

# **Blue Growth**

## **Scenarios and Drivers for Sustainable Growth from the Oceans, Seas and Coasts**

First Interim report – second revised version

Call for tenders No. MARE/2010/01

Client:

Rotterdam/Brussels, 28<sup>th</sup> June 2011



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# About the Consortium



At Ecorys we aim to deliver real benefit to society through the work we do. We offer research, consultancy and project management, specialising in economic, social and spatial development. Focusing on complex market, policy and management issues we provide our clients in the public, private and not-for-profit sectors worldwide with a unique perspective and high-value solutions. Ecorys' remarkable history spans more than 80 years. Our expertise covers economy and competitiveness; regions, cities and real estate; energy and water; transport and mobility; social policy, education, health and governance. We value our independence, integrity and partnerships. Our staff is formed by dedicated experts from academia and consultancy, who share best practices both within our company and with our partners internationally.



Deltares is a leading, independent, research institute and specialist consultancy in matters relating to water, soil and the subsurface. We apply our advanced expertise worldwide to help people live safely and sustainably in delta areas, coastal zones and river basins. Deltares has the knowledge and resources to tackle water and subsurface issues worldwide in an integrated fashion. This means we never focus exclusively on technological issues. Our approach invariably takes account of ecological factors and administrative constraints such as spatial planning, with all the associated policy agendas, competing interests, and legal and economic processes. The integrated application of our various areas of sophisticated know-how, produces solutions that are more sustainable, optimally endorsed by the stakeholders and often, more economical.



Oceanic Développement was founded in 1992 at Concarneau - France, at the core of the European seafood industry, in one of the main fishing ports in France. The company expertise is focused on fisheries and the fishing industry. Since its establishment in 1992, the company gained experience and references on the following areas:

- Consulting: our consulting activity is covering all the fisheries and fishing activities, from the stock evaluation and catches to the marketing via processing, including Monitoring-Control-Surveillance and fishing port management. ;
- Technical assistance: Oceanic Développement manages scientific observers programs, catches control programs, MCS training programs;
- Expertise and know-how of the company are focused on fisheries sector only.

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# Preface

**“We never know the worth of water till the well is dry”**

Thomas Fuller

More than 70 percent of Earth’s surface is covered by water. This truly makes our planet the “Blue Planet”. Not only is water a precondition to the existence of life but it also provides resources that directly contribute to our society, ranging from sea transport to the production of raw materials, fisheries, leisure activities etc. The sea is an integral part of the European identity and of the continent’s economy. Among the 27 Member States of the European Union, 22 have a coast and two thirds of the European frontiers are set by the sea.

In this light it is essential that Europe recognizes the true potential of its marine resources and develops an integrated policy that acknowledges the inter-linkages that exist between the different domains and functions of its seas, oceans and coastal areas. The Integrated Maritime Policy (IMP) that has been pursued by the European Commission since 2007 is an important step in realising Europe’s future strategies and policies.

The Blue Growth project -“Scenarios and Drivers for Sustainable Growth from the Oceans, Seas and Coasts”- builds on earlier policy initiatives to recognize the potential of these marine resources and thus aids in realising the Europe 2020 strategy towards smart, sustainable and inclusive growth.

The current report is the first interim report in a series of three interim reports that will be delivered during the project. It reflects back on the finding of the first steps that have been undertaken and the comments of the Steering Committee members received during the meeting of 13 April and in writing thereafter.

It should be noted that this report represents the views of the consultant, which do not necessarily coincide with those of the Commission.

Rotterdam/Delft/Concarneau, 28<sup>th</sup> June 2011

The Blue Growth Consortium:

