

The aim of this brochure is to present the 31 projects that have been selected under “The Ocean of Tomorrow” initiative (2010-2013). “The Ocean of Tomorrow” calls fall within the activities launched under FP7 to implement the “European Strategy for Marine and Maritime Research” (COM (2008) 534) and to address marine sciences and technologies as a challenge that cuts across themes. “The Ocean of Tomorrow” aims to foster multidisciplinary approaches and cross-fertilisation between various scientific disciplines and economic sectors on key cross-cutting marine and maritime challenges. Research projects funded under these calls bring together scientists, technology providers, industrial partners (including SMEs) and end-users. “The Ocean of Tomorrow” also links to the “Horizon 2020” programme, which acknowledges the importance of cross-cutting approaches.

Project information



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# The Ocean of Tomorrow Projects (2010-2013)

Joint Research Forces  
to Meet Challenges  
in Ocean Management

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# **The Ocean of Tomorrow Projects (2010-2013)**

Joint Research Forces to  
Meet Challenges in Ocean Management

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## PREFACE

Seas and oceans have a huge impact on our daily lives, providing an essential part of our wealth and well-being. They are not only a critical source of food, energy and resources, but also provide the majority of Europe's trade routes. The value of living by the sea, while intangible, is high to many of us. However, the impact of human activities on the marine environment keeps increasing. Maritime transport, offshore energy, tourism, coastal development, resource extraction, fisheries and aquaculture are examples of activities which can have a major impact on the marine environment, putting at risk marine ecosystems. 'The EU Strategy for Marine and Maritime Research' (COM (2008) 534) underpins the EU Integrated Maritime Policy. Through excellence in science and innovation, it aims to support a thriving and sustainable maritime economy. Science and technology have a vital role to play to preserve the marine environment as well as to support the 'Blue Growth'<sup>1</sup> to enhance the great economic potential of our seas and oceans. It is a key component to contribute to the 'Europe 2020'<sup>2</sup> goal of smart, inclusive and sustainable growth for Europe.

The 'European Strategy for Marine and Maritime research' (COM (2008) 534)<sup>3</sup>, adopted in 2008, is a key pillar of the EU Integrated Maritime Policy and provides a reference framework for marine and maritime research at European level. Commissioner Geoghegan-Quinn stated in 2010: *'Just as oceans ignore borders, marine sciences and technologies are by their nature cross-cutting and involve many disciplines. There is no other*

*way but to look beyond traditional sector-specific research to foster sustainable growth of maritime activities'*<sup>4</sup>.

A key initiative in this context is the launch of 'The Ocean of Tomorrow' (FP7-OCEAN) cross-thematic calls in FP7<sup>5</sup>. The 'Ocean of Tomorrow' initiative aims to foster multidisciplinary approaches and cross-fertilisation between various scientific disciplines and economic sectors on key cross-cutting marine and maritime challenges. A key feature is also the participation of business partners, in particular SMEs, in the research projects that are funded.

The aim of this brochure is to present the 31 projects that have been selected so far under 'The Ocean of Tomorrow'. It comprises 21 projects from the FP7-OCEAN-2010, FP7-OCEAN-2011 and FP7-OCEAN-2013 calls for proposals as well as 10 projects under 'The Ocean of Tomorrow 2012' coordinated topics for a total EU contribution of 195,6M€ over 2010-2013. More specific description of the calls can be found in the following pages. The 'Ocean of Tomorrow 2013' with its strong focus on technologies and innovation, already paves the way to the new challenge-driven approaches under Horizon 2020.

Although the 'Ocean of Tomorrow' cross-cutting calls have progressively increased in size in recent years, it should be also mentioned that marine and maritime research actions take place in the different thematic priorities and specific programmes of FP7.

1 COM (2012) 494: [http://ec.europa.eu/maritimeaffairs/policy/blue\\_growth/documents/com\\_2012\\_494\\_en.pdf](http://ec.europa.eu/maritimeaffairs/policy/blue_growth/documents/com_2012_494_en.pdf)

2 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF>

3 COM (2008) 534: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0534:FIN:EN:PDF>

4 See Speech of Commissioner Geoghegan-Quinn at 'The Ocean of Tomorrow 2011 Info Day': <http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/10/415&type=HTML>

5 [http://ec.europa.eu/research/bioeconomy/fish/research/ocean/index\\_en.htm](http://ec.europa.eu/research/bioeconomy/fish/research/ocean/index_en.htm)

# TABLE OF CONTENTS

<b>FP7-OCEAN-2010</b> .....	6
<b>FP7-OCEAN-2010-1 ACCESS:</b> Arctic Climate Change Economy and Society.....	8
<b>FP7-OCEAN-2010-2 VECTORS:</b> Vectors of Change in Oceans and Seas Marine Life, Impact on Economic Sectors .....	10
<b>FP7-OCEAN-2010-3 ECO<sub>2</sub>:</b> Sub-seabed CO <sub>2</sub> Storage: Impact on Marine Ecosystems.....	12
<b>FP7-OCEAN-2011</b> .....	14
<b>FP7-OCEAN-2011-1 H2OCEAN:</b> Development of a wind-wave power open-sea platform equipped for hydrogen generation with support for multiple users of energy .....	16
<b>FP7-OCEAN-2011-1 MERMAID:</b> Innovative Multi-purpose offshore platforms: planning, Design and operation.....	18
<b>FP7-OCEAN-2011-1 TROPOS:</b> Modular Multi-use Deep Water Offshore Platform Harnessing and Servicing Mediterranean, Subtropical and Tropical Marine and Maritime Resources.....	20
<b>FP7-OCEAN-2011-2 MICRO B3:</b> Marine Microbial Biodiversity, Bioinformatics and Biotechnology .....	22
<b>FP7-OCEAN-2011-3 PERSEUS:</b> Policy-orientated marine Environmental Research for the Southern European Seas.....	24
<b>FP7-OCEAN-2011-4 COCONET:</b> Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential.....	26
<b>FP7-OCEAN-2012</b> .....	28
<b>AQUATRACE:</b> The development of tools for tracing and evaluating the genetic impact of fish from aquaculture.....	30
<b>AQUO:</b> Achieve QUIeter Oceans by shipping noise footprint reduction.....	32
<b>BENTHIS:</b> Benthic Ecosystem Fisheries Impact Study.....	34
<b>BIOCLEAN:</b> New BIOtechnologiCaL approaches for biodegrading and promoting the environmEntal biotrAnsformation of syNthetic polymeric materials.....	36
<b>CLEANSEA:</b> Towards a Clean, Litter-Free European Marine Environment through Scientific Evidence, Innovative Tools and Good Governance.....	38
<b>DEVOTES:</b> DEVELOPMENT Of innovative Tools for understanding marine biodiversity and assessing good Environmental Status .....	40
<b>ECSAFESEAFOOD:</b> Priority environmental contaminants in seafood: safety assessment, impact and public perception .....	42
<b>KILL-SPILL:</b> Integrated Biotechnological Solutions for Combating Marine Oil Spills.....	44
<b>SONIC:</b> Suppression Of underwater Noise Induced by Cavitation.....	46
<b>STAGES:</b> Science and Technology Advancing Governance on Good Environmental Status.....	48

<b>FP7-OCEAN-2013</b> .....	50
<b>FP7-OCEAN-2013-1 BRAAVOO:</b> Biosensors, Reporters and Algal Autonomous Vessels for Ocean Operation .....	52
<b>FP7-OCEAN-2013-1 ENVIGUARD:</b> Development of a biosensor technology for environmental monitoring and disease prevention in aquaculture ensuring food safety .....	54
<b>FP7-OCEAN-2013-1 MARIABOX:</b> MARINE environmental in-situ Assessment and monitoring tool BOX.....	56
<b>FP7-OCEAN-2013-1 SEA-ON-A-CHIP:</b> Real time monitoring of SEA contaminants by an autonomous Lab-on-a-chip biosensor .....	58
<b>FP7-OCEAN-2013-1 SMS:</b> Sensing toxicants in Marine waters makes Sense using biosensors.....	60
<b>FP7-OCEAN-2013-2 COMMON SENSE:</b> Cost-Effective Sensors, Interoperable with International Existing Ocean Observing Systems, to Meet EU Policies Requirements .....	62
<b>FP7-OCEAN-2013-2 NeXOS:</b> Next generation, Cost-effective, Compact, Multifunctional Web Enabled Ocean Sensor Systems Empowering Marine, Maritime and Fisheries Management.....	64
<b>FP7-OCEAN-2013-2 SCHeMA:</b> Integrated In-Situ Chemical MApping Probes .....	66
<b>FP7-OCEAN-2013-2 SENSEOCEAN:</b> Marine sensors for the 21st Century.....	68
<b>FP7-OCEAN-2013-3 BYEFOULING:</b> Low-toxic cost-efficient environment-friendly antifouling materials.....	70
<b>FP7-OCEAN-2013-3 SEAFRONT:</b> Synergistic Fouling Control Technologies .....	72
<b>FP7-OCEAN-2013-4 LEANWIND:</b> Logistic Efficiencies And Naval architecture for Wind Installations with Novel Developments.....	74

## FP7-OCEAN-2010<sup>6</sup>:

The objective of the FP7-OCEAN-2010 call is to build the knowledge base for a sustainable growth of sea-based activities. It will do this in two ways: by improving understanding of marine ecosystems' response to a combination of natural and anthropogenic factors, and by providing a scientific foundation for feasible, sustainable management measures supporting policies and possible related technologies. The call consisted of three topics related to: climate change impacts on economic sectors in the Arctic, vectors of changes in marine life and sub-seabed carbon storage and the marine environment. It involved Theme 2 'Food, Agriculture and Fisheries, and Biotechnology' (FAFB), Theme 5 'Energy', Theme 6 'Environment (including Climate Change)', Theme 7 'Transport (including Aeronautics)' and Theme 8 'Socio-economic Sciences and Humanities'. As a result, 3 projects<sup>7</sup> have been selected for a total EU contribution of about 34M€.

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6 [http://europa.eu/rapid/press-release\\_IP-09-1206\\_en.htm?locale=en](http://europa.eu/rapid/press-release_IP-09-1206_en.htm?locale=en)

7 [http://europa.eu/rapid/press-release\\_IP-10-1098\\_en.htm](http://europa.eu/rapid/press-release_IP-10-1098_en.htm)







## ACCESS:

### Arctic Climate Change Economy and Society

[www.access-eu.org](http://www.access-eu.org)

*Climate change is strongly impacting both marine ecosystems and human activities in the Arctic, which in turn has important socio-economic implications for Europe. ACCESS will make 30 years projections based on climate change scenarios for assessing the evolution of human activities such as marine transportation, fisheries, oil and gas extraction in the Arctic with special attention dedicated to environmental sensitivities and sustainability. Understanding the socio-economic impacts of these changes along with their influence on Arctic Governance, are key areas of research within ACCESS.*

The Arctic has experienced substantial changes in recent years. These are most likely caused by a combination of natural variability of the high latitude climate system and anthropogenic changes. They include changes in the radiation balance, in atmospheric and oceanic heat transports and in feedbacks of the air-sea-ice-ocean coupled system linked to a thinning and shrinking Arctic sea-ice cover.

Thus ACCESS activities encompass an assessment of climate model results regarding their representation of sea-ice, ocean and

atmospheric parameters, their seasonal and inter-annual variability and their trends for the next 30 years. With the reduction of sea-ice ahead, a strong increase in ship traffic in the Arctic can be expected. ACCESS dedicates an important effort to the potential impacts shipping activities might have on the sensitive marine environment, including air pollution and long range transport of pollutants by the atmospheric circulation, soot and black carbon deposition on sea-ice, oil spill and ballasting ship tanks in the Arctic Ocean. ACCESS is focusing on enhancing knowledge related to bio-economic

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and socio-economic aspects of fish resources and aquaculture in the context of climate change in the Arctic. It is the aim of ACCESS to assess the opportunities and multiple risks related to oil and gas extraction in the Arctic Ocean, to highlight potential environmental pressures, provide pathways for technological, legal and institutional solutions and to analyse the socio-economic impacts of resource extraction activity on European, world markets and societies. ACCESS gathers the expertise from 28 partners across Europe including a substantial involvement from the private sector. A key objective of ACCESS is to point out governance options in the context of climate change and the envisioned human activities' increase in the economic sectors mentioned above. The wide range of existing legislative instruments, conventions, agreements at national and international level, provide a complex system of regulation in an area requiring special integrated overview. ACCESS is uniquely positioned to identify lacunae and to offer strategic policy options for the medium and long term future in the context of climate change and the Integrated Maritime Policy.

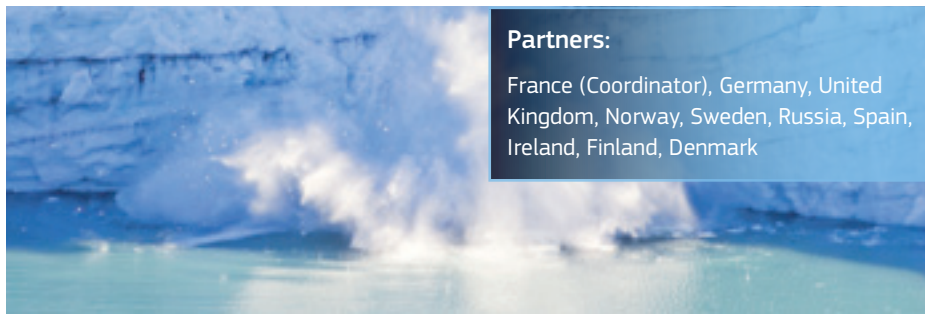
Modelling activities of the ACCESS project are intended to estimate and interpret the impacts of climate change on human activities in the Arctic Ocean and vice versa. Modelling activities

importantly cross all aspects of the ACCESS project to deliver practical policy and infrastructure options for responding to the rapidly changing Arctic Ocean. Ecosystem Based Management (EBM) in particular and Marine Spatial Planning (MSP) in general are key integration tools for ACCESS. EBM and MSP are the links that relate the basic research components of ACCESS. Monitoring activities for long-range and long-term observations of the Arctic Ocean including in-situ and remote sensing observations of the Atmosphere, Sea-Ice and Ocean, are a major development for the ACCESS project.

### ACCESS European Added Value

The European dimension of the ACCESS project, its diversity including Climate Change, socio-economics and governance aspects is in adequacy with the multi-disciplinary and cross-sectorial approach of the 'Ocean of Tomorrow'. In the context of climate change, ACCESS is contributing to the implementation of the IMO Polar Code, the adaptation of the UNCLOS protocol to the Arctic Ocean, the EU Maritime Policy and the EU Marine Strategy Framework Directive for shipping, fisheries and offshore oil and gas extraction in the Arctic in close cooperation with the Arctic Council Task Forces and Working Groups. The scope of the ACCESS project would not have been reached at any national level.

Project N° 265863	Topic: FP7-OCEAN-2010-1: Quantification of climate change impacts on economic sectors in the Arctic	EU contribution: € 10,978,468	Duration: 48 months	From: March 2011
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### Partners:

France (Coordinator), Germany, United Kingdom, Norway, Sweden, Russia, Spain, Ireland, Finland, Denmark



## VECTORS:

### Vectors of Change in Oceans and Seas Marine Life, Impact on Economic Sectors

[www.marine-vectors.eu](http://www.marine-vectors.eu)

*The increasing and diversifying human activities taking place at sea, such as transport, fishing, renewable energy extraction and leisure, are leading to new and challenging changes for marine life and for society. VECTORS is examining how these changes may affect the range of services provided by the oceans ecosystems, the ensuing socio-economic impacts and some of the measures that could be developed to reduce or adapt to these changes. It is adopting a multi-disciplinary and cross-sectorial approach in line with the objectives of the Integrated Maritime Policy.*

With its 38 partners from 16 countries across Europe, VECTORS reviewed the current understanding of drivers, pressures and vectors of change for marine life that are affecting ecosystems in the North Sea, Baltic Sea and western Mediterranean Sea, and completed an overview of the current international and European law relating to these seas. By interviewing stakeholders at the regional and EU level, VECTORS could identify some barriers and drivers for successful European marine environmental resources management. The current status of various modelling approaches, used to examine changes

in the distribution and productivity of fish and other living marine resources, has been reviewed and the results of various VECTORS modelling applications have been analysed. The insights gained ensure that the most advanced modelling approaches are being adopted by VECTORS. Data has been collated on the impacts of outbreaks of indigenous or invasive species on biodiversity and ecosystem functioning through three quantitative, systematic reviews focusing on (a) outbreaks of macroalgae (b) invasive primary producers and (c) invasive ecosystem engineers. Furthermore, multi-species assessment modelling

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has indicated the relative importance of mortality due to fishing and predation for a number of commercial species and demonstrated the potential influence of outbreaks of predatory species. These findings will underpin VECTORS research to assess impacts of changes in marine ecosystems and on their capacity to deliver ecosystem services and economic benefits to society, now and in the future. Future scenarios of the biogeochemistry of three regional seas have been modelled and incorporated into a synthesis of hypothetical future projections. These will feed into an analysis of the relative vulnerability of the lower trophic level of the marine ecosystem to drivers of change (e.g. climate change) through a modelling study. Results in this work provide important indicators of change in physical, environmental and habitat conditions under simulated scenarios, such as regional warming or changes in productivity. These base conditions constitute a key element of the ecosystem assessment of the Regional Seas and inform consecutive modelling activities including fisheries, invasive species or socio-economic projections.

