A new approach to use marine robotic networks for ecosystem monitoring and management: The PLOME Project

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Our understanding of marine ecosystem functioning and processes relies on adequate spatio-temporal multiparametric monitoring procedures. Over the next 3 years, the Project PLOME (Platforms for Long-lasting Observation of Marine Ecosystems) will implement a spatially adaptive and autonomous network of easy-to-use benthic landers with dockable Autonomous Underwater Vehicles (AUVs)ñ This network will be used to intelligently video-

monitor and map marine ecosystems and their environment from coastal to deep-sea areas. All platforms will be connected via acoustic or optical communication and will operate over periods of weeks to months with real-time supervision. Stations will provide continuous and intensive temporal observations, while dockable AUVs (with battery recharge and data downloading capability) will provide intensive measurements at various spatial scales, using intelligent and adaptive trajectories to explore surrounding areas. Biological, geochemical and oceanographic data will be generated by an array of sensors including acoustic receivers and cameras. Images will be processed in real-time for species classification and tracking, using advanced data analysis and Deep Learning techniques. Metadata will be communicated between landers and AUVs and transmitted opportunistically whenever an Unmanned Surface Vehicle (USV) connects the platform via aerial communications (i.e. GSM and satellite communications, depending on form distance to shore). The unattended operation will also be possible with an innovation of pop-up buoys that will allow data transfer to the surface from landers and UAVs to be relayed once the pop-up buoys reach the surface. Complex ecological indicators for ecosystem management will be computed from the collected data, by applying advanced computer vision techniques to classify, count and size individuals in video images and to generate multimodal maps of the seabed. A pipeline for automated data treatment will be tailored for multiparametric analyses to derive cause-effect relationships between biological variables and the physical habitats.

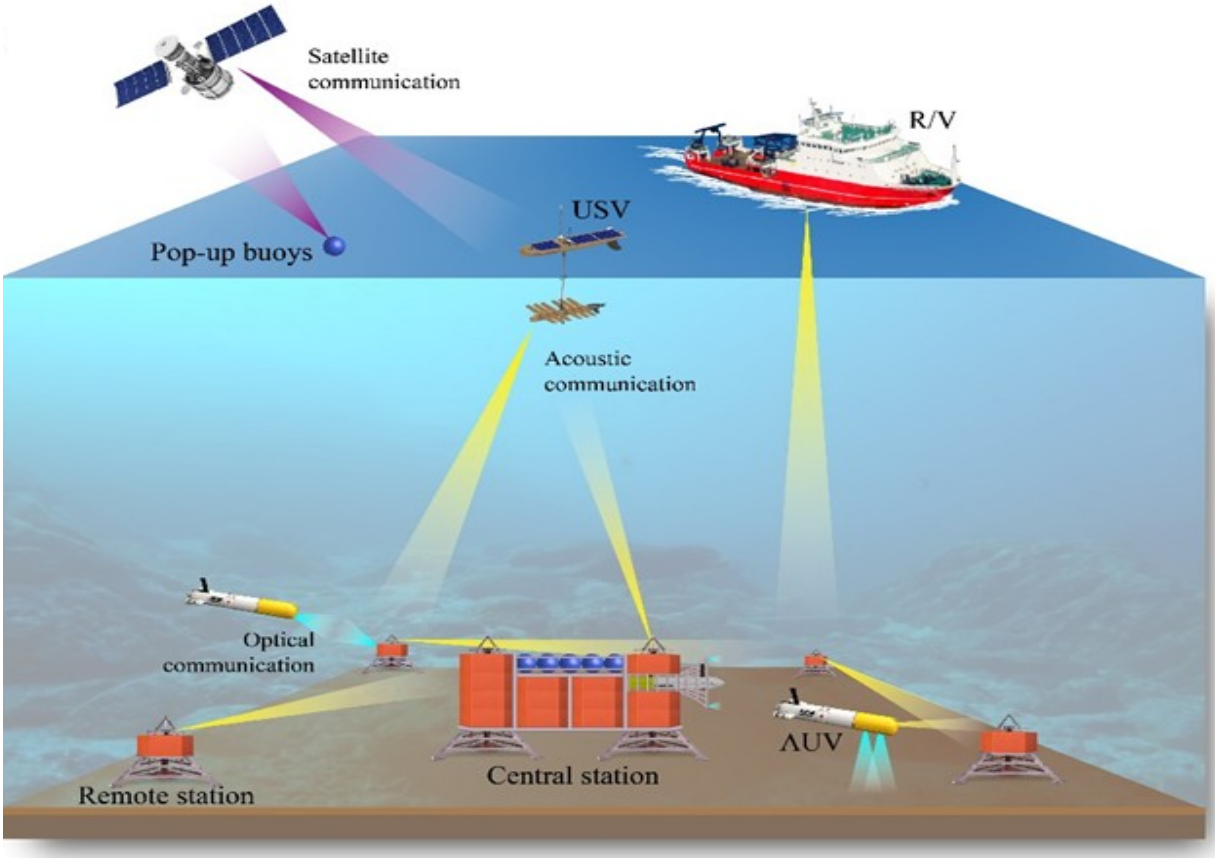

Figure 1. Schematic illustrating the varios scientific and communication platforms that will be incorperated in the PLOME project.