JERICO-NEXT

Proposal for Transnational Access

to Coastal Observatories

2nd Call

20 February 2017 - 10 April 2017

Description of the project to be sent in pdf format to jerico.tna@ismar.cnr.it on 10 APRIL 2017 23:59 HOURS (CET) the latest

Please consult access rules at http://www.jerico-ri.eu and contact the manager of the infrastructure/installation you wish to use before writing the proposal

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Project coordinator: Ifremer, France.

PART 1

1. GENERAL INFORMATION

Title of the project (255 characters max.)	**A**utomatic **D**ata and **V**ideo **A**cquisition for u**N**derwater monitoring across **C**oastal **E**nvironments
Acronym (20 characters max.)	**ADVANCE**
Applying Institution	**Institute of Marine Sciences (ISMAR-CNR), Forte Santa Teresa, Pozzuolo di Lerici- 19032 (SP) Italy**
Legal contact **Name** **Address** **Function** **e-mail address**	**Simone Marini** **Forte Santa Teresa, Pozzuolo di Lerici- -19032 (SP) Italy** **Research Scientist** **simone.marini@sp.ismar.cnr.it**
Legal representative **Name** **Address** **Function** **e-mail address**	**Fabio Trincardi, Arsenale, Castello 2737/f - Tesa 104, Venezia (Ve), Italy**
Host Institution	**Universitat Politècnica de Catalunya (UPC)**
Legal contact **Name** **Address** **Function** **e-mail address**	**Joaquín del Río Fernández** **UPC, Centro Tenologico.** **Rambla Exposición, 24. 08800 Vilanova I la Geltru, Spain** **Obsea Manager** **Joaquin.del.rio@upc.edu**
Legal representative **Name** **Address** **Function** **e-mail address**	**Enric Fossas Colet** **Jordi Girona, 31. 08034, Barcelona, Spain** **UPC Rector** **rector@upc.edu**
Host facility(ies)	**Expandable Seafloor Observatory (OBSEA)**
Host Institution	**SmartBay Ireland, Ltd (SBI)**
Legal contact 2 **Name** **Address** **Function** **e-mail address**	**Rogério Chumbinho** **Marine Institute Building, Renville, Oranmore, Ireland** **Senior Project Manager** rogerio.chumbinho@smartbay.ie
Legal representative 2 **Name** **Address** **Function** **e-mail address**	**John Breslin** **Marine Institute Building, Renville, Oranmore, Ireland** **General Manager** john.breslin@smartbay.ie
Host facility(ies)	**Galway Bay Cabled Observatory (CPO)**

Have you or other members of your user group previously used the requested facility(ies)?	X	Yes		No
If yes, please indicate the EU Program(s), the name of the project(s) and year(s) you or other members of your user group have used such facility(ies)	OBSEA: EU program: FixO3; call: transnational access to FixO3 observatories 2014; name of the project: FISHAUT; year: May 2015-May2016 (PI Emanuela Fanelli). Spanish National Program: RETOS, Call: 2010. Name of the Project: RITFIM (2011-2014) (PI: J. Aguzzi).			
If you have received transnational access support by the JERICO FP7 project, please list below resulting publications, conference contributions, patents. List only the ones that acknowledge the support of the European Commission and JERICO				

Is this a resubmission of a previously rejected proposal?	X	Yes		No
If yes, please give the exact reference number and submission date. Kindly describe briefly the changes made in comparison to the rejected version.	JN_CALL 1_5, submitted July 4th 2016. A prototype imaging system (GUARD1) developed by one of the partner (Dr. Marini CNR-ISMAR) will be deployed for a time at both observatories. Wipers will be installed on the already existing camera to ensure their correct functioning throughout the experiment. However this new submission represents also an improvement if the previous one since one of the main objective is here the assessment of the GUARD1 as a tool for ecological investigation in coastal environments.			

Is this a continuation of an earlier project funded under a previous call for Transnational Access in JERICO-NEXT at the same facility?		Yes	X	No
If yes, please give the exact reference number and submission date. Kindly indicate also what has been achieved in the previous experiment and the reasons why the objectives have not been fully met.				