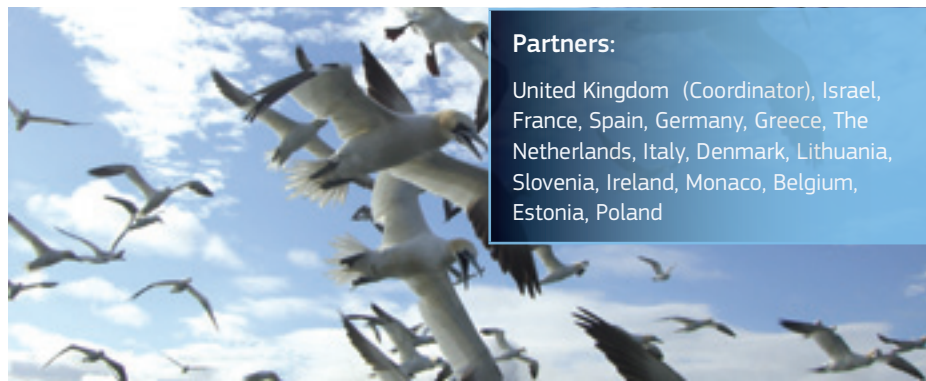
The project is comprised of seven Work Packages (WPs) and is focused on three regional sea case study areas; the North Sea, the Baltic

Sea and the western Mediterranean. For each of these seas VECTORS aims to: identify the main pressures being experienced (WP1), develop a mechanistic understanding of the underlying processes causing change (WP2), evaluate the ecological, ecosystem service and social implications of current change (WP3), integrate information and data across sectors into a common modelling framework (WPs 2-5), and project future changes to the ecosystem, its services as well as the corresponding social and economic consequences (WP5 and 6).

### VECTORS European Added Value

VECTORS is a highly integrated and multidisciplinary project with the aim to understand common pressures and threats being exerted on our marine environment. The understanding developed through the project will contribute the information and knowledge required to inform the development and implementation of forthcoming strategies, policies, regional seas conventions, management bodies and regulations across Europe, such as the IMO International Convention for the control and management of ships' ballast water and sediments, EU Maritime Policy and the EU Marine Strategy Framework Directive.

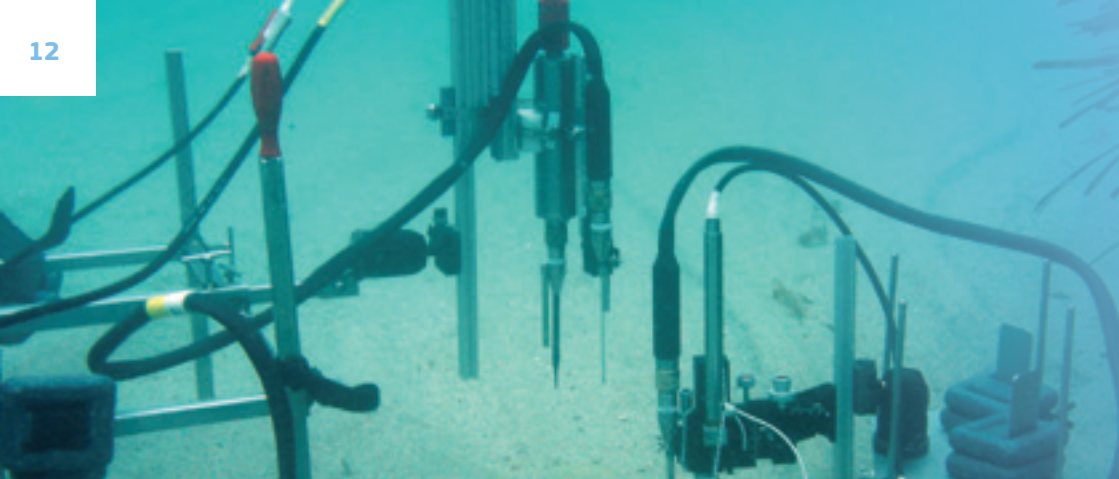
Project N°266445	Topic: FP7-OCEAN-2010-2: Vectors of change in marine life, impact on economic sectors	EU contribution: € 12,484,835	Duration: 48 months	From: February 2011
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### Partners:

United Kingdom (Coordinator), Israel, France, Spain, Germany, Greece, The Netherlands, Italy, Denmark, Lithuania, Slovenia, Ireland, Monaco, Belgium, Estonia, Poland





## ECO<sub>2</sub>:

### Sub-seabed CO<sub>2</sub> Storage: Impact on Marine Ecosystems

[www.eco2-project.eu](http://www.eco2-project.eu)

*Carbon dioxide capture and storage (CCS) is considered as a key technology for the reduction of CO<sub>2</sub> emissions from industrial facilities. Consequently, the European Commission promotes the implementation of CCS in Europe at industrial scale by supporting selected demonstration projects, several of which aim to store CO<sub>2</sub> below the seabed. Currently, little is known about the short- and long-term impacts of sub-seabed CO<sub>2</sub> storage on marine ecosystems, consequently, ECO<sub>2</sub> aims to establish a framework of best environmental practices for sub-seabed CO<sub>2</sub> injection and storage.*

ECO<sub>2</sub> investigated the sedimentary cover at active and potential CO<sub>2</sub> storage sites (Sleipner, Snøhvit, B3 field) using novel geophysical baseline studies, monitoring and modelling techniques to better understand the mechanisms of CO<sub>2</sub> migration. It assessed the effects of leakage of CO<sub>2</sub> through the sediment at storage sites and natural analogues and quantified the fluxes across the seabed and into the water column by means of sophisticated monitoring techniques and investigated the impact on benthic organisms, through experiments. All fieldwork data is stored in the project database. The main targets

of 2011 to 2013 research expeditions were the Utsira CO<sub>2</sub> storage formation (Sleipner) in the Norwegian North Sea where Statoil stores CO<sub>2</sub> since 1996 and the natural CO<sub>2</sub> seepage site Panarea in the Mediterranean Sea. At Sleipner an intensive shallow-focused monitoring programme has been conducted to assess the sedimentary cover and the chemical composition, its fluxes and the techniques to trace any irregularity. Whereas at Panarea the CO<sub>2</sub> migration and the behaviour of gas bubbles within the water as well as the effect on the benthic ecosystem was studied for different spatial and temporal

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flux rates. The environmental risks associated with CCS and how these risks may impact on the financial, legal, and political considerations surrounding the future geological storage were elaborated. The public perception group investigated trust and context as two influencing factors. ECO<sub>2</sub> presents itself and its public results (e.g. cruise reports, a CCS glossary etc.) on a webpage ([eco2-project.eu](http://eco2-project.eu)) and further informs stakeholders and interested individuals about new findings and the project progress via press releases, articles and e.g. lunch briefings at the European Parliament. The results and final product of ECO<sub>2</sub> will be of scientific and political value to all stakeholders within the European Member States and beyond regarding CCS, ocean acidification, climate change and other related issues.

ECO<sub>2</sub> evaluates the likelihood of leakage from sub-seabed CO<sub>2</sub> storage sites, the possible impacts on marine ecosystems and the associated economic and legal issues. Project partners are using cutting-edge monitoring technology and novel approaches, including autonomous underwater vehicles (AUV) with synthetic aperture sonar to detect shallow-focussed irregularities in the integrity of the sedimentary cover of storage sites, and membrane inlet mass spectrometry (MIMS) to trace potential leakage. Sophisticated computer models interlink the natural scientific and economic results and interpretations. The majority of research

### Partners:

Germany (Coordinator), United Kingdom, Norway, Italy, Belgium, Sweden, The Netherlands, France, Poland

expeditions, gathering the essential core data of the project, are funded by national sponsorship. The project follows a multi-disciplinary and comparative approach investigating active and potential storage sites as well as natural CO<sub>2</sub> seep sites.

### ECO<sub>2</sub> European Added Value

In 2009 the European Commission adopted the directive on the geological storage of carbon dioxide, and several European States intend to store CO<sub>2</sub> sub-seabed to implement the directive. EU funding through 'The Ocean of Tomorrow' made it possible to bring together leading experts from the ocean acidification, natural seepage and CCS communities in Europe from research and industry (e.g. Statoil) to jointly study in a multi-disciplinary way the impact of sub-seabed CO<sub>2</sub> storage on marine ecosystems. Furthermore, the consortium attracted key non-European countries (Australia and Japan) involved in sub-seabed CO<sub>2</sub> storage. Accordingly, the project ensures the pooling of capabilities, short-term scientific exchange, and the validation and dissemination of results throughout Europe and beyond, which would not have been reached at any national level.

Project N°265847	Topic: FP7-OCEAN-2010-3: Sub-seabed carbon storage and the marine environment	EU contribution: € 10,500,000	Duration: 48 months	From: May 2011
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## FP7-OCEAN-2011<sup>8</sup>

The aims of the call are to improve our understanding and the predictive capacity of marine ecosystems' response to a combination of natural and anthropogenic factors, while fostering innovations to make the most of sea resources. The call consisted of four topics. Two were of generic nature: Multi-use offshore platforms and Marine microbial diversity while the other two were of particular relevance to the Mediterranean and the Black Sea regions: (1) natural and human-made pressures in the Mediterranean and Black Sea and (2) marine protected areas and wind energy potential in the Mediterranean and Black Sea. The call was implemented jointly between Theme 2 'Food, Agriculture and Fisheries, and Biotechnology' (FAFB), Theme 5 'Energy', Theme 6 'Environment (including Climate Change)' and Theme 7 'Transport (including Aeronautics)'. As a result 6 projects<sup>9</sup> have been selected for funding for a total EU contribution of almost 46M€.

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<sup>8</sup> [http://europa.eu/rapid/press-release\\_IP-10-1098\\_en.htm](http://europa.eu/rapid/press-release_IP-10-1098_en.htm)

<sup>9</sup> [http://ec.europa.eu/research/bioeconomy/fish/research/ocean/fp7-ocean-projects\\_en.htm](http://ec.europa.eu/research/bioeconomy/fish/research/ocean/fp7-ocean-projects_en.htm)





## H2OCEAN:

Development of a wind-wave power open-sea platform equipped for hydrogen generation with support for multiple users of energy

[www.h2ocean-project.eu](http://www.h2ocean-project.eu)

*The increasing interest for a low carbon economy, together with the potential of offshore renewables, has opened an opportunity to develop new concepts for multi-use offshore platforms with energy harvesting as a core activity. H2OCEAN goes a step further and gathers a set of individually proven technologies (renewable energy harvesting + hydrogen generation + aquaculture + environmental monitoring) to develop a proof-of-concept design for a fully integrated multi-component and multi-purpose platform to exploit far offshore ocean resources in a sustainable way and assess the impact at both, environmental and economic levels. Its flexible design will be easily adapted to address the requirements of a particular location and local economics worldwide.*

During the first 18 months, H2OCEAN has completed a varied set of objectives and results. The stakeholder requirements for an H2OCEAN system have been identified and analysed, including design constraints and system boundaries and interfaces. Based on this, three sites have been selected (North Atlantic Ocean, North Sea and Mediterranean Sea) to develop and test an H2OCEAN design. An outline design specification for the H2OCEAN concept has been produced in the form of a 'Technical dimension paper', specifying key parameters (electrical output, fresh water, hydrogen and oxygen, aquaculture farm) and a glossary of terms. An aerodynamic modelling of a floating Vertical-axis wind turbines (VAWT), considering unsteady wind profiles and platform motions has been developed (incl. hydrodynamic, gyroscopic, inertia and mooring), and individual modules have been validated with data. Based on the P80 WEC (Wave Energy Converter), an integrated

WEC+VAWT hydrodynamic model has been built and design sensitivities have been conducted for a range of VAWT parameters. Regarding hydrogen generation, electrolysis technologies have been evaluated with the requirements of an H2OCEAN design and a low pressure alkaline electrolyser has been selected. A preliminary design of the offshore desalination system has been completed as well. Regarding aquaculture, the specific combination of species to be cultured at each site (fish, shellfish and seaweeds) has been defined, full production programmes have developed and transportation requirements analysed and determined. A broad environmental impact scoping study for the three sites has been produced (European directives, baseline conditions/impacts, potential impact factors, broad identification of stakeholders, recommendations for the Environmental Impact Assessment, etc). A pilot version of the software tool to evaluate H2OCEAN optimal

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### Partners:

Spain (Coordinator), Denmark, Germany, Italy, United Kingdom

locations has been prepared and data selected from relevant databases are being incorporated in a continuously open process, while the operating scenarios for the selected sites are created. The basis of the Life Cycle Assessment (LCA) has been defined ('from cradle to grave', operative framework and collaborative tool). Also, the cost structure for equipment and functional units has been completed and an adaptable tool to collect data on every cost has been prepared. Finally, the requirements specification from technology developers has been collected and a functional analysis of the H2OCEAN design has been completed, including a preliminary design of platform units, process flow diagrams, block flow diagram, work center summary and functional layout diagram.

### H2OCEAN European Added Value

H2OCEAN deals with a range of interdisciplinary and interrelated challenges from sectors as diverse as ocean energies, green technologies, food/fisheries, maritime transport and shipbuilding. Also, the intrinsic nature of the oceans, require an international approach. EU funding and 'The Ocean of Tomorrow' initiative, has made it possible to bring together contributions from a well-balanced transnational consortium with the necessary range of multidisciplinary knowledge, competences, experience and strong management skills. Scientific and technological expertise from partners (research organizations, SMEs and large companies) is coherently applied and integrated to achieve the envisaged H2OCEAN proof-of concept design. To enhance complementarities and synergies, close collaboration has been established with MERMAID and TROPOS projects, and as result of a jointly organized workshop, coordination has been specifically agreed on environmental impact, socioeconomic analysis and life cycle assessment.

Project N°288145	Topic: FP7-OCEAN-2011-1: Multi-use offshore platforms	EU contribution: € 4,525,934	Duration: 36 months	From: January 2012
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## MERMAID:

Innovative Multi-purpose offshore platforms: planning, Design and operation

[www.mermaidproject.eu](http://www.mermaidproject.eu)

*European oceans will be subject to massive development of marine infrastructure in the near future that is why the concept of multi-use offshore platforms is particularly interesting, especially in connection with the development of energy facilities e.g. offshore wind farms, exploitation of wave energy, and also development and implementation of marine aquaculture. These developments require effective marine technology and governance solutions. Simultaneously, both economic costs and environmental impacts have to remain within acceptable limits. These concerns are at the core of the MERMAID project funded under 'The Ocean of Tomorrow' call for proposals.*

The MERMAID project began on the 1<sup>st</sup> January 2012 and the kick-off meeting took place in March 2012. The main objective was the drafting of an inception report and a QA (Quality assurance) plan for the entire project. The inception report provides the basis for the research that will be carried out during the remaining part of the project. The first consultation involving stakeholders from government offices, industry, facility managers, NGO's and other stakeholders has been completed for each of the four selected project sites: Baltic Sea, North Sea, Atlantic and Mediterranean

in order to clarify the most important issues regarding technical, environmental and socio-economic analyses. An inventory on existing legislative framework and policies regarding offshore wind farms and aquaculture in EU has been elaborated. A methodology for Integrated Socio-Economic Assessment (ISEA) has also been developed. The end product of MERMAID will include guidelines for project development in order to facilitate a smooth and safe management and implementation of the Multi Use Platforms (MUP) concept. Work on the guidelines has already started. The knowledge and

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science base for multi-disciplinary approaches will be strengthened. As part of this activity, the accumulated effect of various large scale structures interaction with for example waves, currents or seabed as well as the mixing and dispersion processes will be analysed in detail. This will be useful for designers, manufacturers and contractors. A decision-support system regarding transport infrastructure and the economic and environmental feasibility of the Multi-use offshore platforms will be tackled. Specific questions will be addressed such as: will the environmental impact decrease or increase? Will the multi-use approach lead to a better exploration of ocean space for aquaculture? Addressing such key questions will be of interest to Governmental agencies, spatial planners (private and public), investors and NGO's (Non-Governmental Organisations).