- Ecorys
- Deltares
- Océanic Développement



# 1 Introduction

## 1.1 The Blue Growth project

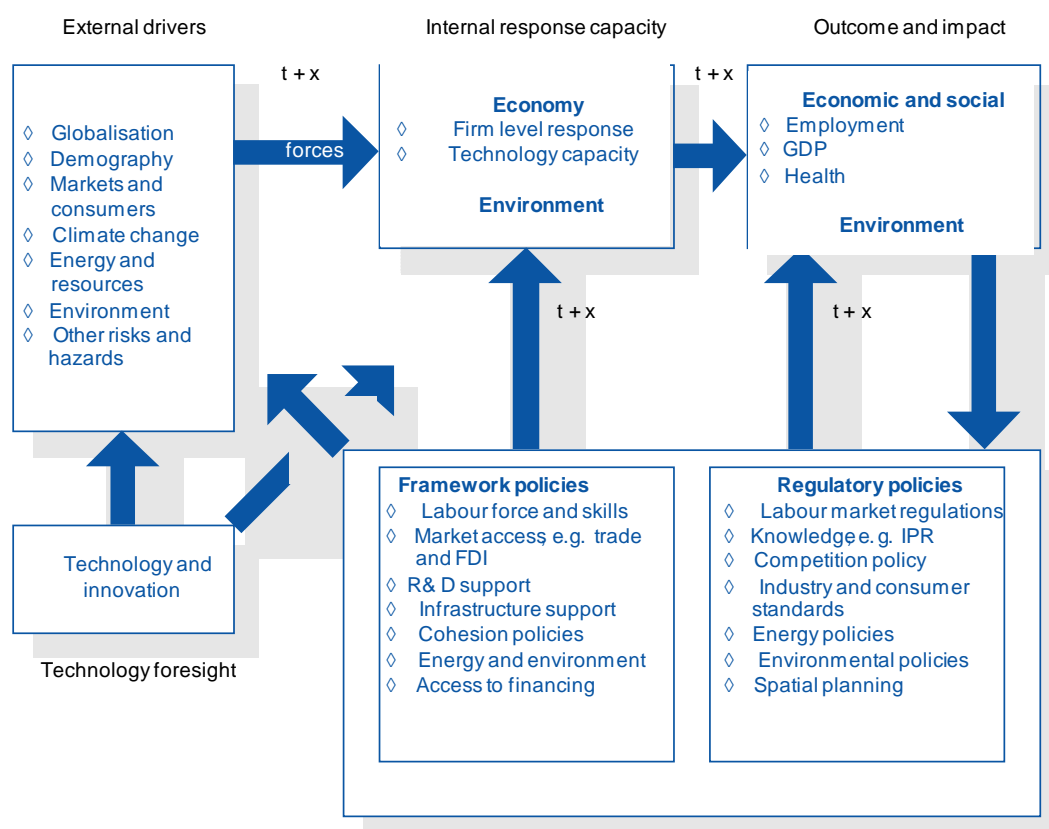
The main aim of the Blue Growth project is to provide policy-makers at EU and sea-basin level with a comprehensive, robust and consistent analysis of possible future policy options to support the maritime sectors in the EU.

For this purpose the project will:

- provide insight into the state of the art within maritime sectors;
- present knowledge of innovation and technological developments that influence these sectors;
- create an understanding of key external drivers that influence their potential;
- identify key economic areas for the future sustainable growth of oceans, seas and coasts; and
- assess the impacts of policy interventions that may contribute to reaping the existing potential.

To answer these questions we have adopted an analytical approach which is based on a chain of causal links and takes the best insight from both socio-economic and environmental aspects of sectoral policies.

**Figure 1.1 Analytical framework**



Note: t + x: t = time, t + x indicates that impacts may materialise later in time.

This approach creates a number of advantages:

- It is *comprehensive* and takes full account of drivers, pressures, states, impacts and responses

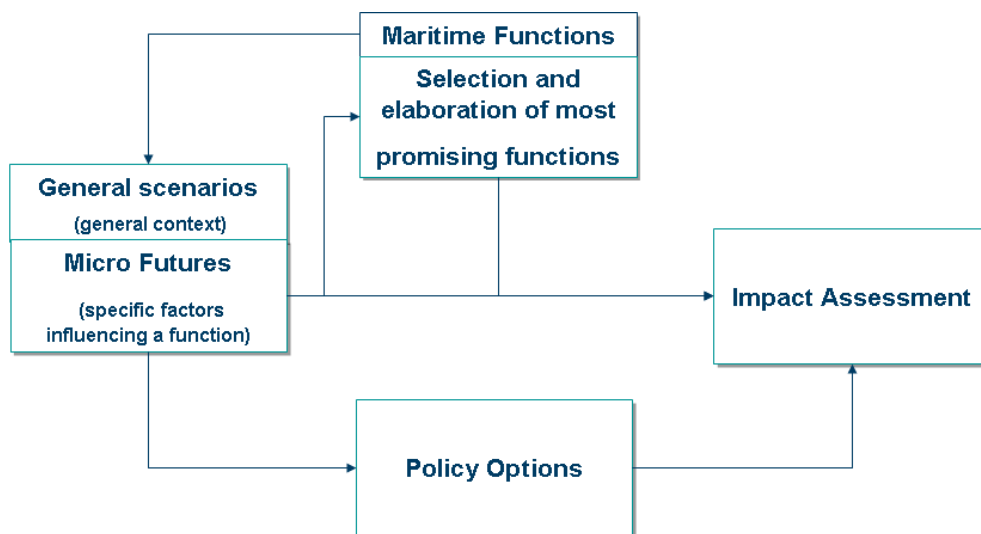


- It is *dynamic* and allows the assessment of (policy) responses over time, as particularly required for the impact assessment part of the assignment
- It allows the *construction of analytical scenarios*, based on differences in drivers (e.g. energy prices, economic growth, technological breakthroughs)
- It is based on *causal chain analysis* – a recommended tool for Impact assessment in the Community Impact Assessment Guidelines
- It allows differentiation by maritime (sub-)sector, research areas and sea basin, and we will do so by taking forward *maritime functions* and *clusters*
- It allows quantification and the use of *indicators*