2. USER GROUP DETAILS

Indicate if the proposal is submitted by

[ ] an individual

[X] a user group

Principal Investigators (user group leaders)

First and last name	Simone Marini					
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Previous user	**X***	Yes		No		

*only Obsea infrastructure

User group members

Member # 1

First and last name	Jacopo Aguzzi					
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Previous user	**X**	Yes		No		

Member # 2

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Member # 3

First and last name	Tiziana Ciuffardi					
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Previous user		Yes	**X**	No		

Member # 4

First and last name	Corrado Costa					
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Member # 5

First and last name	Franco Andaloro					
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Institution	Istituto Superiore per la Protezione e Ricerca Ambientale					
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Previous user	**X**	Yes		No		

3. HOST INFRASTRUCTURE

Indicate the JERICO-NEXT host facility(ies) offered in you are interested in

(Tick more than one boxes if it is useful for your project)

Chapter 1 (Observing systems)

		Short name	***Requested access time (UA*)***
X	cabled observatory	OBSEA and CPO	60 days for OBSEA and 2 months for CPO
	ferrybox		
	fixed platform		
	fishing vessel		
	glider		

**UA: please refer to the Infrastructure description in the JERICO-NEXT website*

Modality of access

	remote	*the measuring system is implemented by the operator of the installation and the presence of the user group is not required*
X	partially remote	*the presence of the user group is required at some stage e.g. installing and un-installing*
	in person/hands on	*the presence of the user group is required/recommended during the whole access period*

Chapter 2 (Supporting facilities and special equipment)

		Short name	***Requested access time (UA*)***
	Supporting facilities and specialized equipment		

**UA: please refer to the Infrastructure description in the JERICO-NEXT website*

Modality of access

	remote	*the measuring system is implemented by the operator of the installation and the presence of the user group is not required*
	partially remote	*the presence of the user group is required at some stage e.g. installing and un-installing*
	in person/hands on	*the presence of the user group is required/recommended during the whole access period*

Explain briefly why you think your project will be best carried out at the specified host facility(ies)	Our project is aimed at assessing the innovative imaging technology (GUARD1) for fixed and mobile platforms (Corgnati et al. 2016), as an automatic image acquisition and analysis tool for biological/environmental data acquisition and processing. OBSEA and CPO are ideal facilities where to pursue these goals: they are both located in shallow waters, where the GUARD1 can be easily installed, and they are already equipped with video cameras that can be used for assessing the images acquired by the GUARD1 and for comparisons between different imaging systems.
If possible, list other JERICO-NEXT facility(ies) where you think your experiment could alternatively be carried out	As a matter of facts, not many coastal observatories equipped with video cameras exist within the JERICO-NEXT network, such that the GUARD1 imaging device can be easily installed on.

Is there a facility similar to one/all those you wish to utilize in your country?		Yes	X	No
If yes, please indicate your reasons for requesting access to the JERICO-NEXT facility(ies) you have chosen and also exist in your country	The other available facility is AcquaAlta, which is already used for experiments by ISMAR outside the JERICO-NEXT framework. In this sense we will have three different scenarios to compare, characterized by contrasting oceanographic settings and thus water condition for image acquisition (i.e. high *vs*. low turbidity, different water trophism and in turn transparency, etc.)			

4. REQUEST FOR A JERICO-NEXT GRANT

(tick the box)

X	**Travel grant** (*)
X	***Shipment of your equipment, if applicable***

(*) travel, hotel and meals

Please provide a <u>detailed and realistic budget</u> for the expenses you expect to incur, including the number of people and days required. <u>Explain clearly the role of each person for which a travel grant is requested</u>.

*Please note that a comprehensive nominal reference amount of 3000-6000 € is available to each project. The effective grant assigned to a project will be considered case- by-case depending on the type of access, the types and number of facilities requested, the length of stay, and the costs in the visited country. <u>**Please be sure to provide detailed justification of your request.**</u>*

<u>OBSEA</u>

- Travel: one travel for Dr. Marini and Dr. Fanelli to Barcelona in order to discuss the technical and biological design of the experiment and for assisting the technicians in the deployment of the GUARD1 device.

Dr. Marini (co-PI) will assist the technicians for assuring the correct functioning of the GUARD1 device and will participate to the design of the experiment; Dr. Fanelli (co-PI)will define the biological/environmental design of the experiment.