The test areas were chosen to represent different marine environments, socio-economic conditions and data accessibility. The potential to create direct connections between local research teams, stakeholders, decision makers, SMEs and the industry were also key elements when selecting the case studies. First concepts for multi-use platforms at the four sites are under development. Early engagement of

### Partners:

Denmark (Coordinator), Germany, Belgium, Italy, Sweden, Spain, Greece, Norway, The Netherlands, Poland, Turkey, Cyprus, United Kingdom

multiple stakeholders from a wide array of sectors is critical to address such complex issues and will facilitate cooperation for the future. MERMAID has also established close links with the TROPOS and H2OCEAN projects funded under the same 'The Ocean of Tomorrow' topic in order to enhance complementarities and synergies. This cooperation agreement focuses on three areas: EIA (Environmental Impact Assessment), SEA (Socio-Economic Analyses) and LCA (Life Cycle Assessment).

### MERMAID European Added Value

At the end of the project, a set of specific guidelines will be produced in order to assist future stakeholders within the offshore industries in order to plan, establish and operate their businesses in the most optimal way possible. The multi-disciplinary and cross-sectorial approach of this project is very innovative and the EU added value also lies in the case studies that address four EU regional seas.

Project N° 288710	Topic: FP7-OCEAN-2011-1: Multi-use offshore platforms	EU contribution: € 5,483,411	Duration: 48 months	From: January 2012
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## TROPUS:

Modular Multi-use Deep Water Offshore Platform Harnessing and Servicing Mediterranean, Subtropical and Tropical Marine and Maritime Resources

[www.tropusplatform.eu](http://www.tropusplatform.eu)

*While availability of space on land is already limited, it is especially restricted and acute in coastal regions, hence the increasing interest in offshore areas. The TROPUS Project develops the design and considers location options for floating modular Multi-use Offshore Platforms integrating a broad range of specific activities from different sectors. The innovative platform is adapted to deep waters and enables integrated exploitation of oceanic resources (including maritime transport, energy, aquaculture, and leisure), with a focus on tropical, subtropical and Mediterranean areas.*

The TROPUS project has a multi-disciplinary nature and represents a significant challenge in terms of standardizing approaches and methodologies since it puts together many different sectors. Thus, the TEAL (Transport, Energy, Aquaculture and Leisure) sectors are being integrated into different conceptual modules and scenarios, highlighting three main concepts: 'Sustainable Production Concept', 'Green & Blue Concept' and 'Leisure Island Concept'.

At the moment, the project has also designed the platform central unit, which can be used for

three different models of platforms in three different locations: Canary Islands, Crete (Greece) and Taiwan. From the economical point of view, a deployment strategy for multi-use offshore platforms is covering several aspects: project objectives, factors in- and excluded, components to be incorporated in the TROPUS platform, and a scenario for the deployment of a multi-use platform outlining final deployment targets. From the start of the TROPUS conceptual design, environmental and socio-economic aspects are studied and fully integrated to ensure that sustainability is part and parcel of

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the project. As the first step, a thorough scoping of possible positive and negative impacts including synergies and cumulative impacts has been performed. A literature study is on-going, focusing on potentially significant impacts, mitigation and monitoring options useful for TROPUS. Finally, a comparison of single-use versus multi-use platforms will be developed and guidelines prepared so that investors know which environmental aspects to address.

With a view to overcome TROPUS diversity, the project work package: 'Geographic and Module Benchmarking and Decision Methodology' (already completed) has provided a common decision methodology based on GIS (Geographical Information System) and a thorough analysis of the main constraints and synergies between platform components for a quantitative evaluation of the specifications of each of the TEAL components. At the same time, the design of the platforms presents an iterative process which simultaneously considers numerous interrelated factors resulting in a dynamic process. TROPUS is also establishing close links with the MERMAID and H2OCEAN projects funded under 'The Ocean of Tomorrow' topic in order

to enhance complementarities and synergies.

### TROPUS European Added Value

The development of the multi-use oceanic platforms concept has clearly become one of the EU's most interesting and ambitious projects in order to ensure the integrated, sustainable and ecological exploitation of oceanic resources. Such objectives are in complete accordance with the aim of the TROPUS project. These objectives require a multidisciplinary and highly specialised team in areas such as offshore structures, energy, aquaculture and maritime transport. Its strong innovative character and the project key conditions motivated the collaboration of 19 partners from 9 countries: 18 European and 1 from Taiwan including national public research institutions, large companies and small and medium-sized enterprises with strong expertise in these sectors.

#### Partners:

Spain (Coordinator), United Kingdom, Germany, Portugal, France, Norway, Denmark, Greece, Taiwan

Project N° 288192	Topic: FP7-OCEAN-2011-1: Multi-use offshore platforms	EU contribution: € 4,877,911	Duration: 36 months	From: February 2012
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## Micro B3:

Marine Microbial Biodiversity, Bioinformatics and Biotechnology

[www.microB3.eu](http://www.microB3.eu)

*With technological advances in the fields of 'Omics' analyses, oceanography and lab automation, marine scientists conduct projects they only dreamed of 10 years ago. The deluge of data produced is beyond the skill-set of many marine scientists and very little data management infrastructure exists. Micro B3 (Biodiversity, Bioinformatics and Biotechnology) will facilitate the whole process from sampling and data acquisition to analysis and interpretation. This will lead to better understanding of marine ecosystems and pave the way for novel biotechnological applications.*

Nine interdisciplinary teams of experts in bioinformatics, computer science, biology, ecology, oceanography, bioprospecting, biotechnology, ethics and law are working together in the Micro B3 project. The consortium includes 25 European research groups with 32 participants from universities, research institutes and companies. The primary objective is to integrate biodiversity, genomic, and oceanographic databases into one Information System (IS), the Micro B3-IS, which is based on global standards for sampling and data processing.

Biodiversity research in Micro B3 has already led to novel results concerning the role of marine

viruses as well as providing interactive guidance and tools for ecological analysis. Case studies were chosen to explore the marine microbial ecosystem, including spatial monitoring done through expeditions and temporal monitoring programmes for long-term ecological research sites.

Bioinformatics work has led to interoperable structures for submission, storage and exchange of data between the established archives SeaDataNet, EuroBIS, the European Nucleotide Archive (ENA at EBI) and the Micro B3-IS. For the Ocean Sampling Day (OSD) planned on 21st June 2014, best practice guidelines for microbial

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biodiversity assessments in rich environmental context were agreed, tested and gathered in an OSD Handbook. ([http://www.microb3.eu/sites/default/files/deliverables/MB3\\_D4\\_3\\_PU.pdf](http://www.microb3.eu/sites/default/files/deliverables/MB3_D4_3_PU.pdf)).

A citizen science and crowd funding campaign ([www.my-osd.org](http://www.my-osd.org)) was started to raise awareness for the marine ecosystem. Training is done in bioinformatics, ecological statistics and modelling with an interdisciplinary summer school, metagenomic and annotation courses planned.

To further biotechnological applications, bioinformatics tools were developed for determining functions of still unknown genes found in marine microbes. One is using co-occurrence networks for determining hypothetical functions of unknown genes from marine microbes. Results from genome mining for anti-tumour compounds, enzyme databases, libraries and new expression systems for experimental screening are becoming available. Industry leaders are targeted through expert workshops and Think Tanks to promote understanding of the value of integrating environmental and 'Omics' data.

Intellectual Property Rights issues are addressed through the development of model agreements and organisation of a stakeholder workshop facilitating access to and benefit sharing of marine genetic resources.

The innovative Micro B3-IS allows for seamless processing, integration, visualisation and accessibility of the huge amounts of marine data collected in on-going biodiversity sampling campaigns and long-term observations. Interoperability is a key feature for data transfer of sequence and contextual data to public

repositories. Therefore all entries will adhere to the Minimum Information checklists Standard (MIxS) for describing molecular samples as outlined by the international Genomic Standards Consortium (GSC, [www.genesc.org](http://www.genesc.org)). Micro B3 also offers analytical and feedback tools on its platform which are unique in terms of integrating genetic and ecological information and generating collective knowledge. This provides new perspectives for the modelling and exploration of marine microbial communities.

### MICRO B3 European Added Value

With Micro B3 we expect to achieve a new communication culture crossing traditional boundaries. As part of the 'Ocean of Tomorrow' initiative we can enhance Europe's ability to make use of the Petabytes of data produced aiming to develop marine ecosystems' biology and biotechnology. Micro B3 integrates expertise from sampling to supporting storage, analysis and downstream use of resulting environmental and bioinformatics data with the objective to create long-lasting and interoperable structures and resources for data mining. Expected impacts include a better understanding of marine microbial ecosystems in terms of their complexity and the parameters driving their functions. Novel bioinformatics tools are having wide-ranging impacts, for example providing information for the cost- and time-efficient generation of new targets for biotechnological applications.

### Partners:

Germany (Coordinator), United Kingdom, Greece, France, Spain, Italy, Belgium, Turkey, The Netherlands, Denmark, Ireland, Monaco, Switzerland, Iceland, Macedonia

Project N°287589	Topic: FP7-OCEAN-2011-2: Marine microbial diversity	EU contribution: € 8,987,491	Duration: 48 months	From: January 2012
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## PERSEUS:

Policy-orientated marine Environmental Research for the Southern European Seas

[www.perseus-net.eu](http://www.perseus-net.eu)

*By using Europe's Marine Strategy Framework Directive (MSFD) as a foundation, PERSEUS is developing and initiating a marine research governance framework that unites scientific research with policy development. PERSEUS has introduced a collaborative framework involving scientists, policymakers and the wide public, to share knowledge and promote collective decision-making. PERSEUS is also inherently relevant to other EU and national policies and actions in both Mediterranean and Black Seas.*

In the last years, PERSEUS has gained significant new knowledge on the current environmental and socio-economic situation. First it identified lack of data, lack of time-series, and poorly described processes in the Southern European Seas (SES). It defined the sampling strategy to address these gaps in data and knowledge. It realised 22 integrated, multi-disciplinary experiments in the open sea and coastal areas and worked on the assessment of the cost of degradation on ecosystem goods and services (e.g. fisheries and aquaculture, maritime transport, tourism, hydrocarbon extraction desalinization etc.). Another key result is the creation of

a complete inventory of the observing systems in the SES which identified gaps in coverage (geographic and temporal), in types of observations. This will lead to an overall strategy for the observing systems to be used for MSFD monitoring. PERSEUS started the upgrading of 12 fixed stations with new biogeochemical & acoustic sensors, supported the launching of 14 Argo floats and proposed new technologies to be used (gliders, VMS and CPR-MED), through cross border, cooperative 'projects'. Numerical E2E 'Ecosystem/End-to-End' perspective models were established and implemented in the SES regional basins, various data were collected.

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A critical review of the Initial Assessments has led to the identification of the approaches and assessment elements used in the EU countries. PERSEUS also adopted a gap scoring system quantifying the main types of gaps and indicating related scientific priorities. The project set-up 5 stakeholder platforms, one for each regional Pilot Case, that have actively engaged almost 100 policymakers ensuring that the adaptive policy framework is developed in response to specific needs. The scientific and operational needs of a new vessel have been identified through a participatory approach involving the consortium and relevant stakeholders while the preliminary design of the vessel has been defined. Two citizen-science campaigns were developed: the Jellyfish spotting campaign (as a joint action with other research projects) and the Marine LitterWatch campaign, enhancing the initiative of the European Environment Agency.

PERSEUS reviewed the current knowledge on the ecological status of the SES along with socio-economic analysis of the related human activities. The results were combined in a unique Umbrella Workshop based on regional approaches. An overall report identifying pressures and their impacts on marine and coastal ecosystems in the SESs has been produced while the most relevant gaps in knowledge and data towards achieving GES were identified and prioritized. Filling these gaps has started through multi-disciplinary experiments, in-situ monitoring, remote sensing observing systems and the use of E2E models. A methodology for

Partners:

Greece (Coordinator), Turkey, France, Spain, Italy, Romania, Malta, Belgium, United Kingdom, The Netherlands, Cyprus, Israel, Slovenia, Ukraine, Russia, Bulgaria, Morocco, Germany, Croatia, Tunisia, Georgia

assessing anthropogenic pressure indicators using Remote Sensing and models is developed. Consistent economic and social analysis of the use of the SES waters and an assessment of the cost of degradation has been performed as a first step towards the development of the Adaptive Policy Framework.

PERSEUS European Added Value

It is widely acknowledged that healthy marine ecosystems supply a host of services, which provide direct and indirect benefits to the world's population. In this context, PERSEUS tries to provide clear evidence-based answers to questions like: how 'healthy' are the marine ecosystems of the Mediterranean and Black Seas? Is marine protection really a good social investment? It is clear that policymakers want to protect our seas, as do EU citizens, but they also need to consider the economic aspects of these measures. PERSEUS scientists are challenged to getting the right balance between environmental and economic aspects. It is an on-going process and scientists need to help policymakers understand that 'business as usual' is no longer an option.

Project N°287600	Topic: FP7-OCEAN-2011-3: Natural and human-made pressures in the Mediterranean and the Black Seas	EU contribution: € 12,973,123	Duration: 48 months	From: January 2012
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## CoCoNet:

Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential

[www.coconet-fp7.eu](http://www.coconet-fp7.eu)

*Marine Protected Areas (MPAs) are restricted to national boundaries. CoCoNet is building guidelines to shift the protection of our natural capital from a national to a transnational perspective, with the creation of networks of MPAs. Clean energy production is a strategic EU objective. Offshore Wind Farms (OWF) are crucial for the achievement of this goal in Northern Europe, while being absent in Southern European Seas. This gap must be filled with the greatest respect of environmental integrity.*

The 39 institutes and SMEs of the CoCoNet consortium are based in 22 States covering the Black Sea, the Mediterranean Sea, a significant part of North Africa and Middle East, and the European Union. In the first part of the project, a significant sample of scientific communities that seldom interact have started working together to form a solid group of motivated scientists. This was achieved after a year of intensive theoretical elaboration of the crucial topics for the project through a series of thematic workshops and summer schools. The Pilot Studies were then successfully carried out as programmed, both in the open sea, with

oceanographic vessels, and along the shores, with smaller vessels. The collected data regards both biotic and abiotic features of the environment, and also socio-economic issues. The patterns and processes of connectivity among different areas are critical for the establishment of networks of MPAs, being measured with a series of descriptors ranging from physical oceanography to propagule dispersal, species distribution and genetic similarities among populations. OWF problems were nested into ecological problems, with attempts of considering how to reconcile the presence of MPA with that of OWF. The main goal of working together is the abatement of the

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conceptual compartments hindering the dialogue among disparate disciplines and sub disciplines. The Pilot Projects proved instrumental for this objective. The outreach activities of the project got wide coverage from the media. CoCoNet promoted transnational collaboration through the sharing of infrastructures, data, ideas, and people. The project has strong links with FP7 projects such as VECTORS and PERSEUS, further widening the network of collaborations. With 'The Ocean of Tomorrow' projects the EU is a powerful glue that will have long-lasting effects on the scientific development of the area.