## 1.2 Structure of the study

Based on this approach the study has been structured in such a way that it links specific tasks to match the analytical approach. Starting point are the maritime functions which are defined as the possible uses of seas and oceans by mankind. The external drivers and technological developments are identified and clustered into scenarios which have a direct influence on the potential of the different (sub)functions. At the same time policies may be developed which have an impact on realising potentials. The overall impact of both autonomous developments (under different scenarios) and policy interventions are eventually assessed to arrive at overall findings with respect to the Blue Growth potential.

**Figure 1.2 Structure: main blocks**



## 1.3 Current report and status

The above structure has been elaborated in a specific roadmap for the study. This project will have an expected duration of 20 months and consists of 4 Work packages:

- Work Package I: Work Plan and Data Collection;
- Work Package II: Analysis and Classification of Material;
- Work Package III: Qualification of Material and Definition of Scenarios;
- Work Package IV: Finalisation of project.

This report is the first of three interim reports of the project. This report describes the main functions and presents a selection of the most promising functions which will be further detailed and analysed

in-depth in Work Package II. It also provides a first outline of the general scenarios and describes the overall scenario logic. Micro-futures which specifically determine the potential of the selected promising sub-functions will be elaborated in conjunction with the further analysis of these sub-functions. In essence, this report presents first overall findings on the functions of oceans, seas and coasts at a general level and provides the basis for the in-depth analysis in the subsequent work packages of the study.

**Figure 1.3 Roadmap for the study**

	Level of Analysis			Scenario-related activities	Methodologies applied
	General level	Maritime functions	Clusters and sea basins		
WP I	Task I.1 Refine work plan	Task I.2: Prepare maritime function profiles Task I.3: Draft scenario logic		<ul style="list-style-type: none"> <li>Elaborate scenario-method</li> <li>Review existing scenarios &amp; main external drivers</li> <li>Create a framework for future expectations (Level I)</li> </ul>	<ul style="list-style-type: none"> <li>Data analysis</li> <li>Desk review</li> <li>HSS, team workshop</li> </ul>
WP II			Task II.1: Cluster-specific desk research Task II.2: Cluster-specific interviews Task II.3: Comparing and ranking clusters	<ul style="list-style-type: none"> <li>Rigorous imagining (Level II)</li> <li>Assess implications</li> <li>WP II for scenario's</li> </ul>	<ul style="list-style-type: none"> <li>Data analysis</li> <li>Desk review</li> <li>interviews</li> <li>Technology mining</li> <li>In-depth interviews</li> <li>HSS</li> </ul>
WP III			Task III.1: Prepare intermediate hearing Task III.2: Intermediate hearing Task III.3: Elaborate scenarios Task III.4: One-day presentation	<ul style="list-style-type: none"> <li>Develop and construct (Level III)</li> <li>Refinement process</li> <li>Validate &amp; define policy options</li> </ul>	<ul style="list-style-type: none"> <li>HSS</li> <li>Presentation and discussion</li> </ul>
WP IV			Task IV.1 Execute IA Task IV.2 Draft Final report Task IV.3 Final report	<ul style="list-style-type: none"> <li>Test robustness of policy options by scenario</li> </ul>	<ul style="list-style-type: none"> <li>Impact assessment</li> <li>Input/Output analysis</li> <li>MCA</li> </ul>

The factsheet descriptions of the sub-functions in this first interim report are based on separate function profiles (internal working documents). For selected sub-functions these will be further elaborated during Work Package II and presented at a later stage.

## 1.4 Structure of the first interim report

First, this first interim report describes the background and policy initiatives that are relevant to Blue Growth. It also describes some key research areas and initiatives that are undertaken in other regions in the world (chapter 2). Chapter 3 gives an overview of the maritime functions and presents the methodology and result of the selection of most promising sub-functions. Chapter 4 subsequently introduces the overall scenario logic that will be applied throughout the study and describes the key content of the general scenarios. Finally, Chapter 5 describes the work plan towards the next phase of the study.

