ID13 THE VIDEO-BASED EGIM DEVELOPMENT

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Keywords – Rhythmic behaviour, environmental cycles, cabled seafloor observatories, climate change, biodiversity indicators, environmental drivers, fish community.

ABSTRACT

The use of technology as a low-impacting monitoring method is becoming widespread across the oceans. Furthermore, the declared United Nation (UN) Decade of Ocean Science for Sustainable Development highlighted the importance of the technological development for the protection and sustainable use of marine resources. In particular, the use of seafloor cabled observatories in an integrated way, with a multitude of sensors and cameras, will be fundamental in the future management decisions of marine resources. Cameras in such infrastructures could be used as biological sensors extracting meaningful information on number of individuals per marine species. In this context, the Observatory of the Sea (OBSEA, www.obsea.es) [1] was deployed in 2009 at 4 km off the Vilanova i la Geltrú harbour (Barcelona, Spain), at a depth of 20 m. The OBSEA seafloor platform is a testing site of the European Multidisciplinary Seafloor and water column Observatory (EMSO, www.emso.eu) [2] where an EMSO Generic Instrument Module (EGIM) was tested, as multi-sensor probe, from 1st December of 2016 to 31st March 2017 (Fig. 1). This new instrumentation hosted a Seabird SBE37 CTD to measure Salinity (PSU), Temperature(°C), and Water Depth (m) (calculated in shifts of water pressure), and an AADI DW4831 Oxygen Optode to measure Dissolved Oxygen (µmol/l). This new set of sensors expanded the previous payload of the OBSEA adding information on the concentration of oxygen in the water, as important Essential Oceanic Variable (EOV) to determine the environmental status. In addition, relevant information on the local fish community was captured by two time-lapse cameras, located about 5 m apart from each other and equipped with artificial lights for night photos, focussing the EGIM structure. Each photo captured from the two cameras was manually analyzed by trained operators (e.g.; [3]) and had a time-stamp code to match each detected faunal entry to the concomitant acquired environmental data. The visual census by cameras was performed in a high-frequency (one photo each 30 min.) and continuous (i.e.; day and night) fashion, giving information on count fluctuations of 17 bony fish taxa. With this test we aim to present the results obtained from a new set of sensors at the OBSEA with future perspectives to improve the ecological monitoring with cabled seafloor observatories. The concomitant acquisition of environmental and relevant biological data allowed us to obtain information on changes in species composition (i.e. richness) and relative species abundance (i.e. evenness), as well as ecosystem functioning (e.g. food-web structure, carbon and energy fluxes etc.), and possible cause-and-effects principles between environmental and biological variables. The results from waveform analysis showed a general diurnal behaviour of the different fish species (Figure 2), with only Apogon sp. genus and Sciaena umbra detected as nocturnal species, and Scorpaena sp. genus and unclassified fishes as nocturnal/crepuscular species. The difficulty to classify fish species with artificial lights could have determined the nocturnal/crepuscular detected rhythm of the unclassified fish category. Nevertheless, the same analysis pointed out the cyclic pattern of the environmental variables with little variations in salinity and depth, and right shifts from the photoperiod for temperature and dissolved oxygen concentration (Fig. 2). The peaks in fluctuations of the fish counts and the environmental variables were determined with the Midline Estimated Statistic of Rhythm (MESOR) method by re-averaging all the mean values of each 30 min. of the day. These results highlighted that the fish species which do not follow the general behavioral pattern in relation to the photoperiod, likewise do not follow the general environmental ranges. However, longer experiments with the same instrumental setting covering the whole seasonal cycle are required to have more reliable data. Furthermore, additional environmental sensors for new EOVs, such as chlorophyll concentration, could add information on the ecological niche of the detected fish species.

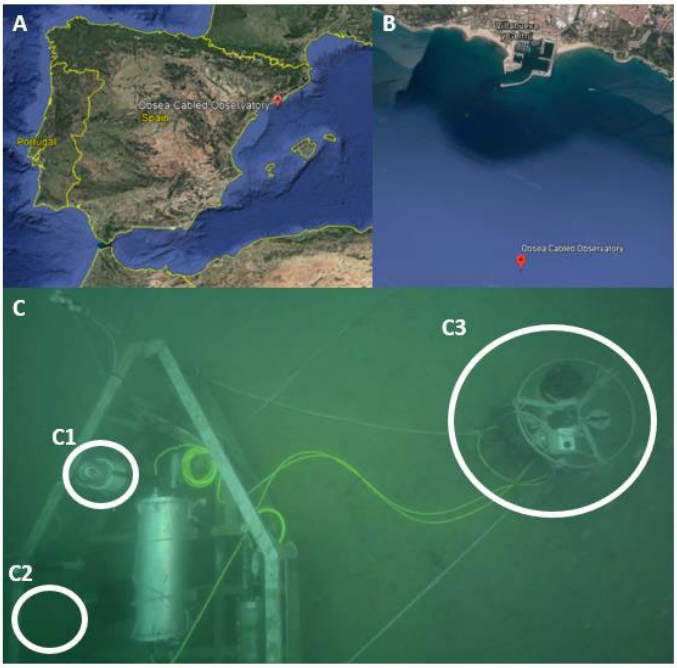

Fig. 1. The location of the OBSEA seafloor cabled observatory in the western Mediterranean Seas (A), with details of its location off the Catalan coast (B). A detailed above view of the platform (C), showing the position the CAM 1 (C1), the CAM 2 (C2) and the EGIM infrastructure (C3) with white circles.

Fig. 2. Integrated chart of significant daily increases in measured values for the 5 biologically relevant oceanographic variables, and visual counts of the 17 taxa, unclassified and total fishes obtained from 1st of December 2016 to 31st March 2017 of continuous measurement by the EGIM sensor infrastructure in front of the OBSEA (dark gray horizontal bars report values above the MESOR for the oceanographic measures, while black horizontal are used for visual counts). With light gray boxes in background is showed the duration of the night hours.

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ID14 DEVELOPMENT OF AN AUTONOMOUS SUBMERSIBLE PROFILER WITH THE ABILITY TO STOP AT SPECIFIC DEPTHS FOR MEASUREMENT OF MARINE PARAMETERS

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ABSTRACT

Understanding marine pollution problems is a complex topic that has led to a wide range of research over the last decades. In this research, an autonomous submersible profiler with controlled depth detention for the measurement of parameters of interest in shallow marine environments -is presented. The device has been designed to carry on several sensors including dissolved oxygen, chlorophyll, electrical conductivity and temperature among others. The profiler includes the performance for sampling, collecting and wireless sending reliable real-time data in marine environments. In addition, its ability to stop at a given depth allows for more accurate and stable measurement of marine parameters at different depth levels. This research describes the design of the profiler as well as the different control assumptions made to achieve zero buoyancy at a given depth. The results show that the submersible profiler is a valuable tool for continuous monitoring of marine parameters relevant to study the causes leading to critical environmental situations.

Keywords – sensor carrier platform, submarine profiler, WSN, depth control, process simulation.