The most stringent objective of this project is to synthesize disparate pieces of knowledge, so as to create a unitary vision of the manifold aspects involved in environmental management and conservation. Workshops and summer schools are promoting dialogue across disciplines, producing state of the art accounts on the various aspects of our research, treasuring the results of previous EU projects. The common fieldwork carried out in the Pilot Projects will test previously elaborated hypotheses, with the use of large oceanographic vessels and of smaller boats for coastal research. The various layers of information are being organized in a single GIS (Geographic Information System) database: the factual platform on which the guidelines

### Partners:

Italy (Coordinator), Belgium, France, Spain, Denmark, Romania, Greece, Bulgaria, Montenegro, Ukraine, Tunisia, Israel, Morocco, Turkey, United Kingdom, Georgia, Norway, Russia, Malta, Germany, Croatia, Albania

for the establishment of networks of MPAs and of OWF will be produced.

### CoCoNet European Added Value

CoCoNet involves important EU and non-EU countries in a strategic scientific and management enterprise promoting a shared vision that will enhance collaboration and capacity building initiatives throughout the Southern European Seas. Only the pooling of many scientific communities can warrant results in such a complex domain. The results of previous EU projects will be used, along with new information, providing knowledge-based guidelines on environmental protection and clean energy production, two stringent priorities of EU policies. The CoCoNet Consortium comprises hundreds of marine scientists that will be available for similar initiatives of Community interest. The creation of a database and the improvement of research facilities will foster transnational collaboration.

Project N°287844	Topic: FP7-OCEAN-2011-4: MPAs and wind potential in the Mediterranean and Black Sea	EU contribution: € 9,000,000	Duration: 48 months	From: February 2012
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## FP7-OCEAN-2012<sup>10</sup>

Following the two previous ‘The Ocean of Tomorrow’ cross-thematic calls, several topics have been launched with ‘The Ocean of Tomorrow 2012’ initiative to support the implementation of the Marine Strategy Framework Directive (2008/56/C). Cooperation involved Theme 2 ‘Food, Agriculture, Fisheries and Biotechnology’ (FAFB), Theme 5 ‘Energy’, Theme 6 ‘Environment (including Climate Change)’ and Theme 7 ‘Transport (including Aeronautics)’. The focus is on research gaps about the definition and monitoring of the ‘Good Environmental Status’ (GES) of EU waters, to be achieved by 2020. Nine coordinated topics were launched in order to address a wide range of marine related issues relevant to several descriptors of the Marine Strategy Framework Directive<sup>11</sup>. As a result, 10 projects<sup>12</sup> have been selected for funding for an EU contribution of almost 44M€.

10 [http://ec.europa.eu/research/agriculture/ocean2012/index\\_en.html](http://ec.europa.eu/research/agriculture/ocean2012/index_en.html)

11 <http://ec.europa.eu/environment/water/marine/ges.htm>

12 [http://ec.europa.eu/research/bioeconomy/fish/research/ocean/ocean\\_tomorrow\\_2012\\_en.htm](http://ec.europa.eu/research/bioeconomy/fish/research/ocean/ocean_tomorrow_2012_en.htm)







## AquaTrace:

The development of tools for tracing and evaluating the genetic impact of fish from aquaculture

[www.aquatrace.eu](http://www.aquatrace.eu)

*Escapes or releases of domesticated aquaculture fish pose a potential risk of adverse effects on native fish gene pools. In order to assure a prosperous and sustainable future for European aquaculture, the development of tools for identifying wild and farmed fish, interbreeding between them and effects on key fitness traits (survival and reproduction) is essential. AquaTrace will develop innovative molecular genetic tools, which will vastly improve the ability for tracing farmed fish in the wild and for documentation of their potential effects on wild conspecifics. The project will also contribute to environmental protection under the Marine Strategy Framework Directive (MSFD) with focus on biological diversity and non-indigenous species.*

The rationale behind AquaTrace is to develop reliable and cost-effective molecular tools for the identification of the genetic origin of both wild and farmed fish (genetic traceability), as well as for the detection of interbreeding between farmed and wild stocks. This work will be carried out on three marine fishes of economic significance and with growing aquaculture activities, the European sea bass, gilt-head sea bream and turbot. Until now, samples of fish have been collected across their

native distribution areas and from the majority of the main farms across Europe. Controlled experiments are ongoing with farmed and wild Atlantic salmon and brown trout in order to address the expected magnitude of effects of interbreeding of farmed fish on wild conspecifics. Such experiments serve to examine links between key fitness and life-history differences and specific functional genetic differences at the DNA level. AquaTrace scientific objective is to address and assess the genetic impact of

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aquaculture escapees. Such non-indigenous fish can potentially introduce genes to wild populations that have been undergoing adaptation to farmed conditions through breeding and domestication selection. The methods and aims developed in the project also contribute to general knowledge on adaptation to local environmental conditions in wild populations, and thus also apply in a restocking context. It is further essential that the tools under development are validated to internationally recognized forensic standards to allow uptake by end-users. The application of tools for monitoring and mitigation must be seen as being supportive to the industry. It represents one of the many approaches that should be used to secure growth, economic prosperity and social acceptance. Similarly, traceability of products has become a specific request of consumers, sustained by national and European policies. Here, genetic tools offer cost-effective strategies for supporting quality plans, enforceable by law where required, aimed at tracing and monitoring the origin of aquaculture products.

The project is using cutting-edge genomic methods for developing thousands of SNP (Single Nucleotide Polymorphisms) genetic markers for the marine species and will start to apply these markers to baseline samples of wild and aquaculture fish. Subsequently, small, specific, powerful and cost effective SNP panels for

### Partners:

Denmark (Coordinator), United Kingdom, Spain, France, Italy, Belgium, Norway, Israel, Turkey, Greece

determining the origin of the fish are developed as end-user traceability tools. Already developed large SNP panels for salmon and trout are now being applied to these species maintained under controlled experimental conditions, allowing identification of the genetic background of the fitness effects of domestication and interbreeding.

### AquaTrace European Added Value

This project addresses the common challenge to develop sustainable aquaculture across Europe through improved competitiveness and environmentally-friendly production. This project benefits from the collective cutting-edge expertise and infrastructures of research institutions and aquaculture industry across Europe. The outcome of the project will be made available through a common database allowing researchers, the industry, policy makers and the European consumer a long term benefit. Overall the project will support the development of sustainable European aquaculture and contribute to achievement of the 'Good Environmental Status' (GES) as requested under the MSFD.

Project N° 311920	Topic: FP7-KBBE.2012.1.2-12: Molecular tools for assessing and monitoring the potential genetic impact of aquaculture on native populations	EU contribution: € 2,999,184	Duration: 48 months	From: November 2012
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## AQUO:

Achieve QUIeter Oceans by shipping noise footprint reduction

[www.aquo.eu](http://www.aquo.eu)

*AQUO project is developed in the context of the Marine Strategy Framework Directive (MSFD) adopted in 2008 by the European Union, in order to contribute to marine environmental protection. Recent researches outline the need to mitigate underwater noise footprint due to shipping, to prevent adverse effects to marine life. In this context, the project is expected to achieve important scientific and technical advances, and to bring significant impacts by providing policy makers with practical solutions.*

AQUO project will propose solutions regarding ship design, including propeller and cavitation noise, and solutions related to shipping control and regulation. Main objectives are the following:

- develop and validate a shipping underwater noise footprint assessment tool related to AIS (Automatic Identification System) data,
- improve and/or validate models and methods to predict radiated noise from ship propellers, taking into account cavitation phenomena and interaction effects,
- propose a standard for ship underwater radiated noise measurement method,
- develop new vibro-acoustic measurements tools and methods applied to real experiments at sea,
- establish criteria and good practices for noise protection on marine life, based on analysis of available data and specific bio-acoustic experiments on representative marine species,
- establish a list of design improvement solutions to reduce ship underwater radiated noise, without reducing fuel efficiency of the ship,
- establish practical guidelines to reduce shipping noise for a quieter ocean, providing responses to the needs of policy makers.

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Most technical results will be available to general public through the publication of reports, the website and the scientific community. Wide dissemination of results will be done through technical reports, scientific papers, and a dedicated conference on ship vibro-acoustics and impact on marine life. In addition, links are being established with stakeholders in the maritime sector (e.g. shipyards, ship owners, end users) in order to discuss the research results and their applicability. The project is expected to have a large impact on design guidelines for new ships and on ship traffic control.

The project is supported by different methods and tools, which will be used to assess the effectiveness of noise mitigation measures in order to select the most appropriate ones. For example, we can outline the underwater noise footprint assessment tool derived from an existing operational system, connectable with AIS shipping data and able to run in real time, dedicated bio-acoustic studies conducted on different marine species in order to derive criteria regarding shipping underwater noise acceptable limits, and experiments at sea on different ships, including

### Partners:

France (Coordinator), Spain, Italy, Sweden, United Kingdom, Poland, The Netherlands, Belgium

commercial vessels. AQUO will closely cooperate with the SONIC project, which will adopt a complementary approach on cavitation noise.

### AQUO European Added Value

The AQUO project consortium is a well-balanced team composed of ship industry, specialized small companies, a classification society, research centres and academics. Eight European countries are represented. It should be also noted that noise mitigation measures that could apply to a given European maritime area have to be defined at European level. The team includes a large panel of specialists covering the different technical topics to address, allowing a multi-disciplinary approach. Running the project at European level allows to share the research effort at a larger scale and to merge the partner's expertise with a good completeness that could not be reached at national level.

Project N° 314227	Topic:FP7-SST.2012.1.1-1: Assessment and mitigation of noise impacts of the maritime transport on the marine Environment	EU contribution: € 2,999,571	Duration: 36 months	From: October 2012
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## BENTHIS:

### Benthic Ecosystem Fisheries Impact Study

[www.benthis.eu/en/benthis.htm](http://www.benthis.eu/en/benthis.htm)

*The sea bed provides a place to live for a wide diversity of plants and animals. Fisheries negatively impact these benthic ecosystems, for instance by reducing biodiversity, sea bed integrity, food for bottom dwelling fish and fisheries yield. BENTHIS will provide the science base to assess the impact of current fishing practices and, in collaboration with the industry, develop innovative fishing technology and management scenarios to mitigate the adverse impacts. In this respect it also contributes to the objective of the Marine Strategy Framework Directive (MSFD) to achieve a Good Environmental Status of marine EU waters by 2020, especially regarding biological diversity and seafloor integrity.*

To support an integrated approach to the management of human activities in the marine environment, in particular fishing, as required in the Common Fisheries Policy and the Marine Strategy Framework Directive, there is a need to develop quantitative tools to assess the impact of fisheries on the benthic ecosystem. BENTHIS will provide this knowledge. It will study the vulnerability of different benthic ecosystems in European waters and analyse the physical impact of the current fishing practices on benthic organisms and geo-chemical processes. In

collaboration with the fishing industry, options to mitigate the adverse impact will be reviewed and sea trials will be conducted to study the performance of technological innovations in the five major European seas (Baltic, North Sea, Western waters, Mediterranean and Black Sea). Fisheries studied comprise flatfish and shrimp fisheries with beam trawls, nephrops and roundfish fisheries with otter trawls, and shellfish fisheries with dredges. Finally, new management approaches will be developed in direct collaboration with the fishing industry and

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other stakeholders and tested on their effects on the ecosystem and the socio-economic consequences. BENTHIS will inform managers about the benthic habitats that are impacted the most and about the fishing gears that have the biggest effects and provide information on options to mitigate the adverse impacts.

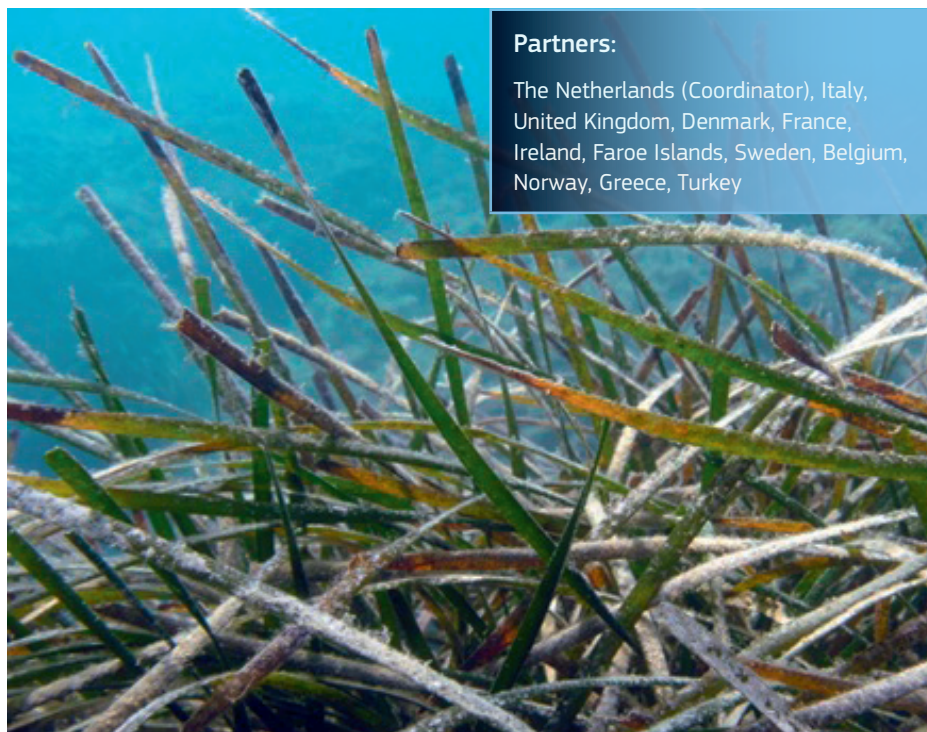
The project follows a multi-disciplinary approach with strong stakeholder involvement. Sea trials will be conducted with innovative fishing gears such as pelagic otter boards and pulse trawls. Generic tools will be developed to assess the impact of fishing gears based on the physical characteristics of the gear and the morphological and life history characteristics of the benthic organisms. Bio-economic models will be

developed to quantify the effect of mitigation measures on the socio-economy of the fishing sector. The models will allow an integrated assessment of both the ecology and the socio-economic consequences.

### BENTHIS European Added Value

Bottom trawl fisheries are a critical source of highly valued fish products and provide employment to coastal regions all over Europe. Mitigation of the adverse effects of these fisheries on the ecosystem will contribute to the sustainability of the European fishing sector. The project will stimulate innovations supporting a 'green fishing technology' and contribute to the implementation of an ecosystem-based approach to fisheries management.

Project N° 312088	Topic: FP7-KBBE.2012.1.2-9: Integrating the role of marine benthic ecosystems in fisheries management	EU contribution: € 5,994,250	Duration: 60 months	From: October 2012
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#### Partners:

The Netherlands (Coordinator), Italy, United Kingdom, Denmark, France, Ireland, Faroe Islands, Sweden, Belgium, Norway, Greece, Turkey



## BIOCLEAN:

New BIOTEchnologiCaL approaches for biodegrading and promoting the environmEntal biotrAnsformation of syNthetic polymeric materials

[www.biocleanproject.eu](http://www.biocleanproject.eu)

*The worldwide and EU production of plastics obtained from fossil resources is about 230 and 70 mil ton/y, respectively. About 45% of plastic waste is currently disposed of in landfills, where it undergoes (photo)degradation with the production of small fragments which enter the marine environment, where they can exert adverse effects. Innovative eco-efficient solutions to degrade/detoxify plastics accumulated in landfills, persisting in composting facilities and in aquatic environments are sought.*

BIOCLEAN aims at developing innovative, eco-efficient pilot-scale and/or field validated biotechnological solutions for degrading (and valorising) plastic wastes in terrestrial and aquatic environments. Waste plastics from landfills, composting facilities, anaerobic digesters and marine environments have been collected and characterized, and are being used as source for the isolation of novel, robust naturally-occurring plastic-degrading mixed and pure cultures. The obtained cultures, together with strains from public culture collections and enzymes, are being tested for their ability to degrade virgin and/or physical/chemical-treated polyethylene

(PE), polypropylene (PP), polyvinyl chloride (PVC) and polystyrene (PS) plastics. The cultures that will show biodegradation activity will be characterized and then exploited in bio-augmentation/biostimulation strategies for enhancing biodegradation of plastic wastes. The processes and strategies developed at the pilot scale will be assessed for their effectiveness and economical sustainability, validated via field trials and preliminary exploited in the formulation of measures for mitigating plastic pollution in the Aegean Sea as a case study. These new processes and solutions would remarkably contribute to a) the eco-efficient safe disposal of

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plastic waste currently accumulating in landfills, b) intensify the mineralization of those entering terrestrial waste treating facilities and aquatic environments and c) support the EU Member States to take the necessary measures to achieve or maintain Good Environmental Status in the marine environment by the year 2020, according to the Marine Strategy Framework Directive (MSFD). The novel pilot and field-scale validated treatments and strategies as well as the microbes/enzymes obtained and characterized in the project can deserve patenting and dedicated market opportunities.

