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Microplastic exposure and effect on loggerhead turtle health

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Plastic forms the majority (*i.e.* 75%) of marine waste with 14.5 million tons per year of dumped into the oceans. Once at sea, sunlight, wind, and wave action break down macroplastic waste into small particles. These microplastics (MPs, particles between 0.1 µm and 5 mm), which can also directly originate from industrial production are ubiquitous and are likely to persist in the marine environment for centuries. Recent studies show that the range of marine animals capable of ingesting these MPs spans the entire marine fauna. The effects of MP ingestion are diverse and vary between taxa: reduced food assimilation efficiency, delayed growth, negative effects on reproduction, reduced energy reserves due to reduced feeding activity, impaired cognitive abilities, decrease of the survival and fecundity rates, increase of the mortality rates, promotion of inflammatory, responses, and disruption of the endocrine system and fomites of pathogens. Due to the complexity of their life history traits (long lifespan, highly migratory species, oceanic or neritic lifestyle depending on life stage) and their feeding habits (visual feeders mistaking their prey for plastic waste), marine turtles appear to be highly vulnerable to plastic contamination. In loggerhead sea turtles, MPs are mostly localized in the intestine, compared to the esophagus and stomach. Despite their importance as key species for monitoring MP contamination and effects, the effect MPs concentratins and composition on the turtle gut microbiota and on their health has never been investigated.

The present study aims to i) quantify and characterize the MP contamination in loggerhead turtles, and ii) measure their impact on the gut microbiota and health indices of loggerhead turtles (*Caretta caretta*) of the western Mediterranean. For this purpose, we collected stool, blood, saliva and scales samples from 112 live loggerhead turtles along the eastern Spanish coast and we related the abundance and composition of MPs to several turtle health indicators such as external parasitosis, nutritional efficiency, immuno-inflammatory response at the intestinal barrier, liver function and chronic stress as well as the diversity of the gut microbiota. Seventy-four percent of the loggerhead

turtles in the study were contaminated with microplastics with an average of 7.90 ± 10.89 microplastics per gram of feces. The most common polymers are polyethylene, polyester, and polyamide (44.82%, 27.23% and 12.11% respectively). Several significant relationship between microplastics abundance and the microbial composition of the intestinal microbiota, the abundance of immune cells or glucose levels suggest that MPs have a potential impact on the health of loggerhead turtles, notably by modifying the structure of the bacterial communities of the intestinal microbiota (increase in specific richness) but also by disrupting the immune system and glucolipid metabolism.