



## Diving into DNA: towards ROV-assisted eDNA and LAMP for early detection of aquatic invasive species

Jessica Frigerio<sup>1\*</sup>, Valentina Verduci<sup>2</sup>, Vanessa Lozano<sup>3</sup>, Giuseppe Brundu<sup>3</sup>, Donatella Spano<sup>3</sup>, Francesco Spaggiari<sup>4</sup>, Cristiano Rosa<sup>4</sup>, Luca Palezza<sup>4</sup>, Thanapol Tantagunninat<sup>4</sup>, Gianluca Orrù<sup>5</sup>, Massimo Labra<sup>1</sup>

\*lead presenter: [jessica.frigerio@unimib.it](mailto:jessica.frigerio@unimib.it)

1 Department of Biotechnology and Biosciences, University of Milano-Bicocca, Milano, Italy

2 Earth and Marine Sciences Department, University of Palermo, Palermo, Italy

3 Department of Agricultural Sciences, University of Sassari, viale Italia 39/a, 07100 Sassari, Italy

4 Immersea srl, Lipari, Parco Archeologico delle isole Eolie Museo Bernabò Brea, Italy

5 Servizio tutela della natura e politiche forestali Assessorato della difesa dell'ambiente Regione Autonoma della Sardegna

Invasive non-native species pose significant ecological and socio-economic threats, particularly in insular environments such as Sardinia (Italy). Detecting new outbreaks at an early stage is essential to enable timely control actions, increase the likelihood of successful local eradication, and minimize environmental impacts. In this context, environmental DNA (eDNA) monitoring offers a powerful tool for detecting invasive non-native species at very low abundance, enabling timely intervention in high-risk areas. Among the most problematic species, the invasive non-native aquatic plant *Pontederia crassipes* Mart. (water hyacinth), native to South America, has been established in Sardinia for several years; however, its distribution remains largely localized, although it can spread over tens of square meters, forming dense mats.

This study presents an integrated approach combining eDNA sampling and Loop-mediated Isothermal Amplification (LAMP) to improve monitoring efficiency. Water samples were collected along a spatial gradient from the infestation core to connected channel sites at increasing distances, including marginal zones and a hydrologically isolated negative control. Laboratory analyses using LAMP are being evaluated for specificity and sensitivity, with the aim of reducing processing times compared to traditional endpoint PCR. This workflow offers advantages in terms of lower operational costs and faster turnaround times, which are crucial for effective early detection and rapid response strategies.

Building on these findings, we are developing an innovative system integrating a Remotely Operated Vehicle (ROV) capable of autonomous water sampling and real-time eDNA analysis through onboard LAMP assays. This approach aims to minimize human intervention, reduce costs, and significantly accelerate monitoring processes.

Overall, this integrated framework represents a scalable and efficient strategy for invasive species management, with potential applications in other aquatic ecosystems, supporting biodiversity conservation and ecosystem protection.