EU Coastal and Open Sea Observatories

Workshop on Interoperability Technologies and Best Practices in Environmental Monitoring. Brest, 10-12 October 2018

Autonomous and cabled underwater sensor networks applied to remote monitoring of biological indicators

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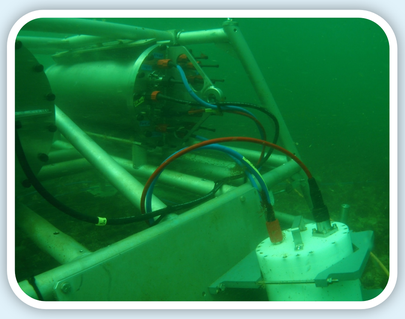
JERICO-Next Introduction

Since coastal areas are one of the most productive and dynamic environment of world's ocean with significant impact on ecosystem, JERICÓ-Next believes that the interconnection between physics, biogeochemistry and biology in the coastal sea should be analyzed in order to understand its complexity. That process requires new technological developments that guarantees the continuous monitoring of a larger set of parameters. So the project's vision is to improve and innovate the cooperation in coastal observatories around Europe.. This work was partially supported by the project JERICO-NEXT from the European Commission's Horizon 2020 research and Innovation programme under grant agreement No 654410

Geophysical cycles in the form of daily and seasonal changes in the light intensity and length of the photoperiod in all photic and disphotic zones, plus the marked hydrodynamic patterning of tides impose a strict synchronization of species behavior through natural selection. Rhythmic behavior under the form of massive populational displacements on the seabed and across the above water column, directly affects our perception of continental margin biodiversity and ecosystem functioning. Monitoring biodiversity and the environmental drivers controlling those rhythms at different spatiotemporal scales is a key issue in a context of estimating the effects of the increasing anthropogenic impact. To comply with the monitoring of biological indicators set by the EU Marine Strategy Framework Directive (MSFD, 2008/56/EC; descriptors: D1= biodiversity; D2= alien species; D3= commercial fish and shellfish species; D6=seafloor integrity and D10= marine litter) and the technical guidance for monitoring (JCR 2014, Report EUR 26499 EN, identifying high-definition cameras as key tools for biodiversity monitoring), the development new methodologies for sampling the composition of communities in relation to species' rhythmic activity and its environmental control trough the coupling of new fixed and mobile multiparameteric platforms, is of pivotal relevance. In order to increase spatial coverage and allow for strategic and adaptive changes in monitoring, autonomous underwater vehicles (AUVs) and benthic robots (crawlers) will be used, which will work in both spatial (near-area) and time-coordinated fashion *via* platform communication. In this scenario, different activities are being executed at the underwater cabled observatory, OBSEA like the H2020 JericoNext TNA action ADVANCED (Automatic Data and Video Acquisition for uNderwater monitoring across Coastal Environments), Spanish National Project RESBIO (Redes de sensores submarinos autónomos y cableados aplicados a la monitorización remota de indicadores biológicos), and MarTERA ERA-Net ARIM (Autonomous robotic sea-floor infrastructure for benthopelagic monitoring). Networks of fixed and mobile video cameras (i.e. fluctuations in counted individuals can be used as proxy of a populations' rhythms) will be used to enforce real-time and prolonged studies of the dynamics coastal and deep-sea communities in relation to surrounding habitat conditionings (i.e. *via* a concomitant acquisition of different oceanographic, chemical, and geological data). This multi-parametric monitoring is a challenge to be overcome, in order to have standardized protocols for the acquisition and automation of data processing regarding species composition (i.e. richness), relative abundances (i.e. evenness) and food web structure. Obtained data are of relevance since could be extended as reference for impact monitoring in industrial sectors .



COSYNA (Coastal Observation System for Northern and Arctic Seas) is an operational coastal monitoring, forecasting and information system for the North Sea composed by fixed platforms, FerryBoxes, gliders and HF-radar systems. Two nodes are available. Underwater node Helgoland is a cabled observatory at 11 meters depth located at the North Sea, with 10 pluggable access points. Underwater Node Spitzbergen is an experimental platform located in a polar fjord system.

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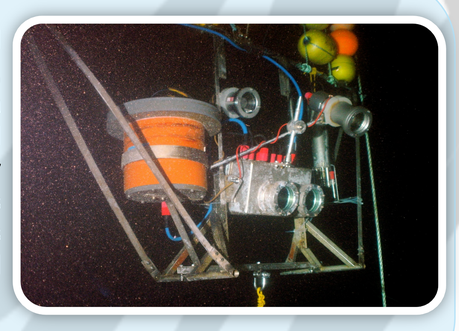

LoVe, cabled observatory with a suite of physical, biological and chemical sensors that involves many scientific fields and is expected to stimulate innovation and research.

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The seabed cabled observatory **EMSO-Molène** was deployed off shore 2 km north of Molène, in the marine protected area "Iroise Marine Park". It is an EMSO testing site at depth 18 meters, dedicated to sensors and equipment in-situ and long-term qualification.