BIOCLEAN includes 18 partners from 9 different EU Countries and 1 from China. The Consortium includes Universities (6), Research Institutes (4), SMEs (7), a multimunicipality and the Association of European plastic producers (PlasticsEurope). Such a membership was formulated to encompass the broad range of complementary RTD expertise and facilities required (that no single Member State could have provided) and to promote the establishment of a common scientific background, methods and measures in the sector of save plastic disposal and marine litter.

**Partners:**

Italy (Coordinator), Greece, China, Germany, Czech Republic, Norway, Belgium, France, Switzerland, Poland

**BIOCLEAN European Added Value**

BIOCLEAN would result in innovative eco-efficient processes and strategies able to improve the environmental status of the EU aquatic environments with regard to marine litter by in turn mitigating the current environmental impact of the plastic sector thus allowing its gradual transition towards the scenario in which the EU market will mainly consist of fully recyclable and biobased/biodegradable plastics. The project would also result in novel and shared monitoring tools and mitigation measures necessary for better addressing MSFD requirements regarding the achievement and maintaining Good Environmental Status in the marine environment. With its focus on plastics, BIOCLEAN is complementary to the CLEANSEA project addressing the issue of marine litter. Both are funded under 'The Ocean of Tomorrow 2012' coordinated initiative.

Project N° 312100	Topic: FP7-KBBE.2012.3.5-2: Biotechnological solutions for the degradation of synthetic polymeric materials	EU contribution: € 2,995,988	Duration: 36 months	From: September 2012
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## CleanSea:

Towards a Clean, Litter-Free European Marine Environment through Scientific Evidence, Innovative Tools and Good Governance

[www.cleansea-project.eu](http://www.cleansea-project.eu)

*Marine litter is widely recognized as a threat to Europe's marine ecosystems. It is a major societal challenge because it impacts the vast natural marine capital that supports economies, societies and individual well-being. Political and public awareness about marine litter has been increasing over the last few years. Marine litter is identified as a descriptor for determining Good Environmental Status (GES) under the Marine Strategy Framework Directive (MSFD). Europe aims to achieve GES by 2020 and CleanSea – the first ever framework program research project dedicated to marine litter – will provide key scientific knowledge and tools for marine litter action plans.*

The CleanSea project will i) provide a comprehensive characterization and analysis of the marine litter problem (biological, chemical, social, economic, legislative and policy-oriented) in the EU's four marine regions, ii) propose innovative monitoring tools and standard protocols to facilitate monitoring marine litter in a harmonized way, and iii) present management measures and policy options to meet MSFD and other international objectives regarding marine litter. Outreach activities (e.g. documentary film) are designed to maximize the project's impact,

transparency and relevance in addressing the marine litter issue. The project's unique combination of disciplines will provide key input into a European roadmap for marine litter reduction. Results will be made available to Member States in order to be applied in their MSFD implementation planning and goals. Project outcomes will benefit the MSFD, but important links also exist with the Thematic Strategy on the Prevention and Recycling of Waste, the Waste Framework Directive, the Common Fisheries Policy, the Water Framework Directive and the

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EU-funded Horizon 2020 Capacity Building/ Mediterranean Environment Programme. Management measures and strategies highlighted in CleanSea may also contribute to the 'Europe 2020' related Flagship initiative on 'Resource Efficiency'. Measures and policies that promote upstream sustainable production and use of plastics or recycling of waste that will be highlighted in the Road map are also relevant in this context. In that sense, CleanSea is complementary to the BIOCLEAN project funded under 'The Ocean of Tomorrow 2012' coordinated initiative. The promising tools being developed by SMEs in CleanSea can be available for MSFD monitoring and future research.

With a Consortium diverse in expertise and experience, CleanSea aims to break down interdisciplinary barriers by synthesizing data and knowledge generated across its 5 RTD work packages. Advanced techniques in the fields of (eco)toxicology, analytical chemistry, satellite imaging, engineering, oceanographic modelling and materials biodegradation testing will be used to assess the distribution, fate and impacts of marine litter. The participatory approach, policy analysis, ecosystem services mapping and economic policy instruments evaluation will be applied to identify financial, social and governance barriers to GES – and to recommend effective policy options and management measures to remove these barriers. Researchers interact via the CleanSea Stakeholder Platform and are well-represented at marine litter and

### Partners:

The Netherlands (Coordinator), United Kingdom, Spain, Belgium, Bulgaria, Sweden, Greece, Norway, Romania, Denmark, Germany

waste conferences worldwide as well in the European Commission's Technical Subgroup on Marine Litter.

### CleanSea European Added Value

With this project, the European Union firmly establishes itself as a serious and committed contributor to marine litter research worldwide. No other country or group of countries has funded a marine litter research project of this kind before. Combining scientific groups from 11 European countries in the 4 marine regions will provide a clear European added value. Exchange of scientists and technical staff will stimulate further cooperation and demonstrate Europe's capacity to approach a complex problem from multiple perspectives. CleanSea also contributes to an ecosystem approach to the management of human activities in EU marine regions. In addition, we expect some of the protocols and tools to be implemented on a larger scale, generating additional projects and business for SMEs, participating in CleanSea. The innovation foreseen will help to build and enhance European leadership in marine litter monitoring and remediation.

Project N° 308370	Topic: FP7-ENV.2012.6.2-4: Management and potential impacts of litter in the marine and coastal environment	EU contribution: € 2,986,571	Duration: 36 months	From: January 2013
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## DEVOTES:

DEvelopment Of innovative Tools for understanding marine biodiversity and assessing good Environmental Status

[www.devotes-project.eu](http://www.devotes-project.eu)

*The Marine Strategy Framework Directive (MSFD) requires EU Member States to take measures to achieve Good Environmental Status (GES) in the marine environment by 2020. DEVOTES is developing tools to understand and describe biodiversity, food-webs and seafloor integrity status at an European scale, including as many components of the ecosystem as possible, providing the scientific knowledge, upon which appropriate monitoring and management strategies under the new directive can be designed and made available for managers.*

There are five key objectives: (i) Improve our understanding of the impact of human activities and climate change on marine biodiversity; (ii) Test the relevant selected indicators and develop new, innovative ones to assess biodiversity; (iii) Develop, test and validate innovative integrative modelling and monitoring tools to improve our understanding of ecosystem and biodiversity changes, applying both traditional sampling and innovative data acquisition devices; (iv) Implement cost-effective indicators, monitoring and assessment strategies; and (v) Propose and disseminate strategies

and measures for ecosystems' adaptive management. During the first part of the project, we have: (i) analysed the legislation barriers preventing to achieve the GES (ii) collated and analysed information on most promising indicators, monitoring networks and modelling tools; (iii) deployed new devices for benthic metagenetic analyses (iv) participated in the Ocean Sampling Day; and (v) proposed a new operational definition of Good Environmental Status. The advantages of the resulting technologies, compared to those presently available, will be EU harmonised methodologies and

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internationally consistent application across regional seas. The exploitation plan includes the use of results of DEVOTES for scientific (i.e. understanding of biodiversity responses to pressures and climate change), technological (e.g. monitoring tools, software), commercial (i.e. potential uses of the findings), but also for societal (i.e. societal participation in marine conservation), and regulatory (i.e. new coherent management tools for the MSFD) purposes. DEVOTES is preparing new PhD researchers, as this new piece of legislation is challenging for marine scientists and managers requiring well-trained staff. DEVOTES has led 3 sessions in international conferences, 2 summer schools, more than 10 publications and scientists contributed with over 50 presentations in international conferences.

DEVOTES covers the 4 EU Regional Seas, with 8 case studies which focus primarily on biodiversity, which is one of the qualitative descriptors identified in the MSFD to characterize the Good Environmental Status. It also considers food-webs and seafloor integrity descriptors where they relate to the impacts of human activities and climatic influences on biodiversity. The project utilizes existing databases and new data from national networks. Innovative

**Partners:**

Spain (Coordinator), United Kingdom, Turkey, Finland, Greece, Germany, Bulgaria, Italy, Belgium, Latvia, Portugal, Norway, The Netherlands, Saudi Arabia, Ukraine, Denmark, France

tools (e.g. remote sensing, ecological modelling, metagenetics), together with socio-economic approaches (cost-based assessment) and integrative tools are being used.

**DEVOTES European Added Value**

Member States should assess the Good Environmental Status of their shared regional seas as part of the MSFD. The added value of DEVOTES primarily consists in a European concerted research effort to reach this goal. DEVOTES will provide integrative, harmonized and validated tools and indicators able to be used across EU. Non-EU countries (Ukraine, USA, Canada, and Saudi Arabia) are also involved, giving to the EU a lead role. DEVOTES is highly relevant to many EU policies: MSFD, Water Framework Directive, Habitats Directive, Maritime Spatial Planning, Integrated Coastal Zone Management, Integrated Maritime Policy, Common Fisheries Policy, and Biodiversity Strategy 2020.

Project N° 308392	Topic: FP7-ENV.2012.6.2-3: Innovative Tools for Understanding and Integrated Assessment of Good Environmental Status (GES) of Marine Waters	EU contribution: € 8,997,984	Duration: 48 months	From: November 2012
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## ECsafeSEAFOOD:

Priority environmental contaminants in seafood: safety assessment, impact and public perception

[www.ecsafeseafood.eu](http://www.ecsafeseafood.eu)

*Despite seafood is a high quality, healthy and safe food item, some seafood can accumulate environmental chemical contaminants with impact on human health. Limited information is available for chemical contaminants for which no legislation or limits set by seafood authorities exist. In order to increase seafood safety to consumers, ECsafeSEAFOOD aims to assess safety issues related to non-regulated priority chemical contaminants and evaluate their impact on public health (including endocrine disruptors, pharmaceutical and personal care products, metal species, biotoxins from harmful algal blooms, marine litter and associated chemicals). The project is relevant for the Marine Strategy Framework Directive (MSFD) and especially for the aspects regarding contaminants in fish and seafood which will be useful to determine the Good Environmental Status of EU waters.*

The ECsafeSEAFOOD project contributes to the necessary baseline for the presence of non-regulated environmental contaminants in seafood, prioritizes those that are real hazards for human health, and improves knowledge on the transfer of relevant contaminants between the environment and seafood, taking into account the effect of climate change. The project is working on an online database that will incorporate the available information about contaminants level in seafood and toxicity. In parallel, seafood is being collected in five hot spot areas across Europe for

quantification of contaminants. Also, a European online survey has been finalized to understand consumer behaviour and choices. The toxicological characterization of seafood contaminants is performed in realistic conditions using cell lines and zebrafish embryos. Such information is crucial to accomplish accurate risk assessment and measure the potential impact of seafood contaminants on public health using in-depth probabilistic exposure tools. The project has started to develop new detection tools (using immunochemical assays and sensors) designed

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to enable the easier and faster assessment of the presence of environmental contaminants in seafood products. At last, simulated conditions were created to assess links between the level of contaminants in the environment and that in seafood taking into account the effect of climate changes. Concerning dissemination activities, the project has already identified the most relevant European stakeholders to share the results that will be obtained in the project, including risk managers, in order to reduce public health risks from seafood consumption. The new information will enable to refine or establish Maximum Reference Levels in seafood for contaminants that are real hazards and for which no legislation exists or information is still insufficient.

ECsafeSEAFOOD addresses its objectives following multi-disciplinary approaches: quantification of contaminants in seafood from different European areas and a European online consumer survey to collect baseline information. Relevant information about priority contaminants available in literature and national

monitoring programmes has been gathered in an online database. Contaminants toxicology is being studied in realistic conditions with human cell lines and zebrafish embryos.

## ECsafeSEAFOOD European Added Value

ECsafeSEAFOOD will have several tangible impacts: (i) the new detection tools will increase European competitiveness and innovation of food-producing SMEs; (ii) offering safe and high quality seafood to consumers; (iii) positive economic effects as a result of increasing seafood consumption; (iv) scientific breakthroughs including monitoring of non-regulated chemical contaminants, risk assessment, toxicity, links between contaminants in the environment and that in seafood, effect of climate changes; and (v) societal impacts: improving education, increasing employment, improving nutrition and increasing the sustainability of an important food sector. EU funding ensures that capabilities are pooled and results are validated and disseminated throughout Europe and beyond.

Project N° 311820	Topic: FP7-KBBE.2012.2.4-1: Contaminants in seafood and their impact on public health	EU contribution: € 3,999,874	Duration: 48 months	From: February 2013
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### Partners:

Portugal (Coordinator), Spain, Slovenia, Belgium, Norway, Denmark, The Netherlands, Italy, Ireland, France





## KILL•SPILL:

### Integrated Biotechnological Solutions for Combating Marine Oil Spills

[www.killspill.eu](http://www.killspill.eu)

*Oil spill disasters are a worldwide problem and current technologies do not satisfactorily address the issue. It is important to recognize that 'miracle microorganisms' and 'magic elixirs' sprinkled on an oil spill will not do the job. An integrated approach considering at the same time: (1) metabolic requirements of biodegrading organisms alongside the properties of the oil, (2) environmental limitations on oil biodegradation and (3) innovative delivery mechanisms for agents that alleviate these bottlenecks is critical. This is the essence of the Kill•Spill project. It represents a European initiative fully committed to tackle oil spill disasters in an integrated and interdisciplinary fashion employing highly efficient remediation strategies.*

The principal objective of Kill•Spill is to develop highly efficient, economically and environmentally viable solutions for the clean-up of oil spills caused by maritime transport or offshore oil exploration and related processes, which have been fully validated in large mesocosm facilities under controlled conditions and by application to real life oil spills.

In general, once crude oil is spilled, it takes at least one week before biodegradation

processes begin to take effect. Kill•Spill aims to shorten this start-up period to the absolute minimum by providing technologies for example, that provide the necessary nutrients together with hydrocarbon degrading consortia and/or enhancing compounds (biosurfactants) to both accelerate and maximize bioremediation rates from the time of application. In addition, when the use of dispersants is recommended, the previously mentioned biostimulation and bioaugmentation formulations will

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be applied together with specific compounds acting as dispersants that take the oil from the surface to the water column and ultimately to the sea floor. Taking into account that as we go deeper in the water column, the amount of dissolved oxygen is more difficult to replenish by diffusion, Kill-Spill also offers specific novel technologies (Oxygel™ and Aerobeads™) that release oxygen over longer periods of time. As a result, it maintains greater bioremediation rates of dispersed oil in the water column, even when it reaches the sediments. In cases where it is not feasible, this approach will be complemented with the development of processes to stimulate oil biodegradation anaerobically in anoxic sediments. Once the dispersed oil reaches the sediments, bioremediation rates are substantially reduced due to the prevailing anoxic conditions. Kill-Spill provides a series of highly innovative technologies (e.g., 'Kill-Spill snorkel', 'Kill-Spill Robot', 'Kill-Spill Sed-Cleaner') that overcome this problem and induce enhanced biodegradation rates in the sediments. These technologies can also be used for the remediation of recurrently polluted sediments (from old oil spills) in all types of environments from the Eastern Mediterranean to Disko Bay in Greenland. In addition, several other innovative products will be developed, e.g. 'Kill-Spill All-in-One', 'Kill-Spill Deep-sea', 'Kill-Spill Bio-boom', besides the 'Kill-Spill Biosensor' for in-situ monitoring of oil degradation.

A toolbox of highly innovative (bio)technologies will be developed and made readily available to all emergency response personnel subject to final approval by the European Marine Safety

### Partners:

Greece (Coordinator), Switzerland, Italy, United Kingdom, Denmark, Spain, Belgium, Czech Republic, Germany, Ireland, Norway, Slovenia, United States

Agency and related Member State agencies. An important aspect of the Kill-Spill project is the field testing of the developed technologies in actual oil spills that will occur in Eastern Mediterranean Sea and in North/Norwegian Sea over the next 4 years. Kill-Spill has secured the partnership of two SMEs whose primary business is the emergency response for combating oil spills in both marine regions.