The expected costs for two full days of meeting, corresponding to a four days travel are:
- flight cost from Pisa to Barcelona roundtrip approx. 300€ per person;
- public transportation from/to Barcelona-Vilanova i la Gertrù approx. 30€ per person for two days = 60€ per person (depending on the outcome of the first day meeting, the second day meeting could be held in Barcelona, and will be hosted by the CSIC);
- Hotel: 3 nights , approx. 360€ per person
- Meals: approx. 60€ per person per 4 days, approx. 200€ per person
The expected total cost for the travel for three persons is approx. 1840€

- Shipment of equipment : *GUARD1, international shipping such as DHL, UPS or similar, approx.. costs for shipping to Vilanova and back to Lerici= 400€*

Approx. Cost of travel and shipping to OBSEA=**2240€**

CPO

- Travel: 1 travel of Dr. Marini, Dr. Fanelli and Dr. Aguzzi to Galway in order to discuss the technical and biological design of the experiment and for assisting the technicians in the deployment of the GUARD1 device.

  Dr. Marini (co-PI) will assist the technicians for assuring the correct functioning of the GUARD1 device and will participate to the design of the experiment together with Dr. Fanelli (co-PI); further Dr Fanelli and Dr. Aguzzi, depending on the outcome of the first meeting at OBSEA will define the biological/environmental design of the experiment.

  The expected costs for a two days meeting, corresponding to a four-days travel are:
  - flight cost from Pisa to Dublin and Barcelona to Dublin (roundtrip) approx. 300€ per person
  - public transportation from Dublin airport to Galway (round trip) 50€ per person
  Hotel: *3 nights for approx. 400€ per person*
  Meals: approx. 60€ per person per 4 days, approx. 240€ per person

  The expected total cost for the travel for two persons is approx. 2970€

  Shipment of equipment : *GUARD1camera, international shipping such as DHL, UPS or similar, approx.. costs for shipping to Galway and back to Lerici= 500€*

Approx. Cost of travel and shipping to CPO=**3470€**

Total requested budget: 5710€

PART 2

Note: This part contains material for the evaluation

1. SCIENTIFIC AND TECHNOLOGICAL EXCELLENCE OF USER GROUP
(maximum score: 5)

Short biography of the two PIs ***(half a page)***

Simone Marini is a research scientist at the Institute of Marine Science (ISMAR) of the National Research Council of Italy (CNR). He obtained the Laurea degree in Computer Science and the PhD in Electronic and Computer Engineering, both from the University of Genova. His current research activity deals with pattern analysis, recognition and classification of marine ecological data, with special interest in feature and variable selection, knowledge discovery through evolutionary computing, recognition and classification methodologies for underwater visual data. He is first inventor of the GUARD1 imaging device for underwater images acquisition and processing (European Patent EP 2863257 A1). He is involved in several national and international research activities and he is author and co-author of more than 50 articles and book chapters (H-index= 13).

Emanuela Fanelli is a Research Scientist at ENEA (Marine Environment Research Center) since 2012. PhD in Ecology and Management of Biological Resources. She's mainly interested in ecosystem functioning and trophic relationships both in coastal and deep-sea environments. Her research is also focused on how environmental changes (either natural or human-induced) affect biodiversity and functioning of marine ecosystems. She collaborates with several European and extra-European Universities and Institutions and has participated in 20 national and international research projects, in some of which she was WP leader. Emanuela published 83 scientific papers and book chapters (54 in SCI journals and 24 of these, as first author with H-index=22) in the most important journals of Marine Biology, Ecology and Oceanography.

Expertise of the user group in the domain of the application ***(half a page)***

Jacopo Aguzzi is a Research Fellow at Marine Renewable Resources Department of the ICM-CSIC of Barcelona. His field of research is the chronobiology of marine species and ecosystems at the level of behavior, physiology, and underlying molecular control. He has published more than 90 papers (H-index=25).
Ernesto Azzurro, PhD in Marine Biology and Ecology, is researcher at the *National Institute for Environmental Protection and Research* (ISPRA). With a solid expertise in the ecology of Mediterranean fishes, his research focuses on the effects of climate change and invasive species. He is currently leading transnational initiatives to develop innovative approaches for monitoring large-scale changes in coastal fish biodiversity (91 papers in SCI journals, H-index=24).
Franco Andaloro is senior scientist and director of the ISPRA Department of Sustainable Use of Resources. He has been principal investigator of more than 80 research projects focused on the Mediterranean coastal environment. He published almost 80 papers in SCI journal (H-index=23).
Tiziana Ciuffardi is a marine environmental scientist at ENEA. She has more than 10 years of experience in metocean data analysis and marine/coastal management.
Corrado Costa is Researcher at the CREA-ING specialized in optoelectronique techniques and multivariate statistic and modeling with complex biological and environmental data. He has already extensive experience in working with cabled observatories and smart multisensor platforms in terrestrial ecosystems. He published more than 100 papers with H-index of 36.

