URBAN AND REGIONAL DEVELOPMENT

MUR DM 117/Biru - Geomatics to support knowledge, monitoring and conservation of the coastal landscape and marine ecosystem in the Mediterranean basin

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Context of the research activity	The research to be pursued has as its objective the development and application of new multi-sensor and multi-scale 3D metric survey methodologies linked to Geomatics methods for knowledge, monitoring and conservation of the Mediterranean's coastal landscape and marine ecosystem. The experiments will focus on two case studies: (1) the Culuccia Island and (2) the protected marine area of Capo Testa Punta Falcone in Sardinia. Progetto finanziato nell'ambito del PNRR - DM 117/2023 - CUP E14D23002080004

	The research is inspired by the recommendations of international organizations such as the European Environmental Directives, the Mediterranean Network, the International Partnership for Blue Carbon, and the Intergovernmental Oceanographic Commission of Unesco, which consider the resources linked to natural and marine ecosystems a resource to be known, documented and safeguard. Due to the effects of climate change and extreme events affecting coastal areas globally, there is a growing concern for the state of conservation of ecological systems that interact with local anthropic disturbances. In recent years there has been a growing demand for high/very high-resolution 3D metric products capable of documenting these changes. Although many Geomatics tools and methods are already available for terrestrial areas for understanding, studying and monitoring the areas analysed for the underwater context (over 70% of the earth's surface), the challenge is still open and the techniques and methodologies investigations are not yet mature and consolidated. Starting from the state of the art, within

Objectives	the research, new methodologies and techniques will be studied and developed, useful for a better 3D documentation of the underwater environment which will allow, at least in part, to bridge the gap between the techniques and methods used for the survey of emerged areas and those used up to now for submerged areas. The research fits perfectly within the themes of the PNRR, with particular attention to the M2 mission (Green revolution and energy transition) according to the C4 component (Protection of the landscape and water resources), within the M2C4.1 areas (Increase the ability to predict the effects of climate change) and M2C4.3 (Safeguarding air quality and biodiversity through the protection of greenery, soil, and marine areas), in line with investments I3.2 (Digitalization of natural parks) and I3.5 (Restoration and protection of the seabed and marine habitats). The aims of the project are also in line with the objectives of the PNRR for the restoration and protection of marine habitats which will translate into the preservation and recovery of at least 20 percent of the seabed and marine habitats in Italian waters. This goal is crucial to achieving the EU's goal of protecting diversity and promoting sustainable fisheries, tourism and blue growth. The first objective is to identify and improve tools and methods for knowledge of the situation by: - Geomatics instruments and sensors for spatial data acquisition; - Multisensor data fusion and integration - 3D survey using Unmanned Aerial Vehicles and Unmanned Ground Vehicle, also in real-time - Autonomous Underwater Vehicle vehicle for acquisition data in marine areas. he second objective id the definition of the advanced data model for extracting information for a correct description of analysed region: - machine learning for semantic interpretation of acquired data; - advanced 3D model for mapping data; - digital ontology; - extension of the existing data model (CityGML, INSPIRE,…). Propose and develop solutions for multiple-criteria spatial analysis specifically defined for a multi-scale self-adaptive approach. Based on this analysis, it is possible to define some future scenarios and related strategies to deal with this situation in a complex and complete way.

Skills and competencies for the development of the activity	• Instruments and techniques for spatial data acquisition: terrestrial and aerial LiDAR, aerial, marine and underwater photogrammetry • Multi-sensor data acquisition using Unmanned Aerial Vehicle (UAV), Unmanned Ground Vehicle (UGV), Autonomous Underwater Vehicle (AUV), manual laser scanner, SLAM techniques • Multi-scale data fusion algorithms • 3D GIS and 3D model for mapping data