### Kill-Spill European Added Value

The Kill-Spill project involves 14 SMEs active in complementary areas, contributing to the development of innovative and integrated solutions and tailored strategies for the oil spill cleanup market. Thus, Kill-Spill consortium will generate new industrially driven foreground and deliver innovative processes and services to policy makers and European citizens. The Kill-Spill project has also much to offer to the Marine Strategy Framework Directive (MSFD). For example, all the technologies developed for hydrocarbon polluted sediments can be part of the mitigation measures to return marine environments to Good Environmental Status (GES). Furthermore, the monitoring tools can be used by Member States in their requested initial assessment to identify current environmental status. Moreover, many of the Kill-Spill biostimulation strategies can be applied to sea areas faced with chronic pollution.

Project N° 312139	Topic: FP7-KBBE.2012.3.5-1: Innovative biotechnologies for tackling oil spill disasters	EU contribution: € 8,996,599	Duration: 48 months	From: January 2013
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## SONIC:

### Suppression Of underwater Noise Induced by Cavitation

[www.sonic-project.eu](http://www.sonic-project.eu)

*With the steady growth of shipping activities over the last decades, underwater noise is increasing. It may be hindering sea mammals, or may even be harmful to them. Underwater noise is a European concern and is identified as a qualitative descriptor for determining the Good Environmental Status under the Marine Strategy Framework Directive. The main sources of noise are the ships' propellers, especially if the flow around the propellers is cavitating. Most propellers are cavitating when the ship is sailing at its designed speed. The surge for more fuel-efficient propellers is increasing cavitation. Therefore the dilemma is the following: less CO<sub>2</sub> emissions into the air yields more noise emissions under water.*

The first goal of the project is to enhance the understanding of radiated noise from ships. From earlier studies, it is known that the kind of noise generated far away from the ship can vary according to the form of cavitation. Based on this knowledge, the project aims to improve computational and measurement techniques used in the design of a ship. Numerical tools are extended and tuned to correctly predict the noise level; measurement techniques in model basins and cavitation tunnels are calibrated to correct noise measurement for the reflection

of noise from the walls of the facilities. Both the numerical and experimental tools need to be validated for the frequency ranges that are most harmful to sea mammals. Once a ship is designed, it is critical to establish the actual noise level with a trial. Such trials are usually conducted at ballast conditions, for which cavitation is absent. Noise measurements, therefore, need to be performed during service of the ship with the minimum possible hindrance to the economical operation of the ship. New techniques will be tested to measure the noise

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generated by the propeller on-board the ship. Another technique is to measure the noise off-board with buoys or sound arrays. Both techniques will be compared in order to obtain a reliable and cheap measurement procedure. With data available on the noise level of ships, it becomes possible to estimate underwater noise given the actual shipping activity. Using AIS (Automatic Identification System) data, the project will develop a technique for mapping underwater noise in the North Sea. This map can be used by authorities to manage shipping or to study the influence of mitigation measures.

The project will use model basins to study the noise emission from ships in design stage. Full-scale measurements at sea will be performed to establish accurately the noise of several ships, but also to determine long-term noise profiles of seas. All measurements will be fed into a database which will be made available to ship designers outside the project. The project will finally use computational tools to predict the noise in a given sea for a longer period, showing the hinder to sea mammals in a noise map.

### Partners:

The Netherlands (Coordinator), Italy, Germany, Spain, Sweden, United Kingdom, France

SONIC will closely cooperate with the AQUO project, which will adopt a complementary approach to study cavitation noise.

### SONIC European Added Value

The Member states of the EU have committed themselves to marine environmental protection. One of their commitments is to monitor and limit the level of noise in their respective seas. The project will enhance the knowledge on noise radiated from individual ships, and on noise in seas due to shipping. The consortium consists of all major propeller manufacturers and ship model basins in Europe. With the knowledge generated, the Member States will be able to take protective measures, like spatial planning of shipping, and recommend legislation to the International Maritime Organization (IMO).

Project N° 314394	Topic: FP7-SST.2012.1.1-1: Assessment and mitigation of noise impacts of the maritime transport on the marine Environment	EU contribution: € 2,999,972	Duration: 36 months	From: October 2012
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## STAGES:

Science and Technology Advancing Governance on Good Environmental Status

[www.stagesproject.eu](http://www.stagesproject.eu)

*EU Member States are required to implement measures to ensure their marine waters achieve Good Environmental Status (GES) by 2020. Defining what constitutes GES is challenging. Advances are being made in marine research that can underpin environmental assessments. The uptake of this knowledge is hindered by the lack of awareness of the current research effort and outputs; and the lack of an interface between science and policy. STAGES will work to directly address these gaps.*

STAGES has carried out a series of targeted support activities to develop additional scientific understanding for assessing GES and offer solutions to make this knowledge accessible, relevant and usable by policy-makers and stakeholders in the Member States affected.

- 1) The STAGES project has developed an inventory of relevant EU and national research projects and results relating to the Marine Strategy Framework Directive (MSFD), and will make this information widely accessible to policy-makers and MSFD stakeholders through the Marine

Knowledge Gate, a dynamic, searchable online portal. The STAGES consortium has performed a survey of more than 4,000 projects from EU and national funding programmes with relevance to MSFD by using an online questionnaire as main tool to collect knowledge. The in-depth analysis of the knowledge collected will inform the production of five State of the Art Synthesis Reports on major MSFD Themes: 1) Biodiversity; 2) Contaminants and Nutrients; 3) Disturbances; 4) Commercially exploited fish and 5) Hydrographical conditions.

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- 2) Areas with a need for further research were identified in a series of three Workshops aimed at identifying gaps and needs for further research in: Monitoring Programmes, Pressures and their impacts on marine ecosystems, and Socio economic analysis under the MSFD.
- 3) STAGES has also conducted a MSFD Stakeholders consultation to put forward a proposal for a long-term European science-policy platform to bridge the MSFD science-policy gap. Stakeholders were targeted that represented International, European, Regional and National levels across a wide cross-section of marine sectors. The results of the survey will be used to inform the organisation of a Stakeholders Workshop scheduled on 12 February 2014.

Through close engagement with DG Environment and MSFD stakeholders, STAGES has carried out a range of tasks to achieve its objectives. A comprehensive knowledge collection process was performed with the aim of building the inventory of MSFD-relevant research projects and knowledge outputs. Through scientific foresight

### Partners:

Spain (Coordinator), Portugal, France, Ireland, Denmark, Belgium, Norway

workshops, MSFD knowledge gaps were identified. Recommendations for a Science-Policy Interface (SPI) will be based on stakeholder consultation and assessment of existing structures, processes and global best practices.

### STAGES European Added Value

MSFD is the environmental pillar of the Integrated Maritime Policy (IMP) that provides, for the first time, a Europe-wide policy framework to holistically and sustainably manage human activities in EU territorial waters. It aims to support the continued development of a sustainable maritime economy in Europe, whilst protecting and restoring the environmental health of Europe's marine environments. To achieve this, multi-disciplinary and multi-stakeholder cooperation at a European level is needed. As part of 'The Ocean of Tomorrow' 2012 coordinated initiative, STAGES will contribute to this goal.

Project N° 308473	Topic: FP7-ENV.2012.6.2-5: Scientific knowledge base to support the implementation of the Marine Strategy Framework Directive	EU contribution: € 999,733	Duration: 24 months	From: September 2012
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## FP7-OCEAN-2013<sup>13</sup>

**'The Ocean of Tomorrow 2013'** was the third and last cross-thematic call of its kind under FP7. It involved Theme 2 'Food, Agriculture and Fisheries, and Biotechnology' (FAFB), Theme 4 'Nanosciences, Nanotechnologies, Materials and New Production Technologies' (NMP), Theme 5 'Energy', Theme 6 'Environment (including Climate Change)' and Theme 7 'Transport (including Aeronautics)'. The aim of the 'The Ocean of Tomorrow 2013' call is to pool the efforts of stakeholders from a broad range of sectors in order to develop innovative marine technologies for a wide range of applications. The call comprised 4 topics covering three key areas: marine sensing technologies (including biosensors) to monitor the marine environment, innovative antifouling materials for maritime applications and innovative transport and deployment systems for the offshore wind energy sector. As a result, 12 projects have been selected for funding for an EU contribution of almost 71,6M€. Most projects have just started or are about to start.

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13 <http://ec.europa.eu/research/index.cfm?lg=de&pg=newsalert&year=2012&na=na-060612>



## BRAAVOO:

### Biosensors, Reporters and Algal Autonomous Vessels for Ocean Operation

[www.braavoo.org](http://www.braavoo.org)

*As a result of multiple anthropogenic pressures there is a slow but steady degradation of the marine water quality, both chemically and biologically. One of the strategies of the EU for mitigating further degradation of the EU marine water quality is the effective detection and monitoring of chemical assaults, and of the well-being of marine living organisms. Biosensors are considered as an important tool to allow easier, real-time, in-situ, and cost-effective yet highly reliable measurements.*

The main goals of the BRAAVOO project are to develop three types of biosensors that can rapidly target a number of marine priority compounds or compound classes and can measure general toxicity:

- i) nano-immunosensors, detecting molecular interactions between antibodies and chemical substrates.
- ii) biosensors that consist of living bacteria that can be tuned to produce vivid colours in response to target chemicals.
- iii) algal sensors that are sensitive to 'anything' in the water that causes toxicity.

The second major goal of the project is to integrate the three biosensor types into automated modules, which (i) can be deployed as hand-held single-use instruments, e.g., on ships or by harbour authorities, (ii) will be integrated into a marine data buoy and (iii) an unmanned surveying vessel (USV) that will perform real-time on-site sampling, sample analysis and surveying. The biosensor units will be tested throughout the lifetime of the project and calibrated to state-of-the-art chemical analytics. This enhances the valorisation of intermediate project goals and developments. It will also allow iterative selection of the most promising development options before an actual autonomous



USV can be assembled and a prototype tested. In addition to the biosensors, the USV will also contain a number of 'off-the-shelf' physico-chemical sensors, and will be equipped with the latest telemetry options to allow remote control and data communication. All three biosensor types will be specifically developed and extensively tested with a number of prime marine priority pollutants. BRAAVOO will concentrate on and demonstrate 'the proof of concept' of automated real-time and in-situ detection by the biosensors in the buoy and USV of two toxic compounds frequently encountered in harsh marine environments: oil pollution and algal toxins. The expected impact is an easier and rapid way of on-line detection of chemical assaults in marine water, and secondly, a 'democratization' of analytics from specialized laboratories to users.

BRAAVOO uses a combination of biological micro-, optical and electrical engineering to develop the two major parts of its programme. The biological engineering will optimize bacterial and algal sensors for new chemical target specificities, and will find solutions to maintain living cells within microfluidic systems. The micro- and optical engineering will design the 'package' for the cells and antibodies systems and include the optical detectors for their readout. The electrical engineers will focus on the connections between the systems and their integration into

**Partners:**

Switzerland (Coordinator),  
The Netherlands, Spain, Italy, Germany,  
Israel, Ireland

independent modules, and autonomous vessels. Finally, chemists and marine biologists will validate the measurements made by the biosensors in real-life mesocosm settings.

**BRAAVOO European Added Value**

BRAAVOO with its focused R&D on priority compounds can positively contribute to the competitiveness of the European biosensor industry and exploitation of the biosensor market. The potential lost cost, simple operation, and successful demonstration of the added-value of biosensor sample analysis will enable further market introduction. The expertise in the area of nano-immunosensors, bacterial and algal bioreporters exploited in BRAAVOO is unique and is expected to have an impact on the potential competitive leadership of European industry in the field of biosensors. It builds on the experience of several previous framework projects. With a consortium made of 5 SMEs, 2 universities and 2 research organizations, the BRAAVOO consortium forms an excellent group to tackle research and development on the biosensor concepts, maintaining at the same time a strong market focus.

Project N° 614010	Topic: FP7-OCEAN-2013-1: Biosensors for real time monitoring	EU contribution: € 3,529,127	Duration: 36 months	From: December 2013
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## EnviGuard:

Development of a biosensor technology for environmental monitoring and disease prevention in aquaculture ensuring food safety

[www.EnviGuard.net](http://www.EnviGuard.net)

*EnviGuard is a response to the growing need for accurate real time monitoring of the seas/ocean and the aquaculture industries need for a reliable and cost-effective risk management tool. The implementation of the EnviGuard system will allow for early detection of harmful algae blooms (HAB), chemical contaminants, viruses and toxins thus preventing economic losses.*

The objective of EnviGuard is to develop a highly specific and precise in-situ measurement device for man-made chemical contaminants and biohazards (i.e. microorganisms and toxins from biological sources) which are currently hard to measure. The device to be developed under the project would be used as an early warning system for the European aquaculture sector and as an environmental monitoring tool to assess the Good Environmental Status (GES) of the sea. The modular EnviGuard system will be made up of three different sensor modules (microalgae / pathogens, i.e. viruses & bacteria / toxins & chemicals), that are connected to the common interface 'EnviGuard Port' which

collects and sends the information to a server. The data will be accessible through a website in real-time. The modularity of the system enables an individual setup for each purpose thus offering a tailor-made solution for each future client.

In summary the objectives of the project are:

- i) highly specific, precise and reliable in-situ measurements of biohazards and chemical contaminants in seawater with real-time results
- ii) multi-class, multi-analytic method for the simultaneous determination of harmful

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microalgae species, *Betanodavirus*, *E. coli*, okadaic acid, and saxitoxin, PCB 128 and PCB 118

- iii) automatic sampling in the marine environment
- iv) easy access to data from everywhere through internet database
- v) a modular system (of up to three sensors) integrated in a single, portable, durable device

EnviGuard will allow an easier, faster and cheaper way to measure harmful substances in-situ. Thus, it will provide a unique, competitive advantage and leadership to the European aquaculture industry.

In order to achieve EnviGuard's goals, the latest findings of nanotechnologies, genomics, molecular science, bio-receptors as well as material science and information technology are combined in the three biosensor modules and a common interface. For that reason it is necessary to have access to international expertise as there are no actors dealing with all these fields in one single country. Molecular probes, aptamers and antibodies are being used to detect the desired targets. The signalling works electrochemically and through optical label-free

**Partners:**

Germany (Coordinator), Spain, Belgium, France, The Netherlands, United Kingdom, Malta, Turkey, Israel

responses based on changes in reflectivity of nanostructured surfaces.

**EnviGuard European Added Value**

The biosensors to be developed in the project go far beyond the current state-of-the art in terms of accuracy, reliability and simplicity in operation by combining innovations in nanotechnology and molecular science leading to the development of cutting-edge sensor technology putting European research and highly innovative SMEs at the forefront of quickly developing markets. It will be more cost-efficient than current monitoring devices leading to a clear marketing advantage for the European analytical and research equipment industry. The objectives of the project are in accordance with current European policies like the Marine Strategy Framework Directive (MSFD), Directive 2010/75/EU regarding the Prevention and Control of Industrial Emissions and the Water Framework Directive whose environmental objectives must be met by 2015. In addition, arrays of biosensors could become critical to understand and predict the propagation of pathogens, which could bring valuable information for aquaculture planning, site selection and biosecurity control.

