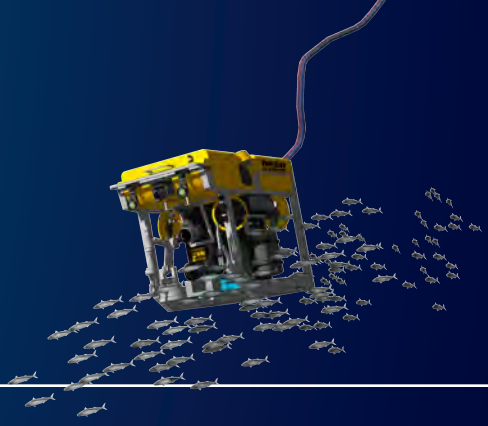

MeshAtlantic Workshop Report

VIDEO SURVEY TECHNIQUES

FARO
June 20-22, 2011

MeshAtlantic workshop report MWR_VST December 2011

Jorge M.S. Gonçalves, Luis Bentes, Pedro Monteiro, Frederico Oliveira and Fernando Tempera (Editors)

University of Algarve | Centre of Marine Sciences

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MeshAtlantic Workshop Report

VIDEO SURVEY TECHNIQUES

WORKSHOP HELD AT **FARO, PORTUGAL:** CENTRO DE CIÊNCIAS DO MAR DO ALGARVE (CCMAR), UNIVERSIDADE DO ALGARVE, CAMPUS DE GAMBELAS

June 20-22, 2011

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INTRODUCTION

The workshop intended to assess the understanding of the different underwater image based methods for biological and physical data acquisition and its use for habitat mapping either for fine scale mapping or for a broad scale mapping and/or as a tool for ground-truthing of acoustic signals and classification data.

The ultimate goal of this MeshAtlantic workshop was to bring together researchers and practitioners in areas relevant to habitat mapping: (i) data acquisition using video and photography, (ii) annotation and data extraction methods and software, (iii) statistical modelling of spatial distributions and (iv) map production. Its objective was to serve as a forum for presenting state of the art research, exchanging ideas and experiences, and facilitating interaction and collaboration.

Based on the best practices presented throughout the workshop a list of recommendations is included as the final section of these proceedings.

ABSTRACTS

SESSION 1 – VIDEO SURVEYING TECHNIQUES

METHODS AND STANDARDS FOR VISUAL SURVEYS OF THE SEABED AND ITS FAUNA IN NORWAY

PÅL BUHL-MORTENSEN & L. BUHL-MORTENSEN
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Information about habitats, biotopes, substrates and species diversity on the sea floor is an important part of ecosystem based management, and necessary in order to evaluate consequences of various anthropogenic activities. Visual surveys are suitable for the description of distribution and occurrence of large and scattered organisms on substrates, where sampling with traditional gear such as grabs and dredges do not provide representative results. Visual surveillance using geo referenced positions is essential to allow revisiting of locations, documentation of environmental conditions and detection of changes in species composition which otherwise would be difficult to achieve.
Remotely Operated Vehicles (ROVs) and passive tethered observation platforms are used for mapping and environmental surveys of the sea floor via video and stills photographs. However, the methods used and the results obtained can be rather variable, without proposed consideration of geographic positioning, taxonomic precision and quantification. It is therefore important that the methods used are standardised in order to compare results.
Here, we present field survey techniques and software for aiding video analysis developed as part of the Norwegian sea bed mapping programme MAREANO (www.mareano.no), as well as a recently proposed European standard for performance of visual sea bed surveys.

VIDEO SURVEYING TECHNIQUES FOR SEAFLOOR HABITAT MAPPING

FERNANDO TEMPERA, J.N. PEREIRA, A. BRAGA-HENRIQUES, C. PHAM, D.CUVELIER & J. FONTES
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Multiple video surveying techniques for benthic habitat characterization have been used in the Azores over the past two decades. So far they permitted acquiring information on shelf habitats beyond the safe limits for SCUBA diving as well as studying deep-sea biodiversity patterns down to depths exceeding 3000m. A review is made of the aims presiding to the choice of the different platforms, including drop-down cameras, mini ROVs, working-class ROVs, submersibles, AUVs and, more recently, BRUVs. Illustrative case studies conducted in different environments will be presented including video surveys for infralittoral biotope distribution modeling (on island shelf and seamount summits), deep-sea habitat classification and description, seamount biotope zonation, hydrothermal vent microhabitat dynamics and seamount habitat use by fish.

A NEW PHOTOGRAMMETRIC AND QUANTITATIVE METHOD FOR THE STUDY OF BENTHIC HABITATS AND BIOLOGICAL COMMUNITIES OF THE DEEP SEA

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Some deep areas of the Cantabrian Sea and off Galicia (North of Spain) were studied in frame in the ECOMARG and INDEMARES projects. The study focused on benthic-demersal ecosystems, with a multidisciplinary approach (www.ecomarg.net). In areas where the presence of rocky outcrops hampered the use of classical sampling methods, we use a non-intrusive method based on a towed vehicle that collects continuously high definition video and periodic digital still imagery of the seabed along transects. This system was designed by the Spanish Institute of Oceanography (IEO) -Santander laboratory- with the aim of sampling deep macro-epibenthic communities quantitatively in a cost-effective manner, in order to eliminate the need for high vessel performance or support from technicians. In each transect, between 1 and 2 km length over the sea floor, a range number of 800-1000 pictures and 1-2 hours of video footage were taken. Using an image processor, the scale and surface of each picture is calculated from the four laser point's geometry analysis. The coordinates estimated were used to re-sampling, surface calculations and for sizing species. These characteristics defined the photogrammetric sledge as a real quantitative sampling system. The coverage of each element (facies, habitats, species, etc.) is also obtained. The classification scheme is built up of different main three information layers: 1) facies; 2) habitat and 3) human impacts. Facies is used to describe the different geological and sedimentological appearance (sand, mud, rocky outcrops, etc.). To define the different habitat the EUNIS hierarchical classification was used. Two sub-classes of anthropogenic impacts are defined:

(1) fisheries (lost gillnets, long lines, trawl damages, i.e.) and (2) rubbish. In addition, other environmental characteristics (water temperature, salinity, reflectivity, etc.) were included in the analysis to detect their effects on habitat and communities spatial distribution.
The analysis of information provides a detailed habitat mapping and benthic community's structure. This new methodology is a valuable tool to locate, characterize and provide high resolution maps of the deep sea vulnerable habitats. The use of this non-extractive methodology, which does not cause damage or alterations to benthic communities, is particularly necessary when establishing a program of MPA monitoring using a visual transect. In order to ground-truth the image records by either incorporating information into in situ survey data, and studying the effectiveness of closed areas on the recovery of structure-forming invertebrates from disturbance, particularly bottom trawling and gillnets.

SESSION 2 – VIDEO ACQUISITION AND PROCESSING (CASE STUDIES)

MAPPING OF MEGAFAUNA DENSITIES AND DISTRIBUTION IN THE HAAKON MOSBY MUD VOLCANO (HMMV) CALDERA

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This work is based on the Ocean Floor Observation System (OFOS) photo transects over the Haakon Mosby mud volcano (HMMV) caldera made on the Polarstern cruise ARKXVIII/1b (in 2002). Different habitats of the volcano and the background seafloor were inspected and photographed at three OFOS transects. The aim of the study was to evaluate the influence of seepage on the abundance and distribution of megabenthic fauna.
Based on examination of 1369 images, 42 objects including animals, bacterial mats and seafloor characters were identified and quantified per meter square. The degree of spatial coverage by pogonophoran or Beggiatoa mats was estimated and grouped into the classes.
Most of observed taxa (echinoids, starfishes, crinoids etc.) avoided areas of active methane discharge. The background community was numerically dominated by ophiuroids *Ophiocten gracilis*. Some taxa were most abundant in the zone of moderate seepage marked by colonies of pogonophorans *Archeolinum contortum* and *Oligobrachia webbi* (pycnogonids, caprellids and unidentified small Lysianassid amphipods). In areas covered by extensive bacterial mats the abundance of benthic species generally decreased. The fish *Lycodes squamiventer* was most abundant in areas of patchy or continuous bacterial mats.

EVALUATION OF THE MEGAFAUNA ASSOCIATED WITH DEEP-SEA CORALS FROM CAMPOS BASIN, BRAZIL, THROUGH ROV IMAGING: PROBLEMS AND SOLUTIONS

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Deep-sea corals, also known as cold water corals, have been studied because of the importance of their community, and with other organisms, they can aggregate fauna, providing breeding places and refuge for several species. Deep-water corals (coral carbonate mounds) are frequently represented by their main reef-building species, Lophelia pertusa, which occurs in many places, as well as in Brazilian waters. Recent studies carried out by PETROBRAS in partnership with Brazilian universities showed that coral reefs from Campos Basin, off Rio de Janeiro, were mostly formed by a matrix of mud and sediment interspersed with the skeletons of dead corals. Lophelia pertusa and Solenosmilia variabilis were the most common species in these formations co-occurring or not with stony corals as Madrepora oculata and Enallopsammia rostrata. Preliminary studies in the Campos Basin have revealed a relatively high variety of species of both macrofauna and megafauna associated with these corals. Some of them are new to science and others are considered important fishery resources. Octocorallia, as well as Porifera, were the most frequent megafaunal groups. Several authors have already reported the presence of deep-water corals off the Brazilian coast, in areas of Espírito Santo to São Paulo, as well as in Campos Basin. However, the "Campos Basin Deep-Water Coral Assessment" project, developed by the R&D Center of PETROBRAS, has contributed effectively to better understand and characterize this ecosystem in terms of biology and ecology, and map these formations and their associated fauna. These studies have been based on images obtained by remotely operated vehicles (ROV), with the addition of biological sampling. Here, we present and discuss the methodology used in the project to identify the zoological groups observed in deep-coral reef areas in the Campos Basin, through images obtained with ROV. Frames are captured from videos