## 2 Policy context and horizontal issues

The starting point for this study is a grounded belief that oceans, seas, and coasts could play a pivotal role in the solutions to many of Europe's current and future challenges. Oceans, seas and coasts can be seedbeds for innovation and technological advancement – and true laboratories for sustainable growth and employment that Europe 2020 is all about. Hence, our commitment to thoroughly investigate the potential for true *Blue Growth*.

In doing so, it is important to take into account the policy context as well as horizontal. This chapter describes the evolving policy context and presents a first analysis of ongoing (research) activities, both in Europe and the rest of the world, which are relevant to Blue Growth.

### 2.1 An emerging awareness of “Blue Growth”

#### **Crude measurements show: maritime activities are vital to Europe**

An effort has been made to identify and standardise all available data related to the seas and coastal areas. This has been led by Eurostat (2008) with the key objectives:

- To analyse the current level of the socio-economic state in all sea-related sectors, reveal trends from the past decade and forecasts for the coming ten years at MS and EU (EU-27) levels;
- To provide an assessment of the strengths and weaknesses of the activities related to the sea or those that use maritime resources.

Data is based on the NUTS 3 regions with a coastline or NUTS 3 regions where more than half of the populations live within 50 km of the sea. Indicators exist for a number of socio-economic characteristics of EU coastal areas, including: Demography, Macro-economy, Labour Market, Education, Agriculture, Tourism, Enterprise, External Trade, Fisheries, R&D and Ports activity. The data shows the relative importance of coastal areas to the EU economy with GDP per inhabitant 5.7% higher than the average in the EU-22 (those countries with coast lines), whereas almost 90% of EU external trade and 40% of the EU's internal trade is using maritime transportation (European Commission 2006c, p. 8).

#### **The need to investigate the potential for “Blue Growth” as part of the Europe 2020 strategy**

At the time of writing, Europe is recovering from the worst economic and financial crisis it has faced for decades. One thing is clear: Europe is exiting the crisis in a very different way as it went in. Overall, Europe's position has been weakened compared to other economic blocks, mostly the emerging economies, such as China, India, Brazil and Russia. But impacts have been unequal. There is emerging evidence that Europe's periphery has been hit harder by the crisis than its core, and that disparities between regions have been growing once more (European Commission, 2010d). Some sectors (e.g. textile, glass, ceramics) have been hit very hard, and find it difficult to recover. Other sectors such as trade and logistics, tourism, and financial services have been hit as well, but are now bouncing back. During the last two years, the policy discussion has focused on the question: will the jobs return to Europe, and if so what types of jobs, and how sustainable will these be? This is not only driven as an immediate response to the economic and financial crisis, but also by the wider strategic positioning of Europe in a long term economic, environmental and social perspective.

A powerful response comes from the Europe 2020 Strategy, a new all-embracing policy framework which aims to provide a post-crisis recovery as well as a longer term strategic framework: a strategy for smart, sustainable and inclusive growth. Sustainable growth is understood to mean “building a resource-efficient, sustainable and competitive economy, exploiting Europe’s leadership in the race to develop new processes and technologies, including green technologies, accelerating the roll-out of smart grids using ICT, exploiting EU-scale networks and reinforcing the competitive advantages of our businesses, particularly in manufacturing and within our SMEs as well as through assisting consumers to value resource efficiency” (EC, 2010a, p.14).

This concept of sustainable growth has then been further translated into various Flagship initiatives, such as the Flagship initiative on Sustainable Industrial Competitiveness, by addressing issues of industrial innovation, access to raw materials and critical product, resource, energy and carbon efficiency (EC, 2010b). Also aligned with these goals is the Flagship initiative on the Innovation Union, which states that stricter environmental targets and standards establish challenging objectives but ensure long-term predictability, thus providing a boost to eco-innovation (EC, 2010d). Even more recently, the Flagship on a Resource-Efficient Europe aims to create a policy framework for policies to support the shift towards a resource-efficient and low-carbon economy which will help to “boost economic performance while reducing resource use; identify and create new opportunities for economic growth and greater innovation and boost the EU’s competitiveness; ensure security of supply of essential resources and fight against climate change and limit the environmental impacts of resource use” (EC, 2011, p.3). The Flagship aims to make use of regulatory, voluntary and communication & information instruments. It also takes account of public investment, by aligning this Flagship initiative with the reform proposals on the future of the EU’s own major spending programmes, including the Common Agricultural Policy, the Common Fisheries Policy, Cohesion Policy, energy infrastructures and trans-European networks for transport.