Project N° 614057	Topic: FP7-OCEAN-2013-1: Biosensors for real time monitoring	EU contribution: € 5,523,461	Duration: 60 months	From: December 2013
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## MariaBox:

### MARINE environmental in-situ Assessment and monitoring tool BOX

[www.mariabox.eu](http://www.mariabox.eu)

*Due to growing concerns about the health of the oceans and their capacity to continue to provide resources as well as associated risks to the human health, there is an increasing demand for real-time monitoring of the environmental status of marine water quality and the provision of early warning systems. Real-time in-situ monitoring of marine chemical contaminants (including man-made pollutants and algal toxins) is of utmost importance for the sustainable management and exploitation of the sea. MariaBox will develop a wireless, portable marine environment analysis device, based on novel biosensors of high-sensitivity, capable of repeating measurements over a long time for monitoring chemical and biological pollutants.*

The MariaBox project has 4 major steps. The first step refers to producing a marine pollution-monitoring device, based on new biosensors, implemented as a set of autonomous modules for the analysis of marine pollutants and the assessment of water quality. The system will be suitable for free floating devices, buoys, ships, or to be used as a portable instrument. Also, the project will develop novel biosensors for monitoring 5 man-made chemicals and 4 categories of microalga toxins. The

third step of development of MariaBox will be a software platform and smartphone application for the marine monitoring and Global Ocean Observing System (GOOS) and Global Earth Observation System of System (GEOSS) data collection and distribution so to be almost real-time available and interfaced to Global Monitoring for Environment and Security (GMES) services. Finally, MariaBox will prove the validity of the system in real and varying conditions in Norway, Cyprus, Ireland and Spain. The

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MariaBox platform will also provide technical tools in order to support the National implementations of the Discharge of dangerous substances directive and the Water Framework Directive that sets out 'Strategies against pollution of water'. MariaBox will additionally emphasise on reaching the general public and maximizing project impact: 45 minutes of video material will be developed for use in International Exhibitions and TV documentaries including Euronews Innovation Showcase. Multiple and sundry dissemination actions, involving presentations in 8 conferences, participation in 5 Trade Fairs, newsletters publication and social media actions are also foreseen in the work programme. Another key objective of MariaBox is to prepare a cost effective solution to be exploited commercially. The device design will be optimized in cost, size, and power consumption to offer a suitable solution for large-scale production by the SMEs.

The work plan has been structured to capitalize on the individual skills of the partners, which include: a) SMEs with expertise in mechanical and industrial design and manufacturing, sensors calibration, Geographic Information Systems (GIS) platforms, web and mobile applications development, electronics and communication systems design and marine monitoring systems integration, b) Universities, private companies

### Partners:

Cyprus (Coordinator), Spain, Ireland, United Kingdom, Italy, Norway

and research centres experts in biosensors and their development and finally c) End-users with access to demonstration sites. The participants in the project will therefore work together to form an integrated and committed partnership, and the consortium will provide the best possible combination of scientific and technological skills to execute the work plan.

### MariaBox European Added Value

MariaBox involves 13 partners from 6 European countries, with complementary expertise, that form a unique consortium capable of achieving the project objectives in an optimised way, maximising at the same time the project impact. The project foresees also the system demonstration in 4 countries at the 4 corners of European Borders (Ireland, Norway, Cyprus and Spain) thus covering a large number of different scenarios and providing clear European Added Value. The MariaBox consortium includes key EU industrial partners with a network of distributors in all continents around the globe and representation in more than 55 countries that will ensure the commercial success of MariaBox product and services.

Project N° 614088	Topic: FP7-OCEAN-2013-1: Biosensors for real time monitoring	EU contribution: € 5,434,221	Duration: 48 months	From: First semester of 2014
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## SEA-ON-A-CHIP:

Real time monitoring of SEA contaminants  
by an autonomous Lab-on-a-chip biosensor

[www.sea-on-a-chip.eu](http://www.sea-on-a-chip.eu)

*Chemical contamination of estuarine and coastal areas is a highly complex issue with negative implications for the environment, human health (through the food chain) and related coastal industries such as fisheries. To tackle such challenges, early warning systems that can provide extreme sensitivity with exquisite selectivity are required. SEA-ON-A-CHIP will develop a compact, autonomous and miniaturized analytical system based on a fully integrated array of micro/nano electrodes and a microfluidic system in a lab-on-a-chip configuration with electrochemical detection.*

The project will improve technology associated to immuno-sensors for marine pollution control (natural or anthropogenic) with a clear repercussion on related industries such as fisheries and aquaculture facilities. Recent technological developments in the miniaturisation of electronics and wireless communication technology have led to the emergence of Environmental Sensor Networks (ESN). These will greatly enhance monitoring of the natural environment and in some cases open up new techniques.

The platform will be developed for a concrete application in aquaculture facilities, including the rapid assessment of 8 selected contaminants from 5 groups of compounds that affect aquaculture production (compounds which are toxic, bioaccumulative, endocrine disruptors), but also affect environment and human health (antibiotics and pesticides). The system will be built in order to work with one-month autonomy and measuring in real time at least once per hour. The units will be tested throughout the lifetime of the project and calibrated

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to state-of-the-art of chemical analytics. With regards to energy, simple batteries will be used with small consumption of reagents and waste production.

In addition, the manufacturing process shall guarantee the cost-effective production of each device, permitting the deployment of multiple devices at a very low cost. SEA-on-a-CHIP will be validated using a step-by-step approach: first under laboratory conditions, second under simulated real conditions, and finally during 3 field experiments in the installation of 2 aquaculture SME facilities.

The last test phase will be performed in a way that will include dissemination of the findings with a clear view of commercializing the devices.

With a Consortium diverse in expertise and experience, SEA-on-a-CHIP aims to break down interdisciplinary barriers by synthesizing data and knowledge generated across its 7 RTD work packages. Three phases of development are planned. During the first phase, an early-prototype will be delivered, consisting of a platform with the basic technological requirements for the platform operation and a reduced number of

compounds to be sensed. In the second phase, a second improved prototype will be validated according to the previous scheme. In the third phase, the final prototype will include the ability to analyse the 8 compounds in duplicates and the final platform will be validated. A long-term case study will be carried out for testing the system, final adjustments, validating the analytical results of the functioning of the platform and dissemination activities.

### SEA-on-a-CHIP European Added Value

SEA-on-a-CHIP will contribute to increase the applicant SMEs' market share being attractive to local and national authorities, environmental and food agencies, public/private research institutes and laboratories working in the field of routine environmental monitoring and food safety. The platform will enable an early detection of contamination in aquaculture exploitations and coastal areas, in support of maritime industry, environmental and human health protection, as well as the implementation of the Marine Strategy Framework Directive. The objectives of SEA-on-a-CHIP can only be successfully achieved with input of a multi-disciplinary consortium with beneficiaries throughout Europe with a high level of expertise.

Project N° 614168	Topic: FP7-OCEAN-2013-1: Biosensors for real time monitoring	EU contribution: € 5,751,459	Duration: 42 months	From: December 2013
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#### Partners:

Spain (Coordinator), France, Italy, United Kingdom, Portugal, Romania, Sweden, Austria, Greece, Norway





## SMS:

Sensing toxicants in Marine waters makes Sense using biosensors

[www.sms-project.eu](http://www.sms-project.eu)

*The increasing demand by citizens and environmental organizations for the protection, preservation and possible restoration of the marine environment has made seawater protection one of the urgent priorities of the EU. At the same time, the Blue Growth Strategy aims to support the growth of maritime activities in a way that is compatible with environmental sustainability. The SMS project will promote the development of novel sensing devices for marine environmental protection. SMS is expected to have a major impact on marine water end-users and relevant stakeholders.*

SMS will deliver a novel automated networked system that will enable real-time in-situ monitoring of marine water chemical and ecological status in coastal areas by the detection of a series of contaminants. The pollutants specifically targeted by the project have been indicated as having priority for quality control of seawater. They cover a wide spectrum of regulated chemicals that have detrimental effects on the marine environment such as the algal toxins, the antifouling pesticides, flame retardants and pharmaceuticals that will be measured using innovative probes.

Commercially available sensors for measurement of temperature, pH, salinity, dissolved oxygen, nutrients and turbidity, will also be employed. They will contribute to gaining a better picture of the chemical and environmental status of the water tested and to draw conclusions about the environment in which algal species, or target analyses tend to thrive.

SMS will design a multi-modular miniaturized apparatus that will host both a Sampling Module and an Analysis Module in a single unit, namely the Main Box. This apparatus will

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be located in buoys already existing in marine areas of Europe for continuous monitoring of the selected pollutants.

With the wireless transmission capability for real-time data, as well as remote access to collected data and remote management of biosensors, it will be possible to realize an automated water quality monitoring and alarm system that will be fairly easy to deploy. A major target of SMS is also to develop smart devices that can be produced at a lower-cost and are suitable for future industrial exploitation and manufacturing.

The consortium consists of six research institutions and four SMEs covering all the expertise and all the disciplines to reach the specific objectives. The methodology, reported in ten Work Packages, goes from the construction and assembling of the analytical devices, to their validation using reference procedures. It also comprises the sampling and preconcentration procedures as well as assembling the sensors in a compact instrument that can be easily located in the marine environment for direct in-situ measurements. Analytical techniques such as optical, electrochemical and separation science as well as remote control of the data will be optimised and then recommended to public

Partners:

Italy (Coordinator), Spain, Sweden, Slovenia, Morocco, Greece, France, Belgium

institutions and stakeholders to be used for monitoring seawater quality.

SMS European Added Value

The SMS project consortium brings together key skills from industry and academia. The partners, the technology development and test cases create a multi-sectorial team of experts interacting with end-users and marine water stakeholders, demonstrating that ICT, biotechnology and nanotechnology can increase the potential of biosensors for marine applications. SMS will positively affect socio-economic aspects related to maritime activities and will enable early detection and more effective monitoring of the marine environment. Also, the project will bring a valuable input for the implementation of appropriate management actions relevant in the framework of the Marine Strategy Framework Directive (MSFD). It will provide competitive advantage and leadership to Europe and industry within the fields of biotechnology, sensor development, diagnostic technologies and nanotechnology.

Project N° 613844	Topic: FP7-OCEAN-2013-1: Biosensors for real time monitoring	EU contribution: € 4,144,263	Duration: 45 months	From: December 2013
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## COMMON SENSE:

Cost-Effective Sensors, Interoperable with International Existing Ocean Observing Systems, to Meet EU Policies Requirements

[www.commonsenseproject.eu](http://www.commonsenseproject.eu)

*The Marine Knowledge 2020 agenda sets as flagship a Roadmap for a European Marine Observation and Data Network (EMODnet). The implementation of EU legislation such as the Marine Strategy Framework Directive (MSFD) and the Common Fisheries Policy (CFP) request an increasingly integrated and effective data acquisition system. In this sense, Maritime Sensors are key elements within Ocean Observing Systems to understand the functioning of the marine environment. COMMON SENSE will develop cost-effective sensors, fully interoperable with existing observing systems and compatible with standard requirement such as Global Ocean Observing System (GOOS) and Global Earth Observation System of System (GEOSS).*

The COMMON SENSE project will contribute to support the implementation of the MSFD and other EU policies providing cost-effective, multi-functional innovative sensors, easily usable across several platforms. Based on methodological standards, they will serve to perform reliable in-situ measurements on key parameters that are critical to determine the Good Environmental Status (GES) of marine waters.

The project core research will focus on increasing availability of standardized data on eutrophication, on concentrations of heavy metals (Pb

-lead, Hg-mercury, Cd-cadmium, Zn-zinc and Cu-copper), on microplastic fraction within marine litter as well as underwater noise and other parameters (temperature, pressure, pH and CO<sub>2</sub>) according to MSFD descriptors. The sensors, developed onto modular systems, will be integrated and field tested by means of different platforms (research vessels, racing yachts, buoys).

A Common Sensor Web Platform will be created with the aim of bringing a more sophisticated view of the environment. It will implement

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the sensor web enablement standards as well as optimise data acquisition, access and interoperability.

Finally, the Dissemination and Exploitation strategy will facilitate the transfer of knowledge and technology results of the project so that they can be used with commercial, scientific, conservation and strategic purposes. The results of this project will be exploited for the benefit of the end-users, including the marine sensing industry and SMEs by improving competitiveness and market opportunities. It will also be relevant for public and private marine monitoring bodies as it will provide more efficient and effective tools.

The work plan strategy for COMMON SENSE is structured into work packages (11) grouped into 4 key phases: (1) R&D basis for cost-effective sensor development, (2) Sensor development, sensor web platform and integration, (3) Field testing activities that will enable to assess the performance and operability of the sensors developed and (4) Technology transfer activities that will allow the validation of the

competitiveness and the market application of the sensors developed.

The project objectives will be achieved thanks to the cooperation of a multi-disciplinary team involving research organisations, industrial SMEs, developers and end-users from 7 countries. This multi-sectorial expertise will enhance European industry competitiveness as well as contribute to a better understanding and management strategies for European waters.

### COMMON SENSE European Added Value

The Integrated Maritime Policy seeks to provide a more coherent approach to maritime issues covering cross-cutting policies which can only be tackled through a coordinated collection of data at global level.

In this respect, COMMON SENSE consortium's geographical distribution enables to cover key marine regions: the Baltic Sea; the North-east Atlantic Ocean; and the Mediterranean Sea in order to allow marine environmental monitoring at a global scale.

Project N° 614155	Topic: FP7-OCEAN-2013-2: Multifunctional in-situ sensors	EU contribution: € 4,664,072	Duration: 40 months	From: November 2013
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#### Partners:

Spain (Coordinator), Ireland, Italy, Macedonia, Poland, Germany, United Kingdom



## NEXOS:

Next generation, Cost-effective, Compact, Multifunctional  
Web Enabled Ocean Sensor Systems Empowering Marine,  
Maritime and Fisheries Management

[www.nexosproject.eu](http://www.nexosproject.eu)

*As stated in the 'Ostend Declaration' in 2010, a major challenge of the European Union and its Member and Associated States is to support the development of a truly integrated and sustainably funded European Ocean Observing System. This should be achieved with long-term measurements of key parameters but is currently impaired by the costs and lack of reliability of ocean sensors in general. The NeXOS project aims to improve the temporal and spatial coverage, resolution and quality of marine observations through the development of cost-efficient innovative and interoperable in-situ sensors deployable from multiple platforms, and Web Services for key domains and applications.*

The project will develop new, low-cost, compact and integrated sensors with multiple functionalities including the measurement of key parameters useful to a number of objectives, ranging from more precise monitoring and modelling of the marine environment to an improved assessment of fisheries. Seven new compact, cost-efficient sensors will be developed, based on optical and acoustics technologies, addressing a majority of descriptors identified by the Marine Strategy Framework Directive for Good Environmental Status. Two of the new sensors

will specifically contribute to the Common Fisheries Policy with variables relevant for an Ecosystem Approach to Fisheries. New sensors will respond to multiplatform integration, sensor and data interoperability, quality assurance and reliability requirements. These will be specified for each new sensor system. All new sensors will be calibrated, integrated on several types of platforms, scientifically validated and demonstrated. One of the main objectives of NeXOS will finally be to enhance the competitiveness of European SMEs in the ocean sensor market. To

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this end, sensor requirements and specifications will be assessed at an early phase of the project for market penetration.

NeXOS has broad scope since the needs of the maritime community are wide ranging. A systems engineering approach will thus be used to adequately manage the complexity of the work, which requires a 4-year project lifetime. This leaves three years for development of the sensor systems, and sufficient time for validation and demonstration afterwards. This time span also allows for possible contingency planning that will be developed as part of a specific work-package.

### NEXOS European Added Value

The increasing set of ocean variables to be monitored in European waters and beyond can only be reasonably addressed through a diverse scientific and technological expertise. This

#### Partners:

Spain (Coordinator), France, Germany, Norway, Italy, The Netherlands

expertise is often specific to the areas monitored by a single State due to regional necessities. European waters monitoring requirements call for broad expertise in terms of variable diversity and related technical skills. Combining scientific groups from 6 European countries in the 4 main marine regions of the EU will provide a clear European added value. Collaboration between scientists and technical staff towards tangible developments will demonstrate Europe's capacity to create innovative in-situ sensing solutions, contributing in the mid-term to a more cost-efficient European Ocean Observing System. The innovation foreseen will also help to enhance European leadership in ocean sensor technologies.