A list of 5 recent, relevant publications/patents of the user group in the field of the project

1) Aguzzi J., Company J.B., **Costa C.**, Matabos M., **Azzurro E.** et al. 2012. Challenges to assessment of benthic populations and biodiversity as a result of rhythmic behaviour: video solutions from cabled observatories. Oceanography and Marine Biology 50: 235-286.
2) Azzurro E., La Mesa G., **Fanelli E.** 2013. The rocky-reef fish assemblages of Malta and Lampedusa islands (Strait of Sicily, Mediterranean Sea): a visual census study in a changing biogeographical sector. J. Mar. Biol. Ass. UK.

3) Corgnati L, **Marini S**, Mazzei L, et al. Looking inside the Ocean: Toward an Autonomous Imaging System for Monitoring Gelatinous Zooplankton. Martínez J-F, ed. *Sensors (Basel, Switzerland)*. 2016;16(12):2124. doi:10.3390/s16122124.
4) Danovaro R., **Aguzzi J.**, **Fanelli E.**, et al. An international new ecosystem-based monitoring and assessment strategy for the global deep ocean. Science 355 (6324): 452-454
5) Marini S. et al. Underwater images acquisition and processing system. European Patent EP 2863257 A1, https://data.epo.org/gpi/EP2863257A1-Underwater-images-acquisition-and-processing-system
6) Fanelli E., Cartes J.E., Papiol V., López-Pérez C. 2013. Environmental drivers of megafaunal assemblage composition and biomass distribution over mainland and insular slopes of the Balearic Basin (Western Mediterranean). Deep-sea Res. I 78: 79-94. IF 2013=2.82

2. SCIENTIFIC AND TECHNICAL VALUE OF THE PROJECT
(maximum score: 5)

Description of the project

Main objectives *(half a page)*

Many devices exist for the acquisition of underwater images. Most of them have been designed to be towed by supporting vessels or to be installed on cabled observatories. These devices transfer the acquired data through cables and the video/image processing is performed outside the acquisition device (e.g. on board the host vessel or at the laboratory); the power needed for their operation, including the lighting system, is assured by cables. On the contrary, very few devices have been designed to be stand-alone (not wired), autonomous (without human interaction) and suitable for working over extended periods of time. In this context, the aim of this proposal is two-fold, technological and ecological at the same time: on one hand we want to test the efficacy of the imaging device GUARD1, described in the European Patent EP2863257 and in Marini et al. (2015) and Corgnati et al. (2016), as a stand-alone and autonomous sensor capable of quantifying biological activities at individual, population, and community levels. The GUARD1 consists of a low-power system conceived for installation on both fixed and mobile platforms for acquiring images of objects or organisms from 1 mm to 100 cm in size. On-board the device, the image content is autonomously analysed, recognized and classified. Even if the GUARD1 is capable to transmit the information extracted from the acquired images outside the device, in this project, such data will be stored in order to be accessed for further analysis after the recovery. On the second hand we will assess the potentiality of this imaging device by comparing the information automatically produced by the system with the visual inspection of the images acquired by the cameras that the two observatories provide. In particular, the images will be acquired continuously during the day and night (by using the GUARD1 lighting system) for a period of at least two months, in order to estimate the image quality with a different diffusion of light and with different conditions of water turbidity. The biological assessment of the information produced by the GUARD1 will be obtained through the fulfillment of specific data analysis: i) achievement of faunistic lists based on image recording: this will be mostly focused on fish but also considering other megafaunal species such as echinoderms, cephalopods or large decapods; ii) assessment of the minimum number of images required for an efficient sampling of the megafaunal community; iii) methodological advances for reliable species identification by still imaging sources in the Mediterranean (OBSEA) and in the Atlantic (CPO) coastal areas; iv) collection of ethological data on species interactions and statistically significant co-occurrences, as a proxy of predator-prey relationships; v) collection of continuous high-frequency visual data for all detected species as proxy of populations' activity rhythms at both 24-h and seasonal scale; vi) linking biotic data on species assemblages with environmental fluctuations (both oceanographic and meteorological).