At the moment, it appears that the oceans, seas and coasts are not yet fully considered when elaborating the Europe 2020 strategy. That is surprising, as the oceans, seas and coasts play potentially a vital role in addressing Europe’s challenges, whether it is in the area of economy and employment, energy, climate change, raw materials, food or water.

### **Towards Integration: the EU’s Maritime policy is already changing course**

The holistic nature of the marine economy and development of coastal areas fits within the EU’s *Integrated Maritime Policy* (EC, 2007a). This policy is designed to remove the barriers between different sectors of activity and to place sustainable, global vision at the centre of all maritime initiatives. The core objective of the IMP is to exploit the potential of the seas and oceans in order to make a significant and sustainable contribution to economic growth, by creating new jobs while better respecting natural resources and the marine environment. The IMP’s specific goals are to:

- maximise the sustainable use of the oceans and seas;
- build a knowledge and innovation base on which to further develop;
- deliver the highest quality of life in coastal regions;
- promote Europe’s leadership in international maritime affairs;
- raise visibility for Maritime Europe.

The *Marine Strategy Framework Directive* (EC, 2008a) is considered as the environmental pillar of the EU’s integrated marine policy. It establishes a common framework for the protection and conservation of the marine environment, with the aim of a ‘good environmental status’ of EU marine waters by 2020. The Directive states that programmes elaborated by the Member States must take into account the economic and social consequences of the actions taken to preserve and improve the marine environments. They must do this through impact assessments and cost/benefit analyses. The relationship between this Directive and the future development of marine based

sectors therefore appears to be significant. The governance of the Directive will be critical given the role of the European Commission in guiding the national strategies (and ultimately its assessment of compliance) as well as ensuring the strategies are coordinated, given the supranational characteristic of the marine environment.

Policies to foster integrated territorial development have a significant impact on the seas and coastal areas, especially in those areas classed as 'convergence regions' (principally on the Iberian peninsula, the Southern Mediterranean and the Baltic Sea). *Cohesion policy* is thereto pivotal, and its review for the period 2014-2020 is in progress, following the publication of the Fifth Cohesion Report on Economic, Social and Territorial Cohesion (EC, 2010d). In particular, the *INTERREG* programme which is part of the territorial cooperation objective is important as it brings together coastal areas from all countries. An initial analysis of these programmes (see section 2.3) reveals that many projects from the trans-national (B-) strand are linked to the oceans, seas and coasts.

### **Complementarity to the Common Fisheries Policy**

The *Reform of the Common Fisheries Policy 2014 – 2020* (CFP), which is currently underway, is an important policy development. Any change to the CFP will directly impact the fisheries sector but also have indirect consequences for the wider economy as well as society and the environment. The reform process will therefore have to be closely monitored during the study. The Commission issued a green paper (European Commission, 2009g) and conducted a public consultation in 2009 – 2010. In its green paper, the Commission stresses the need to connect the CFP with general maritime issues and thus a close eye on this policy area is essential in our scenario analysis. Very shortly, the Commission will publish its proposals accompanied by an impact assessment of the different reform scenarios. These two documents will form the basis for a legislative proposal in 2012.

*Within the context of this study, the Common Fisheries Policy will be seen as an important complementary policy development. This study does not seek to explore domains which are specific and exclusive to this policy as they are covered elsewhere. However it seeks to identify complementarities with the CFP where appropriate and relevant, and aims to identify existing or new synergies with it.*

### **Important policy developments related to maritime transport**

The Commission has recently published its new White Paper on Transport - *Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system* (European Commission 2011b), which strengthens the role of waterborne transport as part of a strategy towards a competitive and resource efficient transport system. An important goal is to optimise the performance of multimodal logistic chains, and to shift 30% of road freight over 300 km to other modes including waterborne transport and more than 50% by 2050. It also aims to develop a "Blue Belt" in the seas around Europe that shall simplify the formalities for ships travelling between EU ports.

In its aim of promoting intermodal transport and Short Sea Shipping, the European Commission proposed already in its predecesing Transport White Paper of September 2001 the development of "Motorways of the Sea" as a competitive alternative to land transport. In the 2011 new White Paper this strategy is maintained, but enhanced with the aim of identifying a core network of ports which are linked by sea as well as other modes. Intra-Community maritime transport, together with inland waterway transport, is said to be a key component of intermodality which must provide a means of coping with the growing congestion of road and rail infrastructure and of tackling air pollution. Under the Motorways of the Seas initiative, a number of projects have been funded until date, which are located in the various sea basins. Of a set of 14 projects identified, 4 were located

in the Baltic Sea, 2 on the North Sea, 4 in the Atlantic sea basin, 3 in the Mediterranean and 1 on the Black Sea. They all relate to the maritime transport and shipbuilding function.<sup>1</sup> See Annex 5 for the entire list.