Project N° 614102	Topic: FP7-OCEAN-2013-2: Multifunctional in-situ sensors	EU contribution: € 5,989,349	Duration: 48 months	From: October 2013
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## SCHeMA:

### Integrated In-Situ Chemical Mapping Probes

[www.schema-ocean.eu](http://www.schema-ocean.eu)

*Marine environments are vulnerable ecosystems, influenced by a diversity of anthropogenic constituents, natural substances, and organisms that may have adverse effects on their fragile equilibrium, their living resources, and ultimately, on human health. Identification of relevant types of hazards at the appropriate temporal and spatial scale is thus crucial to detect their sources, to understand the processes governing their magnitude and distribution, and to evaluate and manage their risks and consequences preventing marine economic losses.*

SCHeMA's overall aim is to develop, apply and field validate an autonomous marine water quality observatory system deployable from various facilities. The SCHeMA system will consist of a plug-and-play adaptive wireless chemical sensor probe network. This will be used as a front-end for gathering detailed spatial and temporal information on water quality and status, based on a range of hazardous compounds. SCHeMA will particularly focus on the detection of: mercury, cadmium, lead, arsenic and copper bioavailable metal fractions; nitrate, nitrite, and phosphate nutrients; species relevant to

the carbon cycle; volatile organic compounds (VOCs); biotoxins and potentially toxic algae species. An ad-hoc ICT wireless networking solution will allow remote control of data transfer and system reconfiguration. Gathered data will be reported back to a web-based data information system for data logging, storage, standardization, evaluation, modelling, and user-friendly accessibility. The SCHeMA sensing tools will be optimised throughout their development via short field tests and inter-comparison with data obtained using established laboratory techniques. Long-term field applications and

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demonstration will be performed at Atlantic and Mediterranean coastal areas. The expected project outcome is three-fold: (1) *product-based* – it will develop a suite of powerful field-validated submersible chemical sensor probes and a smart multi-sensor probe Hardware/Software interface platform ready for post-industrial production; (2) *applied* – it will enable water quality assessment of various marine ecosystems and identification of the critical parameters considered relevant for successful management of water quality; (3) *scientific* – it will lead to a better understanding of the bio-geochemical processes occurring in selected EU coastal areas. Such steps will be critical to predict the impact of land-based pollution in vulnerable coastal ecosystems, and to develop knowledge-based policies for the protection of the marine environment.

The SCHeMA array of miniaturized sensors will be developed taking advantage of various innovative technical solutions such as: biopolymer-based gel-integrated sensors for direct speciation of a number of trace metals; solid state ion-selective membrane sensors coupled to an on-line desalination module allowing reagent-free, potentially calibration-free, detection of nutrients; mid-infrared optical sensors for the detection of harmful VOCs; optical devices involving selective reversible immobilization of target molecules to sense algae species and toxins. These microsensors will be assembled into miniature low power consumption probes based on Eco-Design - ISO/IEC standards and

### Partners:

Switzerland (Coordinator), Italy, Germany, Austria, Spain, France

EnOcean technology. Data collection/transmission will be handled with a dedicated web-based front-end system compatible with EU standard requirements.

### SCHeMA European Added Value

SCHeMA is an important opportunity for European research institutions and SMEs to develop innovative products and know-how. The project may facilitate new collaborations and business opportunities in the international market of marine sensing and monitoring technologies. A substantial positive impact is anticipated in the field of monitoring pollution and its impact on marine ecosystems. It will also be instrumental in monitoring the influence of increasing atmospheric carbon dioxide levels and climate change on marine ecosystems. SCHeMA will thus contribute to cutting-edge marine technology within a range of European scientific and technological sectors, and will support policies of several EU directives. Dissemination at the regional, European, and international level to the scientific community and the general public, and the training of students and early stage researchers, i.e. the scientists of tomorrow, will contribute to further promote the recognized leadership and competitive expertise of Europe in the field of marine sciences.

Project N° 614002	Topic: FP7-OCEAN-2013-2: Multifunctional in-situ sensors	EU contribution: € 5,200,489	Duration: 48 months	From: October 2013
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## SenseOCEAN:

### Marine sensors for the 21<sup>st</sup> Century

[www.senseocean.eu](http://www.senseocean.eu)

*The marine environment plays an essential role in the Earth's climate, provides resources, recreational opportunities and is a vital transportation route. The marine system remains poorly understood as far as many chemical and physical parameters are concerned. This lack of understanding limits our ability to efficiently monitor the system, and for instance to look at the effects that climate change will have on fisheries, how pollutants move through the environment or how the environment is affected by varying temporal and spatial scales.*

SenseOCEAN draws together established and world leading marine sensor developers from across Europe, to develop a new highly integrated, multifunction, cost-effective and mass deployable in-situ marine biogeochemical sensor system. This collaborative project will provide a quantum leap in the ability to quantify a suite of currently hard to measure biogeochemical parameters. These are crucial to the scientific understanding of the oceans, management of ocean resources, in-situ calibration / validation of satellite Earth Observation data, and supply of data for development of state

of the art biogeochemical (process) models. The project will innovate and combine state of the art sensor technologies (microfabrication, lab-on-chip, micro and calibration free electrochemical sensors, multiparameter optodes and multispectral optical sensors) in a modular and configurable system easily usable across multiple ocean and environmental platforms. Pre-competitive prototypes will be optimized for scale up and commercialization including preparation of data flow and data management architectures. These will be tested and demonstrated on profiling floats, deep-sea observatories,

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autonomous underwater vehicles, and fishing vessels. Specific objectives are the development of integrated systems with sensors for pH, carbon dioxide, carbon, alkalinity, oxygen, nutrients, metals (iron and manganese) but also for coloured dissolved organic matter, chlorophylls, photopigments, primary production, organic fluorophores, etc. These integrated systems will be optimized for power consumption, chemical usage and waste production. They will be resistant to bio-fouling to facilitate long-term deployment in the marine environment. The resulting systems will be developed to provide near-market systems; these will then be launched as commercially available products.

Activities of the project can be described as follows: firstly, the project will focus on underpinning sensors' technology, including power and data management, development and testing of novel sensing technologies and bio-fouling approaches. Secondly, the project will deal with the development of the sensors to the prototype stage and cover the design of the sensors, the testing and performance, as well as the production and integration of the sensors. A specific

### Partners:

United Kingdom (Coordinator), Denmark, Germany, France, Austria, Ireland

work package will also be dedicated to a sensor's demonstration programme.

### SenseOCEAN European Added Value

This project will have a worthy and lasting impact in several significant areas. SenseOCEAN will enhance European capability in integrated low cost autonomous sensing technologies which in turn will enable new advances by users. Moreover, it will contribute to technological advances and provide a socio-economic impact by enhancing collaboration between European universities, research institutes and industry. This impact can only be achieved with the joined efforts of the project partners. SenseOCEAN will have a high potential to change the way marine science is done at the global level by combining the partners' knowledge and resources. All partners will match the European funding with existing national funding to better enhance the project outcomes.

Project N° 614141	Topic: FP7-OCEAN-2013-2: Multifunctional in-situ sensors	EU contribution: € 5,924,945	Duration: 48 months	From: October 2013
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## BYEFOULING:

Low-toxic cost-efficient environment-friendly antifouling materials

[www.bye fouling-eu.com](http://www.bye fouling-eu.com)

*The global focus on the negative effects of increasing emission of Green House Gases (GHG) is one of the key issues on the agenda for the International Maritime Organisation (IMO). Consequently, the whole marine value chain has started to develop solutions aiming at reducing GHG emissions. This will have positive impacts on the ship transport sector, on the fishing industry in Europe (the fourth largest in the world) and on the aquaculture sector, which is an important source of quality protein in Europe.*

The BYEFOULING project addresses high volume production of low toxic and environmentally friendly antifouling coatings for mobile and stationary maritime applications. The technology will fulfil the coating requirements as a result of the incorporation of novel antifouling agents and a new set of binders into coating formulations for maritime transportation and fishing vessels, floating devices and aquaculture. The main goal of BYEFOULING is to design, develop and upscale antifouling coatings with enhanced performance compared to current available products. The approach in BYEFOULING is to tackle the different stages of the biofouling

process using innovative antifouling agents, covering surface-structured materials, protein adsorption inhibitors, quorum sensing inhibitors, natural biocides and microorganisms with antifouling properties. Encapsulation of the innovative compounds in smart nanostructured materials will be implemented to optimize coating performance and cost all along their life cycle. A proof-of-concept for the most promising candidates will be developed and demonstrators will be produced and tested on fields. Active dissemination of the results will be communicated to a large public through the maintenance of a homepage and a series of workshops at

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international level, involving scientific community, industry and standardization organisations. BYEFOULING will provide the means for industrial, cost-effective and robust manufacturing of antifouling coatings in Europe. It involves key EU industry players and SMEs as coating components developers and production technology providers. A set of procedures, guidelines and fabrication tools will be developed, enabling short time to market for new coating concepts. Readily available low toxic and cost-effective antifouling coatings will increase the efficiency of maritime industry and be the enabling technology to realize new products. BYEFOULING will contribute to the objectives of European policies as the Marine Strategy Framework Directive, REACH regulation of production and use of chemicals directive, the Roadmap to a Single European Transport Area, the implementation of the Key Enabling Technologies (KETs) and EU's Lead Market Initiatives (LMIs).

BYEFOULING is a four-year project which will achieve its objectives by implementing interdependencies between RTD activities of innovative development of antifouling materials and coating technologies and between testing, demonstration and validation of developed technologies led by industrial partners. Theoretical

#### Partners:

Norway (Coordinator), Spain, Germany, Belgium, Greece, Sweden, Israel, United Kingdom, Portugal, Switzerland, Malta

studies will also be carried out in a close relationship between industry and academia.

#### BYEFOULING European Added Value

BYEFOULING will combine a multidisciplinary leading research team from 11 European countries already acting worldwide in the scientific community, with highly relevant and skilled technological partners. Therefore, the consortium will be able to develop a full production line for antifouling coatings in Europe. None of the individual partners would be able to succeed in developing the proposed technology alone and within a short time. A national project, being limited to a local choice of the partners, would be much less robust and comprehensive than the project that the present consortium can offer. The BYEFOULING project will provide a unique platform of solutions to the marine fouling problem through close collaboration between experts on fundamental research, applied technology, manufactures, and final users across Europe.

Project N° 612717	Topic: FP7-OCEAN-2013-3: Innovative antifouling materials	EU contribution: € 7,447,584	Duration: 48 months	From: December 2013
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## SEAFRONT:

### Synergistic Fouling Control Technologies

[www.seafront-project.eu](http://www.seafront-project.eu)

*Marine biofouling represents the unwanted colonization of marine organisms on surfaces immersed in seawater. It has a huge economic and environmental impact in terms of maintenance requirements for marine structures, increased vessel fuel consumption, operating costs, greenhouse gas emissions and spread of non-indigenous species. Conserving the marine ecosystem and reducing greenhouse gas emissions requires the development and utilization of innovative and environmentally benign fouling control coatings.*

The SEAFRONT project will deliver i) cost-effective coatings solutions with reduced environmental footprint as determined by comparative life cycle and eco-efficiency assessment, ii) 50% improvement in biofouling deterrence and/or biofouling release measured using newly developed test methodologies, iii) hydrodynamic drag reduction resulting in a consequent 5% improvement in operating efficiency of vessels, all compared to the latest state-of-the-art commercial coatings.

SEAFRONT will release an electronic newsletter quarterly to its stakeholders containing the

highlights of the progress of the project and latest international developments. Additionally, a vibrant website will be created containing major project results, important events and conferences on marine biofouling and breakthrough developments at international level. SEAFRONT will contribute to standardisation by active participation in international committees predominantly via partner and market leader International Paint. In particular, input will be given to CEPE Antifouling Working group which directly inputs into the EU regulatory process for authorising Biocides and Biocidal Products

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Directive. The IPPIC Antifouling working group holds strong relationships with the International Maritime Organization (IMO) responsible for global policy regarding conservation of marine ecosystems.

SEAFRONT contributes to the Marine Strategy Framework Directive by thorough investigation of environmentally benign and sustainable antifouling solutions designed to prevent introduction of biocides, hydrocarbons and heavy metals to the marine environment. SEAFRONT's approach will not only take into account today's REACH regulations, but also anticipates future regulations by avoiding any potentially harmful chemicals that could become restricted by REACH at some point.

With a multidisciplinary consortium, SEAFRONT will consider three different technology concepts and combinations for the development of environmentally benign fouling control coatings. Studies aimed at developing an enhanced mechanistic/fundamental understanding of the relationships between coating properties and hydrodynamic drag, biofouling settlement, biofouling release and biocorrosion along with establishment of new test methodologies will be conducted in separate research work packages. They will run continuously and in parallel with technology development work packages.

### Partners:

The Netherlands (Coordinator), United Kingdom, Germany, Sweden, Italy, Norway, Portugal, Spain

The latter will have to select candidate technologies for integration/combination and/or progression to the benchmarking, standardisation and end-user field trials.

### SEAFRONT European Added Value

The project requires a European approach as the size and diversity of the European market for antifouling coatings encompasses large and small enterprises in the materials, biotechnology, shipping, marine energy and offshore sectors. Moreover, the multidisciplinary approach taken will link Key Enabling Technologies, product development and end-user applications and no single nation or local region would have been able to mobilise all disciplines. In addition, many Member States of the EU share the same seas and oceans and therefore we are facing the same global challenges improving toward clean seas and healthy marine ecosystems.

The last reason for having a European approach refers to the increased efficiency in marine transportation that will amplify the trade of goods into and out of Europe.

Project N° 614034	Topic: FP7-OCEAN-2013-3: Innovative antifouling materials	EU contribution: € 7,995,161	Duration: 48 months	From: January 2014
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## LEANWIND:

### Logistic Efficiencies And Naval architecture for Wind Installations with Novel Developments

[www.leanwind.eu](http://www.leanwind.eu)

*The wind energy sector has ambitious targets to supply 20% of Europe's electricity by 2020 and increase installed capacity to 230GW (40GW offshore). In addition to meeting these goals, the industry must also ensure offshore wind is and remains competitive, particularly as wind farms move further offshore into deeper waters. The industry therefore needs to examine all aspects of the wind farm life cycle to determine where efficiencies can be achieved.*

LEANWIND will address industry challenges such as delivering innovative and cost-effective deployment, operations, maintenance and decommissioning of large-scale offshore wind farms and the associated transport, logistics and equipment needs. The project aims to provide savings across the supply chain, focusing on areas requiring cost reductions to achieve 2020 targets. Key objectives include the following:

- i) Streamline the deployment and installation of large-scale turbines (both fixed and floating).
- ii) Help meet demand for purpose-built installation and servicing vessels and equipment.
- iii) Optimise maintenance strategies and develop novel access systems and equipment.
- iv) Develop remote presence and condition monitoring systems to reduce on-site maintenance.
- v) Optimise full supply-chain logistics including on-land transport links.
- vi) Develop new business models at European level for large offshore systems.
- vii) Identify industry specific safety procedures for installation and maintenance activities.

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LEANWIND will develop technologies and strategies tailored to help solve current and future industry issues. It will produce integrated tools for full life cycle cost and logistical analysis to determine the benefits of project innovations. The LEANWIND dissemination plan ensures that project outcomes will be shared with the wind, vessel and offshore/marine sectors with dedicated showcase events and briefings as part of major vessel and wind energy events. The high level industry participation and the set-up of an Industry Advisory Group will ensure that the findings will be directly exploited by industry. The inclusion of traditional Oil and Gas (O&G) expertise in the consortium will also promote knowledge transfer from the O&G sector to the offshore wind industry.

The LEANWIND consortium is diverse and multi-disciplinary with the experience required to meet the dual energy/transport focus and extensive research scope of the project. The consortium will apply 'lean' principles to the offshore wind industry to streamline processes and find cost and time efficiencies, helping bridge the gap between current costs and industry aspirations. Technologies, tools and strategies will be developed and validated using real-life projects and case studies. Project outputs will then be integrated and

### Partners:

Ireland (Coordinator), Norway, Spain, Denmark, France, United Kingdom, Germany, Greece, Belgium, Portugal, Turkey

evaluated in order to provide recommendations for optimal, cost-effective wind farm systems making the most of the innovation.

### LEANWIND European Added Value

LEANWIND will contribute to the EU vision for a competitive low carbon economy by 2050, enhancing Europe's energy security and leadership in the sector by improving efficiency and reducing the costs of large-scale offshore wind farm developments in the short to medium term. The project will enable the industry to become cost-competitive with fossil fuels and reduce the reliance on subsidies. LEANWIND will also accelerate the market access of new innovative tools and technologies and contribute to developing niche markets, particularly specialised offshore wind farm installation and servicing vessels. It is expected to boost market growth and thus help increase gross domestic product and promote job creation.

Project N° 614020	Topic: FP7-OCEAN-2013-4: Service for offshore wind farms	EU contribution: € 9,986,231	Duration: 48 months	From: December 2013
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