and each organism identified corresponds to a row in a spreadsheet. All field data is recorded as location, date, time, area, depth, latitude, longitude, type of substrate, and an image reference file. These worksheets are organized by different areas of the Campos Basin and will later be added to a robust database. Different types of substrate were classified to better characterize the environment, namely: dead coral, live coral, dead sponge, live sponge, mud and artificial substrate. Porifera is a frequently observed group, with a predominance of *Farrea occa* in some areas, mainly associated with coral banks. Different species of Hyalonema were also observed and their stalks were often covered by zoanthids. Octocorallia constitute one of the most difficult organisms to identify through video observation. Considering the high local diversity, the images do not provide morphological details required for a lower level identification. Shrimps are frequently observed, but are also difficult to identify, because taxonomists depend on details of their carapace, including rostrum side view. They may belong to different groups as Peneoidea, Lophogastridea, or even Caridea. Although squat lobsters (Galatheidae) are easier to recognize, even in dark and distant images, it is hard to detect morphological differences between genera Munida and Munidopsis through images. Comatulids are the most abundant organisms amongst the echinoderms. However, they can only be better identified with associated sampling for detailed taxonomy studies. Brisingid seastars can be easily misidentified as comatulids by non expert observers due to their feeding posture. *Rajella sadowskii* is an easily identifiable ray fish in the region. However, many fish are only determined as Teleostei because of their fast swimming movements which don't allow proper image capturing. Amongst fish, Macrouridae comprise a common family in the deep-sea, but require more images associated with detailed morphological information to be better determine the species level. Some important groups of invertebrates are rarely seen in videos, such as Polychaeta and Mollusca. Since very few images of these organisms are available, most of the available information were gathered from the material collected through other projects. All the points discussed above show that there is a real possibility of a robust assessment of the megafauna associated with deep-sea coral reefs using images obtained with ROV and trained observers. However, samples are crucial to allow accurate identifications, enhance our observations, and build a detailed panorama of these ecosystems.

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BIODIVERSITY AND DISTRIBUTION OF FAUNAL ASSEMBLAGES: THE POLYMETALLIC NODULE ECOSYSTEM OF THE EASTERN EQUATORIAL PACIFIC OCEAN

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The biodiversity and distribution of abyssal megafaunal assemblages in a region of polymetallic nodules of the Eastern Equatorial Pacific Ocean, within the Clarion-Clipperton fracture zone, is analysed at several levels in this study. On a qualitative level, the identification, ethology, taxonomic richness and faunal composition classified by functional groups, are described over the whole area, to provide a baseline reference. An annotated photographic atlas is produced with the participation of worldwide specialists for each phylum. Inventories based on a collection of about 200 000 photographs of the ocean floor and some 55 hours of film show a taxonomic diversity of 240 taxa, of which 46 are echinoderms. Cnidaria is the most diverse phylum in the Clarion-Clipperton fracture zone encompassing 59 different taxa. Suspension feeders are the best represented trophic group in the zone.
On a quantitative level, the particularly well described site, NIXO 45 (130°00'W/130°10'W, 13°56'N/14°08'N) at a mean depth of 4 950 m, was chosen to evaluate faunal relative abundance and composition, classified by phyla and by trophic and functional groups, for different edaphic conditions. Results show that whatever the edaphic facies, suspension feeders are more abundant than detritus feeders, carnivores and scavengers. The highest total faunal abundance is on nodule-facies C+10 % and nodule-facies C+ with slope $> 15°$. The greatest density of suspension feeders is observed on nodule-facies 0 (no nodules) on ancient sediments, dating from the Oligocene to the middle Miocene, and on nodule-facies C+ with slope $> 15°$, while detritus feeders are more abundant on nodulefacies C+10 %. Similarities among taxa and among some types of environment and substratum were emphasized by a factor analysis of Reciprocal Averaging, allowing discrimination of preferential habitats and 'faunal facies', ranked according to an edaphic gradient. Quantitative analysis was also undertaken at species level to study spatial heterogeneity in the distribution of populations.
Comparisons are made with data from other means of in situ observation. The 'Nautile' explored one of the facies at the NIXO 45 site, the 'R.A.I.E' was used for three nodule-facies at the NIXO 41 site and the 'Deep Tow Instrumentation System' for the three nodule-facies ECHO 1 site. An estimate of megafaunal biomass by trophic group is discussed for the three sites studied. These are then compared with estimates of biomass for the megafauna, macrofauna and meiofauna sampled at the DOMES C site. The role of limiting factors (edaphic heterogeneity, currents) and biotic factors in the structure of suprabenthic assemblages is discussed.

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COMBINED IMAGE TECHNIQUES TO ESTIMATE $CaCO_3$ PRODUCTION BY BRAZILIAN RHODOLITH BEDS

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Brazilian continental shelf is considered the largest area supporting rhodolith beds in the world. We have been using Side Scan Sonar (SSS), Remotely Operated Vehicles and technical dives (TRIMIX) to estimate the calcium carbonate ($CaCO_3$) production by rhodolith beds. The images obtained directly on field allow us to estimate the abundance of rhodoliths (ind m^{-2}), determine the mean diameter of rhodoliths and the vitality of coralline algae. The SSS allow us to mapping the area occupied by a rhodolith bed. Experimental data using alizarin red is used to calculate the rate in which rhodoliths are growing. These data have been used to calculate the $CaCO_3$ production by rhodolith beds from the Brazilian continental shelf (e.g. Abrolhos Bank) and Oceanic isolated banks and Islands (e.g. Vitoria Trindade-Chain). We have found that the $CaCO_3$ production by the Southwest Atlantic was until nowadays underestimated. Abrolhos Bank (~46,000 km^2), one of the areas surveyed by our group, showed that rhodolith pavement occupies at least 20,720 km^2, with a mean $CaCO_3$ production estimate of 1.4 kg $CaCO_3$ $m^{-2}.yr^{-1}$. The total $CaCO_3$ production estimated in the present study (0.033 Gt yr^{-1}) is comparable to those from some of the largest biogenic $CaCO_3$ deposits in the world