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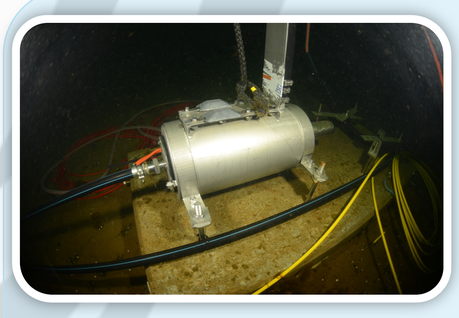

Utö Atmospheric and Marine Research Station is located at Utö Island in Finland, on the outer edge of the Archipelago Sea. Observations at the site include e.g. underwater currents, waves, ice cover; chlorophyll, pCO2, O2, salinity and temperature from the sampling depth of 5 meters; vertical profiles of selected variables down to 90 meters. The site is also equipped with comprehensive set of meteorological, air quality and optical atmospheric observations.

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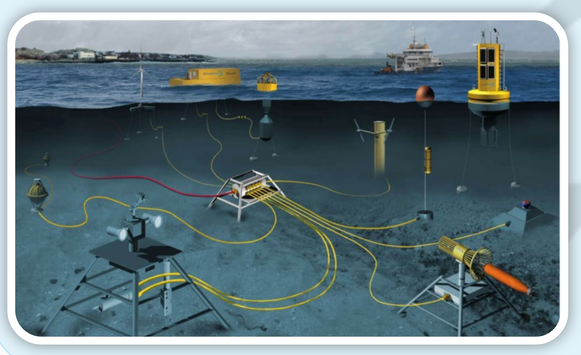


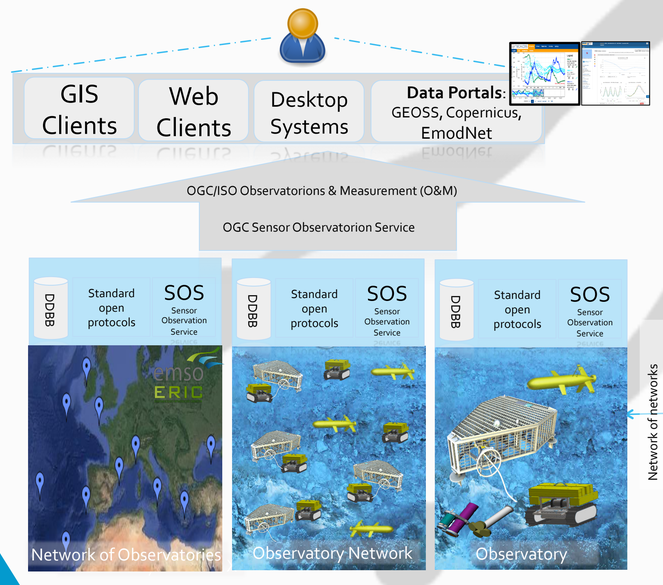
The Galway Bay Cabled Permanent Observatory (**CPO**) comprises a subsea platform cabled to shore, hosting a variety of scientific instruments for ocean observation and equipment testing and validation

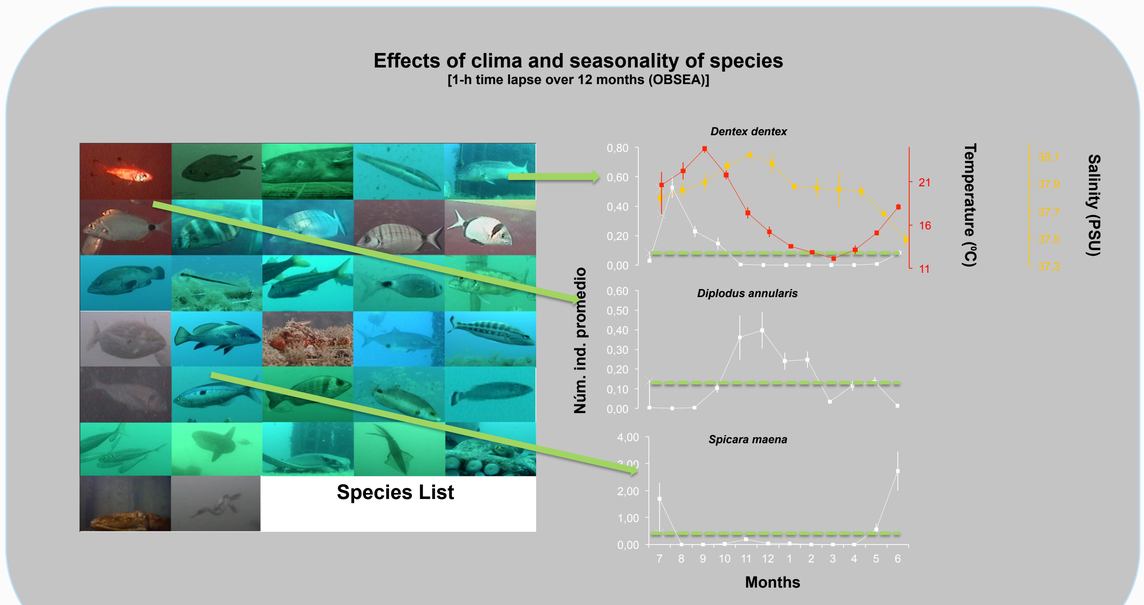
SMARTBAY IRELAND

OBSEA EXPANDABLE SEAFLOOR OBSERVATORY

UPC

OBSEA, the Underwater cabled seafloor observatory located at 4 km from the coast of Catalonia and 20 meters depth that offers real time data from a fishing protected area.





Condal, **Aguzzi** et al. 2012. Mar. Biol. 159: 2809-2817.

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