# Modeling approach of micro- and nanoplastics in aqueous and cell environments

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*Micro- and nanoplastics are tiny plastic particles with size less than 5 mm and 0,1 µm, respectively, and they come from a variety of sources, including degradation of larger plastic fragments and direct release of micro- and nanoparticles from household and customer care products. Microplastics is a global pollutant that may be affecting the behavior of marine and freshwater ecosystems. From aquatic ecosystems microplastic can end up to food webs, foodstuffs and tap water which could potentially increase exposure of chemicals to humans and thus can be risk to human health. However, the human health effects are still unknown. Based on chemical analysis (NMR, MS, FTIR) of microplastic samples, molecular modeling tools can be used to study whether micro- and nanoplastics could pass through cell membrane or bind to transporters that can be used for estimating their effects on human. Molecular modeling allows also to explore the role of plastic additives and organic pollutants in micro- and nanoplastics. The experimental assays will be applied for monitoring cell viability via metabolic activity after micro- and nanoplastic treatment. By combining modeling together with toxicity studies, we can build predictive models to estimate toxicity of micro- and nanoplastics. Our strength in UEF Kuopio Campus is to combine efficient analytical tools with molecular modeling, medicinal chemistry and toxicology. This will offer a novel insight on the toxicity of micro- and nanoplastics and their impact on human health.*

Keywords: Microplastic, Nanoplastic, lake, marine, cell, molecular modeling, simulation

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# Ingestion of plastic debris (Macro and micro) by longnose lancetfish (*Alepisaurus ferox*) in the North Atlantic Ocean

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Pollution by plastic marine debris constitutes a major threat to marine life Ingestion of plastic marine debris by seabirds, turtles, and marine mammals is well acknowledged and has been recognized as a serious hazard to marine biota. The detrimental effects of plastic debris on marine biota include physical entanglement, decreased nutrition from intestinal blockage, and suffocation or decreased mobility. Despite the prevalence of studies documenting the environmental implications of plastic debris in the world's oceans there have been few reports of plastic ingestion by large marine fishes. Reports of plastic ingestion in larger, higher trophic level pelagic fishes are sparse in

the literature but include reports from species such as dolphinfish, tunas, and moonfish.

Longnose lancetfish, *Alepisaurus ferox* Lowe, 1833, a piscivorous ambush predator, is one of the most common bycatch species of the tuna longline fishery. It has a worldwide distribution extending from 45oN to 45o S in the open ocean pelagic ecosystems of the world oceans.

This study evaluates the ingestion of plastic marine debris by *A. ferox*, with the goal of quantifying the amount and type of plastic marine debris ingested. As far as we are aware, there has been no detailed report on plastic ingestion of this fish in the North Atlantic Ocean and it's the first time that microplastics are studied in the stomachs. The stomachs of the fish examined contained many pieces of synthetic materials such as polyethylene and vinyl in addition to ordinary food items (e.g., fishes, cephalopods, shrimps, salps, Pyrosoma). Our study shows that plastic ingestion in *A. ferox* is more prevalent than previously suggested. This study adds to the body of knowledge on piscivorous fish ingestion of marine debris.

Keywords: macroplastics, microplastics, pollution, Alepisaurus ferox, North Atlantic Ocean

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# Influence of solar radiation and plastic type on the bacterial community composition of plastic's biofilm in the North Adriatic Sea

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Once plastic enters the ocean it rapidly becomes colonized by a biofilm. Factors shaping the biofilm's community composition and development are still unclear. In this study we aimed at understanding how solar radiation and plastic type might influence the biofilm's bacterial community composition. We incubated high and low density polyethylene (HDPE and LDPE), polypropylene (PP), polyvinyl chloride (PVC) with two different additives (DINP and DEHP), and glass serving as an inert control over a two-month period in the North Adriatic Sea under minimal light and ambient solar radiation. Samples were taken after one week, one month and two months and the bacterial 16S rRNA gene was used to determine the biofilm community composition. Significant differences were found between the community composition of the biofilm on samples kept under minimal light conditions and ambient solar radiation, with high abundance of cyanobacteria in the ambient solar radiation treatment contributing largely to the variability in bacterial community composition in LDPE, HDPE, PP and glass, especially after one week and two

A preliminary analysis of the presence of microplastic was conducted on a total number of 40 animals of several ages and sexes found stranded on Samos island coastline during 2016 and 2018. Necropsies in situ or in the laboratory, when possible, were conducted for standard diag- nosis analysis samples for the fresh carcass and the isolation of the digestive system for all the stranded animals. The methodology applied for microplastic analysis consists in collecting the entire digestive system from the first tract (oesophagus) to the last (last tract of the large intes- tine). All of the samples, after dissolving the organic matter, are filtrated. The filters are read using a microscope in order to identify and categorize the microplastics (sources, type, shape, colour and size). A ”needle test” is conducted to distinguish between plastic pieces and organic matter (De Witte et al., 2014). A test for external contamination is conducted randomly. A high concentration and variety of microplastics were found throughout each tract of the di- gestive systems of all the animals analysed without any exception, confirming the wide pollution of plastic affecting the top predators of the trophic chain.

Keywords: marine mammal, Monk seal, turtle, Aegean sea, microplastic

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# Dynamics of floating marine debris in the northern Iberian waters: A model approach

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Floating marine debris is distributed worldwide through the oceans and poses a serious threat to marine ecosystems. Field data and model results show high concentrations of floating marine debris in the Bay of Biscay. In this work, the Regional Ocean Modelling System (ROMS), in conjunction with a particle-tracking model, has been used to study the distribution of floating debris in the northern Iberian waters. Long residence times were observed in the south-eastern Bay of Biscay, where the concentra- tion of floating debris would be, on average, 2.1 times higher than in the north-western Iberian coastal waters, and 3.6 times higher when considering only the winter months. The analysis also suggests the existence of a seasonal influx of floating debris into the south-eastern Bay of Biscay, which would be greater during the winter, when an eastward transport of virtual drifters along the northern Iberian coast was observed. Both results - long residence time and influx of floating debris - support the hypothesis that the Bay of Biscay can be regarded as an accumulation zone of floating debris.

Keywords: Bay of Biscay, floating marine debris, marine litter, northwest Iberia, ROMS. ∗Speaker