A PROPOSED METHODOLOGY TO ESTIMATE NEPHROPS BURROW DENSITY IN DEEPWATER GROUNDS FROM VIDEO ANALYSIS

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The use of image-based technologies has gained increasing importance in marine research, particularly in the benthic habitat classification or the assessment of epibenthic commercial species. Fishery-independent estimation of Norway lobster *Nephrops norvegicus* abundance studies are being carried out, on a regular basis, by some research institutes in the north-eastern Atlantic and the Mediterranean. Typically, the experimental set-up consists of a video camera mounted on a sledge towed from a research vessel during targeted surveys. This paper describes the use of an alternative set-up, consisting of a compact video system mounted on a survey trawl headline. Preliminary results include the Norway lobster burrow density for a sample site off the Portuguese south coast, along with an overall appraisal of the sample gear efficiency. Considering that manual counting is a tedious and time-consuming task, the methodology to automatically identify and count lobsters and their burrows, including a software prototype, introduced here, may be used as an alternative by marine biologist. Here, we also highlight the main constrains that are still persisting in this research and point to the interest of a similar general approach for habitat mapping.

DETECTION, MEASUREMENT AND RECOGNITION OF FISH SPECIES UNDERWATER

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High-quality underwater imagery and recent advances in multi-view reconstruction now makes feasible the development of semi-automatic system for detection and recognition of fish species. Systems like these will soon augment or replace operator-based event annotation systems which require substantial human efforts.
We report about the ongoing work in two directions which will merge in the future. First is a 3D scene reconstruction from multi-view underwater imagery. The properties of the seawater medium (significant refraction index, suspended particles, wavelength-dependent absorption coefficient) and use of inhomogeneous artificial illumination renders many techniques developed and proven for in-air conditions, useless. The final goals of this research are the construction of a dense 3D surface (with number of nodes on the order of total number of pixels in the

digital images), recovery of original colors associated with surface facets, search for predefined deformable models (detection of individual fish species), and recognition based on characteristic ratios of measurements and typical color patterns. Complementary research is underway to identify the most effective algorithms for animal detection and species' recognition, first using near ideal experimental imagery and then using images collected during ocean surveys.

SESSION 3 – VIDEO ANNOTATION

METHODOLOGY OF ANNOTATING VIDEOS AND STILL IMAGES AND DEVELOPMENT OF THE SOFTWARE COVER

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IFREMER, France

Image footage from Remotely Operated Vehicles (ROVs) or drop-frame cameras are often used to classify geological and biological data in the deep-sea. However, this image footage is coming from different sources (depending on equipment and camera type, etc.) and it is up to the scientists to optimise the results retrieved from these images. One important step in this direction is the standardisation of the analysis of the image material, e.g. using specific annotation software. Several annotation software are available. However, a review of existing software revealed that no software met the requirements within the European fp7-funded project CoralFISH. In this context, IFREMER has developed the software COVER (Customizable Observation Video imagE Record). It allows the user to load navigation files, images and digital videos. A flexible interface is made based on knowledge tables containing information about subjects of interest, such as species, substrate and habitat type and anthropogenic impact. COVER is able to create frame grabs automatically on a certain time and/or distance interval. This program facilitates standardisation of image analysis by using common knowledge tables. Some features of Cover will be introduced into the existing software Adelie (IFREMER).
Here, we will present the different features of the software COVER. We will give an example of an interface using standardised knowledge tables as well.

PRACTICALITIES OF IMPLEMENTING VIDEO ANNOTATION

JOSÉ N. PEREIRA & F. TEMPERA
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A summary of practical solutions for video annotation is provided based upon the experience of deriving scientific information from underwater video surveys at IMAR/DOP-UAz. The presentation will tackle from video archive management, to platforms diversity, annotation software's and data outputs. The development of a digital and analogical video archive is exemplified, including the adoption of individual codes for tape and dive identification and the input of descriptive content into a 'built to purpose' database. Decisions of video acquisition and digitizing are summarized facing the compromise between disk space and image quality, and a scheme of a video-library management over a network is presented. Strengths and weaknesses of different platform types (working class ROV, mini-ROV, drop-down camera, BRUV) are reviewed for descriptive or quantitative assessments, considering type of survey, accuracy of positioning, field of view estimates, image quality, etc. Video Annotation Software's synchronizing video time with navigation time (OFOP, COVER, VARS) are finally compared for a) baseline knowledge required to operate, b) real-time applications, c) annotation window customization, d) hierarchical data output capability and e) financial costs. Necessary steps to annotate using OFOP & COVER are demonstrated. Outputs for habitat mapping are exemplified as well as a solution for archiving thousands of species entries.

SESSION 4 – STATISTICAL MODELLING AND TIME SERIES

MODELLING BENTHIC BIOTOPES: FROM FIELD SURVEYS TO RELIABLE MAPS

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University of Gothenburg, Sweden

Spatially-explicit predictive models are now widely used for the purpose of estimating variables such as the presence of a feature of interest across unsurveyed areas, so that full-coverage maps of various components of biodiversity (e.g. biotopes) can be cost-effectively produced. Inevitably though, what is ultimately delineated on the map is highly dependent on the choice of

methods and a plethora of other parameters.
Issues relative to data acquisition and preparation of predictor and response variables include spatial patchiness of benthic assemblages, spatial resolution of the model, and patterns of association between taxa. Choice of model and model valuation are the main issues involved in a later phase, which has in turn been constrained by decisions made during the initial phase. In this presentation I will discuss the practicalities involved in achieving our goal of maximal agreement between predictions and reality subject to the use of methods as automated and repeatable as possible, and the trade-offs that had to be made. The context of this project was the investigation of the distribution of benthic biota to aid in the spatial planning of a Marine National Park off the West coast of Sweden, a project which is now nearing its completion.

