Cost effective baseline and monitoring for rocky marine protectedareas (MPAs) at the edge of the Israeli Mediterranean shelf

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**Abstract**

Rocky mesophotic habitats of the Israeli Mediterranean shelf-edge portray unique habitats and provide ecological refuge and biodiversity focal zones. The need to include these habitats into MPAs is therefore critical. However, long term monitoring of these deep water MPAs, a basic need for their definition and management, pose significant technical and budgetary challenges. This proposal directly addresses these challenges, offering to establish a cost effective baseline and monitoring procedure for the rocky MPAs at the edge of the shelf. In the course of developing and verifying this procedure, we propose to create a baseline and monitor a shelf-edge MPA site, to be selected with INPA. Our proposed solution begins with a onetime cm-scale imaging and mapping the site using the synthetic aperture sonar (SAS) mounted on University of Haifa surveying autonomous underwater vehicle (AUV). This will yield a high-resolution acoustic map of a relatively large area. Next, we will define a few quadrats within the mapped area to be surveyed with a high-resolution stereo camera pair, deployed with a hovering AUV. The hovering AUV is able to maneuver slowly and in proximity to the seabed, yielding high-resolution photographs of up to 1cm details. We will color-correct the photographs with our proprietary algorithms, and then construct 3D mosaics of each quadrat. Each quadrat will initially be manually annotated for biodiversity and then the initial annotations will be fed to a machine-learning algorithm that will complete the rest. In addition, we plan to integrate a forward-looking camera on the hovering AUV, to deploy automatic counting of pelagic fish. We propose to base the long-term monitoring program on the operation of the locally available and cost effective photographic surveying of the hovering AUV, which is becoming a globally accepted methodology. In the course of the proposed project, we will carry on a first revisit of the reference quadrangles to verify our baseline and establish the monitoring procedure. All data, including all other available surveys and sampling programs will be incorporated on to a GIS database, which will be provided to INPA and other policy makers. Beyond its direct applicability to the management of MPAs along the Israeli shelf edge the proposed research will be valuable for addressing the broader scope ecological processes affecting the southeastern Mediterranean, as well as find innovative solutions to the engineering challenges.