The *TEN-T programme* is one of the means applied to develop and integrate the European transport network. The programme, with substantial financial contribution of the European Commission, foresees in the investment in new infrastructure, upgrades of existing sections and especially in the completion of missing links in the European core infrastructure network. For its completion a required budget of € 550 bn is estimated.

Through the *Marco Polo programme*, the EC supports the efficient and sustainable use of transport networks. Marco Polo mainly functions as an incentive mechanism for modal shift, helping operators and shippers to overcome the start-up barriers of shifting from road to other modes of transport. The programme budget for 2007-2013 is €450 million.

### **Need to take full account of the environmental challenges ahead**

Serious environmental challenges exist and meeting them is they key to achieving sustainable development. For example, EU governments currently spend € 5.4 billion protecting coastal areas from erosion, a threat that is increasing with sea level rises caused by climate change (Eurostat, 2008).

A large number of reports by public and private agencies identify the current situation and future trends in several areas of interest to this research project. For example, a recent report by the European Environment Agency (EEA, 2010) provides several observations about the state of the marine environment and the impact of human activity. In addition to the problem of over-fishing, it highlights the issue of pollution caused by aquaculture, agriculture and shipping, as well as marine litter and noise. In some areas pollution is reducing but in others there is no improvement and even an increase (especially pollution from aquaculture due to the growing demand for fish). Moreover, climate change is increasing the ecosystem vulnerability because of sea-level rise and ocean acidification. Temperature increases are changing the composition of plankton and some fish species which will have an impact on fishing opportunities. Finally, the reduction in levels of Arctic ice will cause new environmental problems but also economic opportunities because of greater access to the region's resources.

## **2.2 Selected Member State developments**

For some countries, such as the United Kingdom, the Netherlands, the Baltic States or Greece, the seas and oceans have been a vital part of economy for decades if not centuries. For others, this interest is newer or being renewed.

For example in *France*, the government aims to position Paris as the leading capital city linked to the maritime sector through its connections to seven major ports. Specific potential is seen for maritime construction, insurance services, shipbuilding, offshore extraction, ports, shipping and fishing (PricewaterhouseCoopers, 2009). A barometer has been constructed, consisting of:

- An index made up of the following indicators: The Baltic Dry Index (prices of maritime transport for dry materials), passenger numbers in the 17 main French ports, level of container chartering,

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<sup>1</sup> See for detail and updates DG Move website: [http://ec.europa.eu/transport/maritime/motorways\\_sea/motorways\\_sea\\_en.htm](http://ec.europa.eu/transport/maritime/motorways_sea/motorways_sea_en.htm)

ship registrations, orders for new ships, change in steel prices, sales of fish and all goods traffic (by a thousand tonnes) in the seven large ports linked to the Paris metropolis as well as Calais;

- A survey of 53 major maritime actors.

At the same time the *German* government has elaborated a strategy on ports to ensure that the country consolidates its dominant position and coordinates the development of ports with transport infrastructure (Wehrmann, 2011). Part of the German government strategy includes incentives to move more traffic from the roads to the sea which offers significant environmental gains. These gains can be maximised with the introduction of modern ships that are propelled by natural gas ( Liethauz, 2010).

A number of EU Member States are increasingly recognising the economic value that the oceans and seas can have in the context of a sustainable and innovative economic model. For example, *Irish businesses* have come together to launch a “Smart Ocean Innovation Cluster” that is reported in a consultation document written by the Marine Institute. The document calls for ideas on how Ireland can “address major global challenges and emerging market opportunities by utilising our unique Ocean Resource as a catalyst for innovation building on our existing knowledge economy clusters in ICT and Life Sciences” (Shields et al., 2010, page i). It notes how Ireland has built up substantial intangible assets in terms of intellectual property and know how in innovative sectors but they have so far not taken advantage of the great potential of the marine environment. Moreover, it aims to position Ireland as a cutting edge location for carrying out research into specialist ocean technologies by following what it calls “Vision 2020”: “By 2020 Ireland aims to be a recognized leader in the development, testing, commercialization and delivery to market of the next generation of innovative technologies addressing evolving global markets in marine renewable energy, environmental monitoring and water technologies” (Shields et al., 2010, page 1). This vision is based on Ireland’s expertise in technological innovation, especially ICTs but the focus on the marine environment is expected to yield benefits for many parts of the economy, including R+D and financial, legal and other business support sectors.