SESSION 5 – PRACTICING (CASE STUDIES)

ANALYSING VIDEOS AND STILL IMAGES OF VULNERABLE MARINE ECOSYSTEMS IN THE DEEP-SEA: A PRACTICAL APPLICATION USING COVER

INGE VAN DEN BELD, B. GUILLAUMONT, C. CARRÉ & J. DAVIES
IFREMER, France

Cold-water coral reefs and sponge grounds are seen as Vulnerable Marine Ecosystems (VMEs). Due to the development of techniques, including Remotely Operated Vehicles (ROVs) and towed cameras, the research to these VME reefs has been increased since the 20th century. The use of image footage is well adapted in these cases and is less destructive than a trawl sample. Scientists are forced to develop methodologies for optimizing data from different sources of images (depending on equipment and camera type, etc.). A methodology for analysing image footage has been developed within CoralFISH by IFREMER, including the software COVER. COVER allows the importation of navigation files, videos and images, as well as the ability to annotate the image material.
Here, we present a methodology used to analyse image footage of VMEs in the Bay of Biscay. This involves the annotation of images using COVER and presentation of the data in several maps.

IDENTIFICATION OF INVERTEBRATES FROM UNDERWATER PHOTOGRAPHS AND VIDEO: HOW FAR CAN WE GO?

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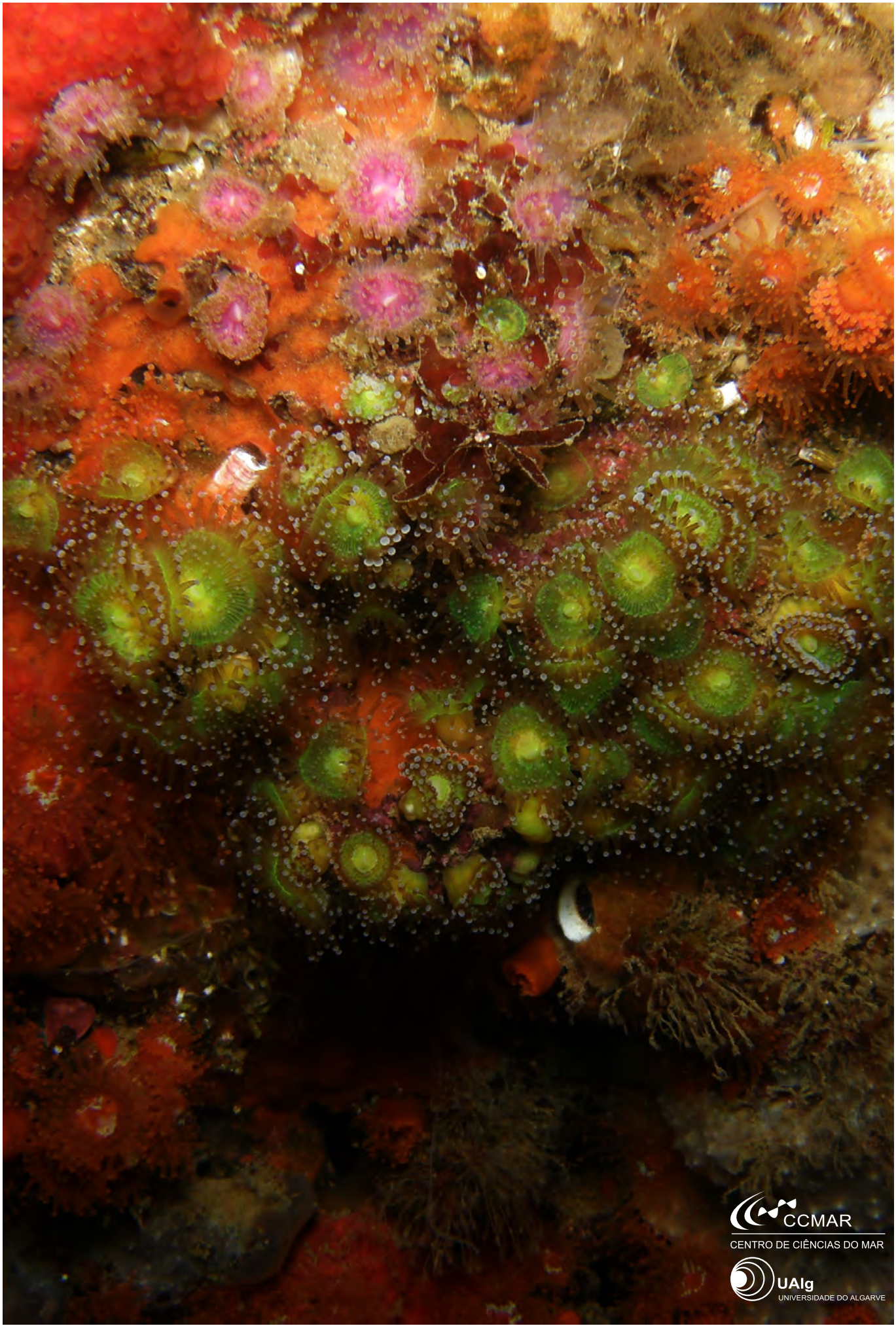
The most abundant groups in the marine fauna are, in decreasing species numbers, the Crustaceans (39600 species), Molluscs (36750), Annelids (13100), Cnidarians (11000), Platyhelminthes (flatworms, 10000), Porifera (sponges, 8300), Echinoderms (7300), Bryozoans (6000), Nematodes (6000) and Tunicates (3000). Apart from this "top 10", all the other phyla represented in the marine realm achieve less (or much less) than 500 described species (figures given are rounded number of accepted species in World Register of Marine Species - www.marinespecies.org). Invertebrate species outnumber Vertebrates (16733 fish, 136 mammals) by one order of magnitude.
The representation of these major components of the fauna on submarine images and their liability to identification vary considerably between groups. Therefore, the representation of the fauna on photos and videos is strongly biased towards a few of them.

