# Acoustic and video remote sensing for monitoring and removal of seafloor macrolitter in the Venice Coastal Area

Fantina Madricardo*†[1], Susanna Mesghez[2,3], Antonio Petrizzo[3], Taha Lahami[3,4], Tihana Marčeta[3], Nicoletta Nesto[3], Michol Ghezzo[5], Valentina Grande[6], Damien Sallé[7], Mariola Rodriguez Mijangos[7], Jose Gorrotxategi[8], Pierre-Elie Herve[9], Arkaitz Oyarzabal[10], David Culla[7], Cyril Barrelet[11], Marc Gouttefarde Gouttefarde[11], Vincent Creuze[11], Marc Chaumont[11], Gérard Subsol[12], Olivier Tempier[13], Fanny Picamal[11], Nicola Ferrari[14], and Vanessa Moschino[15]

[1]Istituto di Scienze Marine [Venezia] (ISMAR-CNR) – Arsenale Castello, 2737/F, 30122 Venezia VE, Italy

[2]Università Ca' Foscari di Venezia (UNIVE) – Dorsoduro 3246, 30123 Venezia, Italy

[3]Istituto di Scienze Marine [Venezia] (ISMAR-CNR) – Arsenale Castello, 2737/F, 30122 Venezia VE, Italy

[4]Università degli Studi di Napoli Federico II (UNINA) – Via Cintia Monte S. Angelo, 80126 Napoli, Italy, Italy

[5]Istituto di Scienze Marine [VENEZIA] (ISMAR-CNR) – Castello 2737/F 30122 Venezia, Italy

[6]Istituto di Scienze Marine [Bologna] (ISMAR-CNR) – Via Gobetti 11, Bologna, Italy

[7]TECNALIA, Basque Research and Technology Alliance (BRTA) (TECNALIA) – Parque Científico y Tecnológico de Gipuzkoa Mikeletegi Pasealekua, 2, E-20009 Donostia-San Sebastián (Gipuzkoa), Spain

[8]TECNALIA, Basque Research and Technology Alliance (BRTA) (TECNALIA) – Parque Científico y Tecnológico de Gipuzkoa Mikeletegi Pasealekua, 2, E-20009 Donostia-San Sebastián (Gipuzkoa), Spain

[9]TECNALIA, Basque Research and Technology Alliance (BRTA) (TECNALIA) – Parque Científico y Tecnológico de Gipuzkoa Mikeletegi Pasealekua, 2, E-20009 Donostia-San Sebastián (Gipuzkoa), Spain

[10]TECNALIA, Basque Research and Technology Alliance (BRTA) (TECNALIA) – Parque Científico y Tecnológico de Gipuzkoa Mikeletegi Pasealekua, 2, E-20009 Donostia-San Sebastián (Gipuzkoa), Spain

[11]LIRMM, Universitè Montpellier, CNRS (LIRMM) – Université Montpellier I – Montpellier, France

[12]LIRMM, Universitè Montpellier, CNRS (LIRMM) – Université Montpellier I – Montpellier, France, France

[13]LIRMM, Universitè Montpellier, CNRS (LIRMM) – Université Montpellier I – Montpellier, France

[14]Servizi Tecnici Srl (ST) – San Polo, 1173 30125 Venezia, Italy

[15]Istituto di Scienze Marine [Venezia] (ISMAR-CNR) – Arsenale Castello, 2737/F, 30122 Venezia VE, Italy

**Abstract**

Plastic pollution in the aquatic environment is recognized as a problem of critical concern, affecting both marine and freshwater ecosystems and there is an urgent need of cutting-edge

*Speaker

†Corresponding author: fantina.madricardo@cnr.it

solutions to monitor and remove marine litter already dispersed in the environment. Within the EU co-founded H2020 Smart technology for Marine Litter SusTainable RemOval and Management (MAELSTROM) project, acoustic remote sensing and video data collection were used to monitor seabed litter and to instruct the operations of an innovative robotic system, i.e. a floating platform combined with an underwater cable-driven robot. This technology was developed to remove macrolitter from the seafloor in a selective and eco-sustainable way. First, two seafloor marine litter hotspots (in an urban area of Venice and an abandoned mussel farm at sea) were mapped and litter identified. The results showed that both study areas are characterised by high amounts of marine litter. In the Venice lagoon site, the litter comes more from urban activities and from the city of Venice (car tyres, crates, piles, wrecks, etc.), whereas in the abandoned mussel farm, most of the litter is linked to aquaculture activities (ropes, nets, mooring blocks and floating buoys). Then, the robotic solution used the high resolution multibeam maps as reference to selectively remove a total of 2240 kg of ML from the Venice urban site and 260 kg of ropes and floating buoys in the abandoned mussel farm. In this research, we demonstrate the efficacy of high-resolution mapping and classification in optimizing the functionality of a cutting-edge robotic system designed for removing litter from the marine seafloor. This research was co-funded under the EU H2020 Project "Smart technology for Marine Litter SusTainable RemOval and Management" MAELSTROM (GA n. 101000832).

**Keywords:** Acoustic remote sensing, marine litter, robotic seabed cleaning platform