

## Are baleen whales exposed to microplastics toxicological threat? The case study of the Mediterranean fin whale (*Balaenoptera physalus*)

Maria Cristina Fossi<sup>1</sup>

Cristina Panti<sup>1,2</sup>, Daniele Coppola<sup>1</sup>, Matteo Bainsi<sup>1</sup>, Matteo Giannetti<sup>1,2</sup>, Letizia Marsili<sup>1</sup>, Ilaria Caliani<sup>1</sup>, Cristiana Guerranti<sup>1</sup>, Simone Panigada<sup>3</sup>, Jorge Urban<sup>4</sup>

- (1) *Department of Physical, Earth and Environmental Sciences, University of Siena, Via P.A. Mattioli 4, 53100, Siena, Italy, fossi@unisi.it*
- (2) *Department of Life Sciences, University of Siena, Via A. Moro 2, 53100, Siena, Italy*
- (3) *Tethys Research Institute, Viale G. B. Gadio 2, 20121 Milano, Italy*
- (4) *Departamento de Biología Marina, Universidad Autónoma de Baja California Sur, La Paz, Mexico.*

The emerging issue of microplastics (plastic fragments smaller than 5 mm) in marine environment is recently raising increasing attention. The impacts of microplastics on baleen whales, which potentially undergo to the ingestion of micro-litter by filtrating feeding activity, are largely unknown. This case study examines the Mediterranean fin whale (*Balaenoptera physalus*), one of the largest filter feeders in the world. These whales feed primarily on planktonic euphausiid species. With each mouthful, the whales can trap approximately 70,000 l of water, and their feeding activities include surface feeding. They could therefore face risks caused by the ingestion and degradation of microplastics. Micro-debris can be a significant source of lipophilic chemicals (primarily persistent organic pollutants – POPs) and a source of pollutants such as polyethylene, polypropylene and, particularly, phthalates. These chemical pollutants can potentially affect marine organisms, are potential endocrine disruptors and can affect population viability.

This study is the first evidence of the potential toxicological impact of microplastics in a baleen whale and suggests the use of phthalates as a tracer of the intake of microplastics through the ingestion of micro-debris and plankton. In this presentation we explore the toxicological effects of microplastics on fin whale comparing two populations living in areas characterized by different human pressure: the Pelagos Sanctuary (Mediterranean Sea -IT-FR) and the Sea of Cortez (MX). The work is implemented through four steps: 1) collection/count of microplastics in Pelagos Sanctuary (Mediterranean Sea); 2) detection of phthalates in superficial neustonic/planktonic samples; 3) the detection of phthalates in Mediterranean stranded fin whales; and finally 4) the detection of phthalates and biomarkers responses (CYP1A1, CYP2B, lipid peroxidation) in skin biopsies of fin whales collected in the Pelagos Sanctuary (n=18) and Sea of Cortez (n=7).

High presence of plastic particles have been detected in superficial neustonic/planktonic samples collected in the Pelagos Sanctuary areas investigated (mean value 0.62 items/m<sup>3</sup>) with high concentration of phthalates (DEHP and MEHP), used as tracers of plastic derivatives. MEHP concentrations were detected (57.9 ng/g), for the first time, in blubber samples of five stranded fin whales collected along the Italian coasts. Finally, relevant concentrations of MEHP and higher biomarker responses (CYP1A1, CYP2B, lipid peroxidation) were detected in the skin biopsies of fin whales collected in the Mediterranean areas in comparison to the specimens of Sea of Cortez. These results suggest the use of phthalates as a tracer of microplastics assumption in fin whales and represent a warning signal on this emerging threat in baleen whales.

These preliminary investigation underscore the importance of future research on the detection of the toxicological impact of micro-plastics in filter-feeding species such as mysticete cetaceans, the basking shark and the devil ray. The results also underscore the

potential use of these species in the implementation of Descriptor 10 (marine litter) in the EU Marine Strategy Framework Directive as indicators of the presence and impact of micro-litter in the pelagic environment.