- Visibility is best for groups represented by many large, epifaunal (including sessile) species or colonies, in the first place Sponges, Cnidarians (hexacorals and octocorals), Echinoderms and to a lesser extent the larger Molluscs and Crustaceans. For these groups, photos and videos can bring a quantitative assessment of coverage and abundance. On the contrary the Polychaete Annelids, albeit numerically and ecologically important, are usually infaunal and concealed, and the majority of Platyhelminthes are internal parasites of larger animals.
- Identification to genus or species level in some groups requires access to anatomical characters or to the examination of inner structures (e.g. spicules of Sponges, dermal sclerites in Holothurians) so cannot be achieved to species or genus level on an image alone.
- Many groups are mostly represented by small species which will never appear on field images. All Nematodes, but also most Mollusca and Crustaceans achieve adult size of a few millimeters only.

A general recommendation can be that species-level identifications must be backed by the examination of actual samples from the same area, from which a short list of candidate species can be constructed to match the visual observations. On the long term, the ability for being identified on images should be taken into account as a criterion for choosing diagnostic or flagship species in the characterization of marine animal communities.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CABLED OBSERVATORIES VIDEO-IMAGING FOR THE STUDY OF BEHAVIOURAL RHYTHMS IN DEEP-SEA SPECIES

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Animals rhythmically displace along continental margins at a day-night and internal-tidal periodicity. Thus, behavioural rhythms produce significant biases in stock and biodiversity assessments if the timing of sampling is not properly taken into account. So far, those biases are poorly understood, with the repetition of trawling at a given location (as required for activity rhythms study) often sacrificed to the needs of data collection over larger geographic areas (as required for population distribution assessment). Permanent and cabled multiparametric observatories are opening the possibility of direct, continuous, and long-lasting monitoring of benthic communities in relation to habitat dynamism. Diel fluctuations in the number of video-observed individuals can be used as a proxy of average population activity rhythms. Therefore, the implementation of automated video-image analysis can transform video cameras into efficient bio-sensors for the direct measurement of life processes at populations and species level. When produced bio-information is coupled with habitat parameters, also gathered at the same frequency from oceanographic sensors, a first trustable cause-effect relationship could be proposed in order to explain ecosystem functioning based on the activity rhythms of species constituting the community.

FIRST OBSERVATIONS OF MORIBUND JELLYFISH AT THE SEAFLOOR IN A DEEP-SEA FJORD

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The deep-sea medusae *Periphylla periphylla* is a common inhabitant of the deep-sea fjord of Norway. To quantify the presence of *P. periphylla* jelly-falls at the seafloor and the standing stock of carbon deposited at the seafloor by this species, we made multiple photographic transects of the seafloor using a Yo-Yo camera system in March 2011. Out of 218 seafloor images taken, 5 photographs showed the presence of jelly-falls at the seafloor, which resulted in a total jelly-fall abundance of 0.01 Jelly-falls m^{-2}. Summed over the entire area of seafloor photographed, 0.01 jelly-falls m^{-2} was equivalent to a carbon biomass of 13.0 mg C m^{-2}. The contribution of each jelly-fall to the C-standing stock of the sediment around each fall was 568.3 $\pm$ 83.9 mg C m^{-2}, or 0.5 $\pm$ 0.1 % of the annual organic matter flux based on C-flux estimates from a nearby fjord. The only megafaunal taxa observed around or feeding on-top of the jelly-falls were caridean shrimp (14.0 $\pm$ 5.3 Ind. Jelly-$fall^{-1}$) and galatheid crabs (0.4 $\pm$ 0.2 Ind. Jelly-$fall^{-1}$). These observations indicate that jelly-falls enhance the sedimentary C-stock at the seafloor, and also provide nutrition to benthic fauna in deep-sea fjords.

SESSION 6 – HABITAT MAPPING (CASE STUDIES)

THE FP7 CORALFISH PROJECT: PROMOTING STANDARDISED APPROACHES TO HABITAT MAPPING AND CLASSIFICATION IN THE DEEP-SEA

ANTHONY GREHAN[1] AND THE CORALFISH CONSORTIUM
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This presentation will give a brief overview of the CoralFISH project and some of the work being done to promote a standardised approach to deep-sea habitat mapping and seafloor classification, particularly with regard video analysis.
CoralFISH is a Collaborative Project funded under the European Commission's Framework 7 Environment Theme. CoralFISH brings together a unique consortium of deep-sea fisheries biologists, ecosystem researchers/modellers, economists and a fishing industry SME, in a collaboration to collect data from key European marine eco-regions to support ecosystem based management of corals, fish and fisheries in the deep waters of Europe and beyond. To answer the fundamental question of whether coral habitat is important for fish, it is first necessary to describe and quantify coral habitat within a regional framework. CoralFISH is developing a number of tools and approaches to facilitate classification of cold-water coral habitats. These include adopting a common attribute nomenclature during video analysis and using a standard seafloor classification system.