## 2.3 Research and development relevant to maritime functions

An important part of the study consists of the identification and assessment of technological capacity and potential of Maritime functions and clusters in Europe. However, the scope of the subject matter is so wide that technology mining could be easily a sheer endless task. Within the project two specific overall activities have been identified in the field of technology mining:

- Scoping of FP6 and FP7 and other EU funded research (Work package I). (see 2.2.1)
- Patent and publication analysis (Work package II)

As part of the background analysis for the project, an overview of EU funded programmes has been made. This will be useful material to support all stages of the work programme, including the preparation of the sub-functional profiles, interviews and the stakeholder platform and the building of scenarios. Inventories are included in Annex 5. An inventory has been made from the following policy areas / funded programmes:

- Projects funded by the Research Framework Programmes 6 and 7 (DG Research)
- Projects funded by the Union for the Mediterranean initiative (DG EuropeAid)
- Other Community funded research and support initiatives

### Research Framework Programme 6 and 7

The Seventh Framework Programme for Research and Technological Development (FP7) is the EU’s main instrument for funding research and development in the period 2007-2013. A great



number of projects are relevant to the oceans, seas and coasts are being funded by FP7, as well as by the Sixth Research Programme (FP6), of which some projects are still continuing and the material will still be useful for this study. The consortium has reviewed these as inputs to the sub-functions analysis that is part of Work Package II. In the sub-function reports that will be drafted the main findings will be elaborated.

### Other Community funded research and support initiatives

Besides the above described research and support programs, several other Commission initiatives are relevant in the context of growth opportunities for the oceans and seas. The GALILEO programme contains a number of projects and pilots that will deliver maritime benefits and future opportunities. The GMES initiative also fits here as it creates opportunities for integral monitoring and surveillance at very effective levels. European-wide projects such as SafeSeaNet, e-Maritime or the establishment of an LRIT European data centre bring efficiency gains and new functionalities for maritime traffic management and monitoring.

In addition to an inventory to the (EU financed) RTD activities that are undertaken in Europe, some key developments in other world regions have been identified. Rather often these activities are undertaken around a specific theme of maritime functions. The following section presents a first indicative overview at a general level on RTD activities in the US, Japan and Norway. In addition main research organisations and funding instruments are indicated. In subsequent WPs this will be elaborated for the selected sub-functions and extended to other relevant countries.

### USA

In the United States, the *National Science Foundation* (NSF) is the largest organisation in terms of funding academic research. With an annual budget of about \$6.9 billion (FY 2010), the NSF is the funding source for approximately 20 percent of all federally supported basic research conducted by America's colleges and universities. The themes NSF is covering vary widely, and also extend to the maritime fields that are in the scope of this study.

Under NSF, over 1500 maritime research projects have been funded. A great variety of topics is covered and includes projects relevant for each of the six maritime functions concerned in this study.

In addition to the NSF, since 1998 also the *National Oceanographic Partnership Program* exists. Their focus lies with oceanographic research and exploration, technology development, resource management, and ocean education. NOPP has supported diverse topics, such as: Sensors for Marine Ecosystems, Assessing Meridional Overturning Circulation Variability – Implications for Rapid Climate Change, Improving Cyclone Intensity Forecasting, Exploration and Research of Deepwater Coral Communities, the Global Ocean Data Assimilation Experiment, and Understanding and Predicting Changes in the Ocean Workforce. NOPP focuses on ocean-related objectives which are too large for single agencies to undertake, but satisfy multiple agency missions and would benefit from partnerships between government, private industry and academia. In 2010 they disbursed approx. USD 21.7 mln of funds. The topics covered mainly relate to biodiversity, climate and weather, sea floor research and coastal effects. Therefore they are mainly of relevance for the maritime functions of food, nutrition and ecosystem services (no. 2), energy and raw materials (no. 3) and coastal protection (no. 5).

A third funding route in the USA is *Sea Grant*. Sea Grant is a nationwide network (administered through the National Oceanic and Atmospheric Administration [NOAA]), of 32 university-based programs that work with coastal communities. The National Sea Grant College Program engages this network of US top universities in conducting scientific research, education, training, and



extension projects designed to foster science-based decisions about the use and conservation of aquatic resources. Under Sea Grant, a number of partnership initiatives are developed both within the USA and with other countries, targeting research areas that link to several of the maritime functions identified in our study.

### R&D in Japan

In Japan, the *National Maritime Research Institute* is one of the prime bodies for sea related R&D. Research topics covered strongly relate to vessel navigation, shipbuilding and ship design. This covers hull and ship equipment, as well as the studying of weather and nautical conditions with the aim to optimise maritime operations.