Scientific/Technical background and rationale
(one page)

All ecosystems are characterized by temporal fluctuations in the composition and function of their communities. This variability is expressed in rhythmic changes in species composition, with associated variations in biotic interactions at the intra- and interspecific levels. Millions of animals perform extensive vertical migrations of pelagic character within the water column or along the seabed in a nektobenthic fashion in response to tidal and inertial flows as well as upon light intensity and photoperiod length of day-night and seasonal cycles (Aguzzi and Company, 2010). Still, displacements from the continental shelf to the slope and viceversa, have been observed in different megafaunal species, associated to ontogenetic shifts in diet or movement for reproduction (Cartes et al., 2009). Diel and seasonal community changes drastically affect our perception of species biomasses, and biodiversity and this is deemed to be one of the major gaps for an appropriate management of marine resources, especially in demersal and coastal systems (Aguzzi et al., 2015).

Persistent climatic or human-induced environmental changes can produce long-lasting modifications in species behavior, with pervasive effects on population distributions and abundances (Peer et al. 2014). These effects can be particularly apparent in fish, due to their high mobility, which can allow entire populations to respond rapidly to environmental changes (Cheung et al. 2013).

For these reasons, tracking these changes at the fine temporal scale is today a requisite of community studies, with clear implications for fisheries and, in a broader sense, for ecosystem management. Yet, the underwater imaging technology offers promising opportunities to fulfill this need (Corgnati et al. 2016, Marini et al. 2015, Aguzzi et al. 2012) but the use of video cameras to quantify biological activities is still an emerging discipline and much experimental work has still to be done to proceed further (Aguzzi et al. 2015; McLoad et al. 2010).

Ground-truthing results can be thus compared to automatic counting and classification. This latter may offer very promising tools considered the huge amount of data provided by cabled observatories. Still, these technological advances, combined with the continuous improvement of the hardware performances, provide new grounds for understanding the complex dynamics of the underwater ecosystems.

3. QUALITY OF THE WORK PLAN
(maximum score: 5)

Experimental method and work plan ***(one page)***

Imagery and environmental data acquisition:

Both observatories are equipped with underwater video cameras recording underwater images in real time. A prototype of the GUARD1 imaging device will be installed on both the observatories and a time-lapse imaging will be performed at 15 min frequency, in agreement with previous studies (Aguzzi et al., 2012). The GUARD1 will acquire underwater images by using its own lighting system and its own battery pack and it will automatically recognize and count the fish specimens present in the acquired images.

Moreover, oceanographic sensors installed on the underwater platforms together with the atmospheric sensors placed on the above buoy or in a meteorological station nearby the observatories, will monitor a large spectrum of variables. These will be considered as potential driving forces to explain changes in fish abundance and composition of the obtained time-series.

Automated video-imaging:

The image analysis algorithms, presently installed on the GUARD1, will be used for recognizing and counting the fishes present in the acquired images. Further, the accuracy of the automated recognition will be assessed through a-posteriori ground-truth image dataset obtained from the visual inspection of the acquired images by expert biologists. A quantitative estimation of the recognition accuracy will be performed by computing the true positive, the false positive rate and the false negative rates with respect to the produced ground-truth.

The GUARD1 imaging device will be positioned in order to acquire images similar to the images acquired by the camera already mounted on the two observatories. In this way the abundance time-series automatically produced by the GUARD1 will be compared with the abundance time-series obtained through the visual inspection of the images acquired by the observatory's camera in the period of the experiment.

Data analysis:

All recorded images will be taxonomically analyzed and a library of marine taxa will be constructed by extracting high-quality frame grabs. A large database will be generated with visual count time-series for all reported taxonomical units plus associated oceanographical and meteorological data. Species count time series will be screened for significant fluctuation periodicity with the chronobiology package El Temps (Diez-Noguera, University of Barcelona, www.el-temps.com). Relationships between species rhythms and the environmental variables will be studied by integrated waveform analysis and multivariate class-modeling techniques will be used to forecast expected abundances of different species, based on environmental parameters. When the phenomena to be studied, either in prediction and in classification are strongly non-linear, Artificial Neural Networks will be used (ANN; Costa et al., 2009).

Intra- and interannual variations in species composition/abundance will be tested by multivariate (PERMANOVA, SIMPER, PERMDISP) and univariate (ANOVA) techniques. Further, correlations between observed changes in the biotic component and potential drivers (i.e. oceanographic and atmospheric variables) will be explored by means of linear or non-linear regression models.

Proposed time schedule ***(half a page)***

One year experiment: From 1st January 2018 up to 31st December 2018.