MULTI-SCALE MAPPING OF COLD-WATER CORAL HABITATS ON THE IONIAN MARGIN (MEDITERRANEAN SEA)

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The present work reports the main results obtained from acoustic investigations carried out at different spatial scales within the Mediterranean Santa Maria di Leuca (SML) Cold-Water Coral (CWC) province (south eastern Italy – northern Ionian Sea). The SML coral area represents the largest occurrence of a live CWC community so far known in the Mediterranean sea. It has been investigated by national (i.e. APLABES) and European (i.e. EU-FP6 Hermes and EU-FP7 CoralFISH) projects, that collected acoustic data (over more than 1700 km^2 survey area between 80 and 1400 m water depth) along with video observations (performed by work class ROVs) and sediment samples.

Three different scales of data sets are presented and discussed: (1) a small scale morphobathymetric map (1/1000000) that resolves the regional geomorphology of the Apulian plateau; (2) a detailed medium scale morphobathymetric map (1/40000) obtained from multibeam data acquisition and (3) large scale morphobathymetric and backscattering maps (1/1000) obtained at different representative sites, where video-data, micro-bathymetry (by ROV-based multibeam surveys) and/or high resolution side scan sonar mosaics have been collected. Video investigation and sediment samples documented CWCs occurrences along a bathymetric gradient varying between 500 and 900 m depth (1) within a large mass-movements and mass-transport deposition area, where coral-mounds occur, (2) on sparse debris deposits diffused along the eroded western flank of a prominent ridge, where drift sedimentation also occurs, and (3) on firm and hard grounds outcropping at the top of narrow ridges and fault scarps that characterise the western sector of the mapped area. The large scale maps, obtained on some key areas, well show the fine-scale morphology of coral mounds and of other type of occurrences of CWC habitats, revealing a number of features indicative of active benthic current and its interaction with coral distribution at these representative sites.

The role of geomorphology in determining different expression of CWC habitats on the northern Ionian margin is investigated.

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CONCLUSIONS AND RECOMMENDATIONS

Traditional sampling gear for marine biodiversity evaluation such as trawls, dredges and grabs should not be used in habitats where the levels of destruction of species and habitats is incompatible with established conservation goals or the amount of information extracted. When physical samples are not required, visual methods instead can provide non-destructive interventions and be used to generate valid data on bottom type as well as on the associated biological assemblages, namely large epibenthic organisms (megafauna and macrophytes) abundance, size, behaviour and condition.
Therefore, underwater video techniques have been increasingly used in comparable seafloor surveys, namely in areas beyond the reach of divers, such as the deep-sea and complex consolidated substrates.
Based on the best practices presented and discussed throughout the workshop, a list of recommendations is presented below:

1-Vulnerable Marine Ecosystems (VMEs) and other priority habitats should be sampled inasmuch as possible sampled using non destructive image-based surveys.

2-Species identifications must be backed by the examination of actual samples from the same area that permit establishing short lists of candidate species for each visual observations.

3-A reference collection of taxonomic resources should be used to aid in the identification of the *taxa* observed. This, along with the use of a standard species list, will ensure that the identification of *taxa* follow the current literature.

Taxonomic resources can include:

I. A collection of up to date literature and identification/reference books namely with underwater images.

II. A comprehensive and regularly updated reference and taxonomic key library/ database namely with underwater images.

III. Expert second opinion.

4- New techniques, taxonomic information and good practice need to be dicussed and disseminated . This could be achieved in two ways:

I. Organization of specific workshops by universities, research institutes, museums or marine organisations/associations;

II. Creation of a working group (Underwater Video Techniques Working Group) with annual meetings.

5- Obtaining comparable results at regional levels requires standardization of underwater visual methods (e.g., survey design, imagery acquisition and post-processing).

6- Video annotation requires software enhancements that make the available tools more user-friendly.

7- Obtaining robust quantitative data (namely area and size measurements) requires introducing better linear measurement capabilities in the image acquisition technology, namely the use of stereo imagery or making use of time-of-flight (ToF) cameras or even kinetic sensors.

8- As the use of imagery techniques evolves from exploration to monitoring, long lasting observatories will need to be created that integrate image acquisition technology for observational studies.

ANNEX I - POSTER PRESENTATIONS

NEREIDA, A MULTIDISCIPLINARY PROJECT SUPPORTED WITH UNDERWATER IMAGE

JIMENEZ GARCIA, P. & ELVIRA JIMÉNEZ, E.
Tragsatec S.A.Gerencia de Asuntos Pesqueros y Acuícolas, C/ Alcalá 265, Edificio 1- 2ºplanta, 28027 Madrid, Spain

PRELIMINARY ANALYSIS OF THE DISTRIBUTION AND STRUCTURE OF THE COLD-WATER CORALCOMMUNITIES ON CONDOR SEAMOUNT

ANDREIA BRAGA-HENRIQUES, J.N. PEREIRA, F. TEMPERA, F.M.PORTEIRO, C. PHAM, T. MORATO & R.S. SANTOS
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A NEW PHOTOGRAMMETRIC SLEDGE: IMAGING AND SAMPLING TECHNOLOGY FOR STUDYING BENTHIC HABITAT AND BIOLOGICAL COMMUNITIES

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IMAGINS TECHNIQUES IN THE HABITAT MAPPING AT THE MARINE PARK PROF. LUIS SALDANHA, ARRÁBIDA, PORTUGAL

