**From Nets to Imaging: Towards Next-Generation Zooplankton Monitoring in ITINERIS**

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Zooplankton plays a fundamental role in marine food webs and biogeochemical cycles. However, its diversity and dynamics remain challenging to assess, primarily due to the high taxonomic complexity and pronounced spatial-temporal variability of planktonic communities.

Traditional methodologies, based on plankton net sampling and stereomicroscopic identification are the standard approach for achieving species-level taxonomic resolution and ensuring the comparability of datasets. Nevertheless, these methods are time-consuming, require a high level of taxonomic expertise, and may underrepresenting taxa that are rare or fragile.

To address these limitations, within the framework of the PNRR ITINERIS project, we explored innovative technologies for zooplankton monitoring in coastal and offshore environments, embedding this approach within the Long-Term Ecological Research (LTER) network and the Distributed System of Scientific Collections (DiSSCo) infrastructure.

A dedicated test approach was implemented during the ITINERIS’ EYES oceanographic cruise carried out on board CNR’s R/V Gaia Blu in July 2025 where the Underwater Vision Profiler 6 (UVP6) was installed on the CTD rosette and successfully operated *in situ*. This setup allowed the acquisition of vertical profiles of plankton abundance, size spectra, and particle fluxes, providing high-resolution insights into the spatial distribution of organisms directly in the water column. In parallel, ZooScan and FlowCam will be employed for laboratory-based image acquisition, enabling semi-automated classification and quantification of zooplankton samples collected with the WP2 net. The integration of machine learning algorithms further enhanced the efficiency and consistency of image-based identification.

Preliminary results confirm that combining classical and innovative approaches improves the robustness of biodiversity assessment: traditional taxonomy provides ground-truthing and species validation, while imaging systems expand throughput, standardization, and long-term interoperability of data across sites and infrastructures. Here, we present evidence that integrating advanced technologies within several research infrastructures enhances efficiency, scalability, and reproducibility in zooplankton biodiversity assessment, supporting community studies under changing environmental conditions.

**Keywords: Zooplankton, Imaging Technologies, Biodiversity Assessment**