Time schedule

Months 1: The GUARD1 will be shipped to the OBSEA and tests will be performed for positioning the GUARD1 imaging device on the OBSEA, in order to obtain useful images.

Months 2-3: recording of images at OBSEA through the GUARD1 imaging device.

Months 4-6*:* the *a priori* ground-truth will be defined on the images acquired at the OBSEA during the months 2-3 and the recognition performance will be quantitatively estimated.

Month 4: The GUARD1 imaging device will be shipped to the CPO and tests will be performed for positioning the GUARD1 imaging device on the CPO observatory, in order to obtain useful images.

Months 5-6: recording of images at CPO through the GUARD1 imaging device.

Months 7-9: the a-posteriori ground-truth of the images acquired at the CPO will be defined and the recognition performance will be quantitatively estimated.

Months 10-12: Time series analysis of biological and environmental parameters and trophic modeling; comparisons and validation of the time-series obtained by the GUARD1 and by the observatory's cameras. Preparation of publications of derived results.

Please specify your requests regarding the use of your chosen facility's equipment/instruments/sensors, including any additional services, data or other requirements

We need minimal amount of clamps or cable-ties for installing the imaging device;
We will use the cameras that are already installed on the OBSEA and CPO;
Full access to multiparametric data recorded by both the OBSEA and CPO sensors.

List all material/equipment you plan to bring to the facility

We will deploy the GUARD1 imaging device for two months at each site. The GUARD1 will be equipped with its own battery pack and with its own lighting system.
We will also install a prototype system for cleaning the cameras' dome.

Risks, contingencies and mitigation measures

<Describe below the potential risks and contingencies that might occur during the project and how do you plan to avoid, mitigate or resolve them?>

#	Risk / Contingency	Prevention / Mitigation / Corrective action
1	Fouling on cameras at both Obsea and CPO observatories	A dedicated technical team is already in force to provide maintenance at both the OBSEA and CPO observatories. The cleaning prototype system could be also strongly help in solving this problem.
2	Illegal fishery activities could damage or move away the cameras with their gear (although fishing is not allowed in the area, some illegal activities may occur)	At both sites, the technical team will eventually recover and/or repair the sensor/equipment.
3	Problem with the data acquisition during the planned acquisition periods	Use of alternative periods within the project duration.

4. POTENTIAL FOR SEEDING LINKS WITH INDUSTRY AND/OR POTENTIAL APPLICATION TO STAKEHOLDERS
(maximum score: 5)

Highlight below any innovative aspect of your proposal beneficial to industrial application and/or relevant to other stakeholders.

(half page)

The development of an automated system of species identification and counting has a great potential for a variety of industries in any marine system. Potential links can be identified with aquaculture enterprises that need to monitor the number and quality of individuals; enterprises that produce submerged video-systems for monitoring Marine Protected Areas or in general for monitoring nursery areas of strategic importance for fishery. All the major oil companies operate with artificial structures and need to perform periodical activities of environmental monitoring in correspondence of offshore gas platforms. These transnational enterprises could largely benefit from the project results. Furthermore, the availability of an automated system for underwater species counting is expected to disclose a relevant business for all the enterprises operating in the video and imaging pattern recognition context. Also, the potential involvement in our meetings of Irish representatives of the ICEM WGNEPS from the Marine Institute (Dr. C. Lordam) would allow to introduce the cabled observatory science within the framework of industrially sponsored fishery-independent assessment initiatives.

5. EUROPEAN RELEVANCE AND INTERESTS FOR THE SCIENTIFIC COMMUNITY (maximum score: 5)

Describe the relevance of your proposal at the European level and the potential interests for the research community

(half page)

Tracking the temporal variability of marine resources and biodiversity is as a need of strategic importance for the conservation of marine ecosystems (Tittensor et al., 2010). This information, yet largely unavailable, is deemed critical to manage commercially fishery in both continental margins and coastal areas (reviewed by Bertrand et al., 2002). Up to now, experimental bottom trawling has been the most reliable methods of population assessment but innovative approaches are worth to be investigated.

At the European level, there is a great urgency for monitoring and managing rapid environmental and biotic changes that are now occurring in the marine environment. Outcomes of this project are expected to serve these needs and to track several of the 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). Noteworthy, the MSFD, through the technical guidance for monitoring (JCR 2014, Report EUR 26499 EN) identified in high-definition cameras promising approaches for biodiversity monitoring. Thus the achievement of an automation protocol has all the potential to be implemented in monitoring programs at a European level end beyond.