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EFFECTS OF MICROPLASTICS ON FISH AND INVERTEBRATES

Session Chairs: Chelsea Rochman, University of Toronto; **Matthew Cole,** Plymouth Marine Laboratory; **Amy Lusher,** Norwegian Institute for Water Research (NIVA)

This session focuses on new experimental evidence regarding the impacts of microplastics on fish and invertebrates in aquatic ecosystems.

Microplastic pollution has been identified in habitats and animals, in both freshwater and marine ecosystems, from all over the world. Microplastics contaminate every level of aquatic foodchains, from the smallest zooplankton to the largest vertebrates. This begs the question: how does microplastic impact animals that become contaminated via ingestion or absorption? The weight of evidence regarding impacts is rapidly increasing. This session aims to highlight new findings that demonstrate the effects that microplastic (and associated co-contaminants) can have upon fish and invertebrates. This session will highlight both field and laboratory research investigating how microplastic exposure can affect fish and invertebrates at multiple levels of biological organization. Scientific presentations in this session will contribute novel findings, work to close some of the key research gaps relating to plastic pollution, and address topics relevant to policy change.

ABSTRACTS

Distribution and ecotoxicological effects of microplastics in Mediterranean marine organisms

Authors: Francesco Regoli (Dep. Life and Environmental Sciences, Polytechnic University of Marche, Italy), Lucia Pittura (Department of Life and Environmental Sciences), Daniele Fattorini (Department of Life and Environmental Sciences), Marta Di Carlo (Department of Life and Environmental Sciences), Stefania Gorbi (Department of Life and Environmental Sciences), Francesco Regoli (Department of Life and Environmental Sciences)

Microplastics (MPs) are widely diffused in the oceans and their ingestion by marine organisms is raising concern for potentially adverse effects. In this study, the distribution of MPs along Mediterranean trophic webs was evaluated, in approximately 600 specimens representative of the main invertebrate and vertebrate species. MPs were characterized in terms of size, shape and polymer typology trough microscopy and μFT- IR analyses. The results indicated that ingestion of MPs is widespread, with their occurrence in approximately 30% of Mediterranean specimens, and much higher frequencies in some species; fragments, lines, films and pellets are the more represented particles, while polyethylene, polystyrene and polyamide are the dominant polymers.

However, no clear relationship with trophic position, feeding strategy or habitat preference can be easily observed.

The ecotoxicological effects of MPs were further investigated in Mediterranean mussels, Mytilus galloprovincialis, focussing on biological interactions of these particles when contaminated by PAHs. After ingestion, MP were observed in different tissues causing a significant bioaccumulation of B(a)P. The analysis of a wide range of molecular and cellular biomarkers, including immunological and antioxidant systems, neurotoxic responses, genotoxic damages and lipid peroxidation showed a different susceptibility of analysed pathways, depending on time of exposure, tissue and treatment typology. Toxicity of MPs alone was slight, but increased for contaminated particles. Even in the absence of strong toxicity, the downregulation of the immune system might have long-term consequences on organisms health status. In conclusion, this study provided new insights on the distribution of MPs in marine food webs, and on the mechanisms for their potential toxicity.

Microplastic fiber uptake, ingestion, and egestion rates in the blue mussel (Mytilus edulis)

Authors: Madelyn Woods (Marine & Environmental Research Institute, United States), Margaret Stack (Marine & Environmental Research Institute), David Fields (Bigelow Laboratory for Ocean Sciences), Patricia Matrai (Bigelow Laboratory for Ocean Sciences)

Microplastics are a ubiquitous contaminant in the marine environment. Microplastic fibers, which make up to 90% of microplastics in coastal systems, are consumed by more than 200 marine species. However, the fate of these fibers and their effects once ingested remain largely unknown. Here, we present the effects of polyethylene terephthalate microplastic fibers (MPF) on blue mussel (Mytilus edulis) feeding rates, using imaging flow cytometry—a tool we have quantitatively adapted and applied to MPF. Mussels were fed a diet of Rhodomonas salina and experimental treatments ranged from 3,000 to 30,000 MPF/L, or 0.0004–0.004% of available seston. Microalgal uptake rates were greatly reduced in mussels exposed to levels of 15,000 MPF/L or higher. Pseudofeces production showed a positive correlation with MPF uptake rates at 30,000 MPF/L. Up to 70 MPF were isolated in a single fecal pellet and an average of approximately 300 to 1000 MPF accumulated in the digestive track. Based on our results, it is possible that mussels act as microplastic sinks in Gulf of Maine coastal waters where MPF concentrations average 10.16±0.54 MPF/L in summer and fall (2014-2017). Depuration times of exposed mussels were also examined to assess MPF egestion rates and may be an important processing step for commercial farmers. Ecological implications of MPF intake and egestion by filter feeders will be discussed.

Understanding scleractinian microplastic ingestion: size limits, retention, and calcification effects

Authors: Cheryl Hankins (U.S. Environmental Protection Agency, United States), Allyn Duffy (student), Kathryn Drisco (U.S. Environmental Protection Agency)

The prevalence of microplastics in the marine environment has been of increasing concern in the past decade. Microplastics have been shown to be ingested by aquatic organisms, however the