Italy, Italy

Abstract

Micro and nanoplastics are ubiquitous in the marine ecosystem, representing an emerging threat due to their small size able to be taken up by many organisms. The aim of this study was to investigate for the first time the micro and nanoplastics (MPs, NPs) ingestion and ecotoxicological effects in gelatinous zooplankton (Cnidarian jellyfish). With this aim, the ephyra stage of the *Aurelia* sp. jellyfish, recently suggested as valid model organisms in ecotoxicology, was exposed to both environmental and high concentrations (0.01-0.1–1-10 mg/L) of fluorescent 1–4 μ m polyethylene MPs and 100 nm polystyrene NPs to evaluate ingestion and ecotoxicological endpoints, such as Immobility and Frequency of pulsations. After 24 and 48 hours, MP and NP ingestion was assessed by using a novel technique, namely three-dimensional (3D) holotomographic microscope. Polyethylene MPs and polystyrene NPs were detected in the gelatinous body and in the mouth. Only the ingestion of MPs affected jellyfish survival, while significant effects on pulsation frequency were observed in ephyrae exposed to both MPs and NPs. Finally, a "recovery test" was performed, exposing contaminated ephyrae with MPs and NPs to clean seawater. Full recovery in terms of the frequency of pulsations was observed after 72 h and 24 h from exposure to MPs and NPs, respectively. In conclusion, short-term exposure to MPs and NPs temporarily affects ephyrae jellyfish health, impairing in different manner their survival and behavior, probably due to a mechanical disturbance triggering a loss of radial symmetry in ephyrae more evident after MP than NP exposure. This study provides a first step towards understanding and clarifying the potential impacts of MP and NP contamination in gelatinous zooplankton, a key component in marine ecosystems and in the marine food web.

Keywords: Microplastics, Nanoplastics, Polyethylene, Polystyrene, Jellyfish, Frequency of pulsation

^{*}Speaker

[†]Corresponding author: elisa.costa@ias.cnr.it