VICTOR HENRIQUES, B. MENDES, P. FONSECA, A. CAMPOS, M. T. GUERRA & Mª J. GAUDÊNCIO
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UNDERWATER VIDEO IMAGING IN SUPPORT OF FISHERIES MANAGEMENT

PAULO FONSECA, A. CAMPOS, V. HENRIQUES & B. MENDES.
IPIMAR, Portugal

USING UNDERWATER VIDEO TO CHARACTERIZE MARINE BIOTOPES

JOANA FERNANDEZ-CARVALHO, L. BENTES , R. COELHO, K. ERZINI & J. M. S. GONÇALVES
CCMAR, Universidade do Algarve, Portugal

MAPPING ATLANTIC AREA SEABED HABITATS FOR BETTER MARINE MANAGEMENT

MESHATLANTIC CONSORTIUM

APPLICATIONS OF VIDEO SURVEY TECHNIQUES IN THE MARINE INSTITUTE

EIMEAR O'KEEFE, F. MCGRATH, J. GUINAN, C. LORDAN, L. SCALLY
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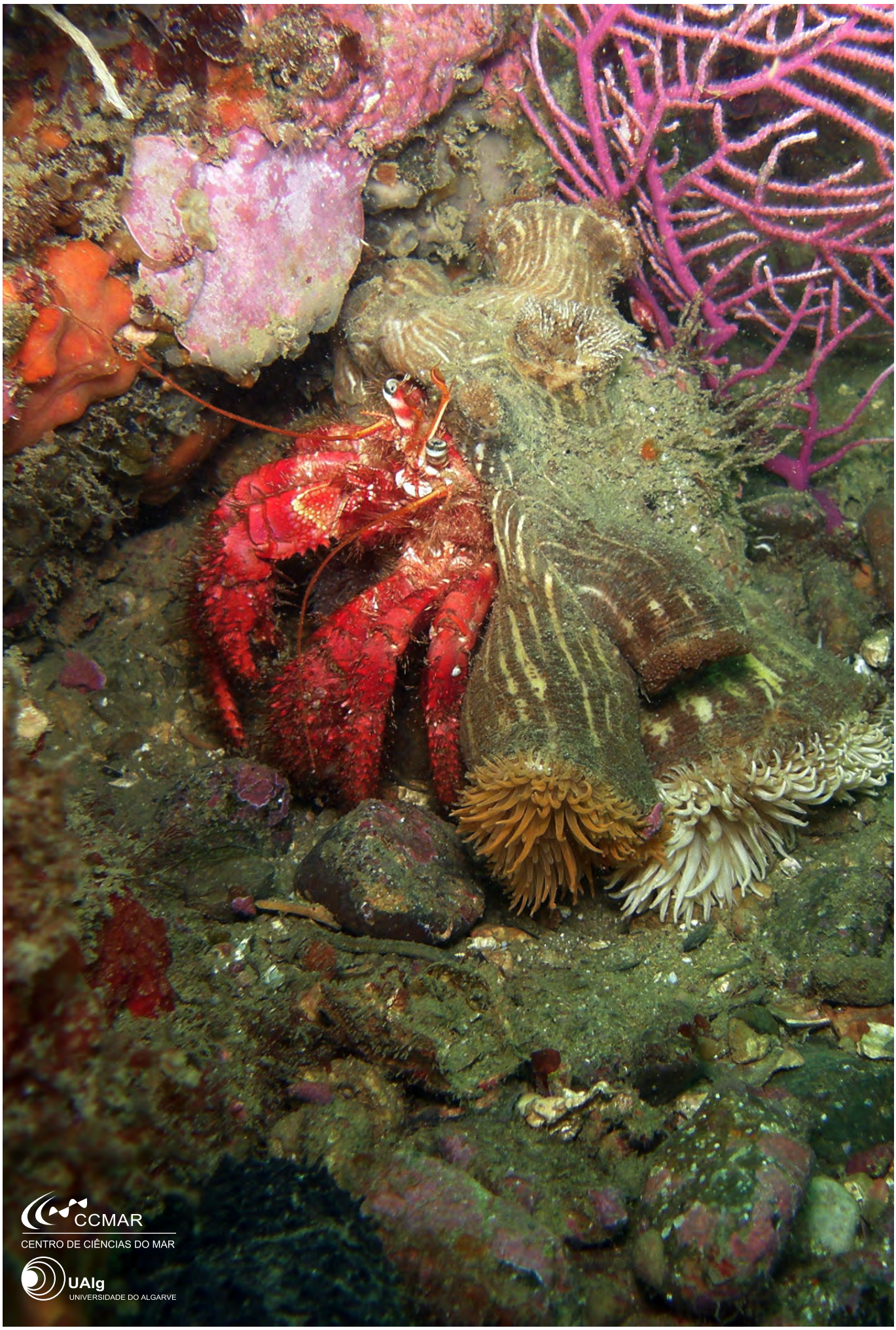
MONITORING OF SEA SCALLOPS PLACOPECTEN MAGELLANICUS IN BOTTOM SEEDING TRIALS USING VIDEO IN MIQUELON BAY, SAINT-PIERRE ET MIQUELON, FRANCE

STÉPHANE ROBERT ET AL.
IFREMER, France

IDENTIFICATION DES PEUPLEMENTS BENTHIQUES DES FONDS DURS SUBTIDAUX DE LA BAIE DE MORLAIX PAR ANALYSE D'IMAGERIE VIDÉO SOUS-MARINE

MAXIME NAVON & DOMINIQUE HAMON
IFREMER, France



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