Another research institute is the *Japan Agency for Marine-Earth Science and Technology* (JAMSTEC). This is one of the predecessors of Japan Marine Science and Technology Center. JAMSTEC has the main objective to contribute to the advancement of academic research in addition to the improvement of marine science and technology by proceeding the fundamental research and development on marine, and the cooperative activities on the academic research related to the Ocean for the benefit of the peace and human welfare. Projects cover areas such as meteorology, cryosphere studies, biochemicals, and climate variability. Cooperation with other Pacific countries plays an important role in a number of their projects.

The *Frontier Research Centre for Global Change* studies climate variations and topics like El Nino. Eco-systems, hydrological cycles and atmospheric composition are among their research themes.

The recent Fukushima nuclear disaster from March 2011 is likely to lead to a complete overhaul of the Japanese energy policy, with a much stronger emphasis on renewable energy. Throughout this study, we will therefore monitor relevant policy developments from Japan.

### R&D in Norway

In Norway, a 10-year research programme under the name of *MAROFF* (Maritim virksomhet og offshore operasjoner) was re-started in 2010 after its first phase ended in 2009. MAROFF will help realize the Government's maritime strategy for the promotion of innovation and environmental value creation in the maritime industries. The program will contribute to maritime companies and research institutions development of their knowledge advantage, and supports projects that are oriented towards the research challenges that are necessary to achieve the three key innovation areas

- Environment
- Advanced transport and logistics
- Environment-friendly demanding maritime operations.

The designated areas are chosen because they both can give rise to new business opportunities for Norwegian players, besides that they largely build on specialized expertise and experience that exists within the Norwegian maritime industry.

Projects funded under the MAROFF program are to be user driven, should have user involvement and also acts as co-funding for European projects headed under ERA-net MARTEC.

Several other research programmes exist in Norway, such as

- The Oceans and Coastal Areas (HAVKYST) is intended to generate basic knowledge for a future ecosystem-oriented, precautionary management system for marine ecosystems, while being designed to contribute to the increased creation of value from ocean and coastal resources. The primary objective of the Programme is to encourage creative research of high international quality on the marine environment.

- Aquaculture - An Industry in Growth (HAVBRUK) is designed to help to realise the vision: Norway – the world’s leading aquaculture nation. Norwegian aquaculture contributes substantially to upholding value creation with respect to exports, employment and settlement patterns in coastal areas. Over the past 40 years, Norway has developed into the world’s leading exporter of salmon and rainbow trout, bringing in considerable export revenues. The main challenge facing Norwegian aquaculture is to make production more sustainable and to solve environmental problems that limit the further development of the industry.

## 2.4 Specific cross-cutting EU funded activities per sea basin: INTERREG and Union for the Mediterranean

### INTERREG

INTERREG is the EU’s main instrument for promoting cooperation between regions and is currently in its fourth version (2007-2013). There are three strands to INTERREG: A – Cross border cooperation, B – Transnational cooperation, and C – Interregional cooperation. The most relevant strand for this study is strand B, which includes 13 programmes covering different European macro-regions. Of these, eight are the most relevant for the study, since the macro-regions cover the main European sea basins. In total 69 projects have been identified. The relevant programmes are (number of projects identified):

- North Sea Region (19 projects)
- Atlantic Arc (18 projects)
- Med Area (14 projects)
- Baltic Sea Region (seven projects)
- Northern Periphery (four projects)
- North West Europe (three projects)
- South East Europe (two projects)
- South West Europe (two projects)

In addition, two relevant projects from INTERREG strand C were identified.

For all projects, the timescales and budgets were recorded, together with a description of the projects and their objectives and intended outcomes. Projects are related to all the functional profiles, with the most common profile being transport.

### Union for the Mediterranean

The Union for the Mediterranean (UM) initiative is the re-launched MEDA programme which started initially after the 1995 summit in Barcelona to bring together countries that surround the Mediterranean Sea. The ‘Barcelona Process’ aimed at forging a new relationship between the EU and its neighbours in the Mediterranean region, with the cross cutting aims of peace, stability and growth. Since 2004, the countries participating in the Barcelona Process are now part of the European Neighbourhood Policy. The re-launched Union for the Mediterranean includes several interesting and strategic projects including the establishment of maritime highways and the de-pollution of the Mediterranean Sea. Some projects such as Euro-Med Migration and Euro-Med Police carry on from similar projects in the MEDA programme. In Annex 5, an inventory of the projects identifies several relevant projects in the re-launched programme, covering many of the functional profiles.



## 3 Maritime functions – overview and selection

### 3.1 Introduction

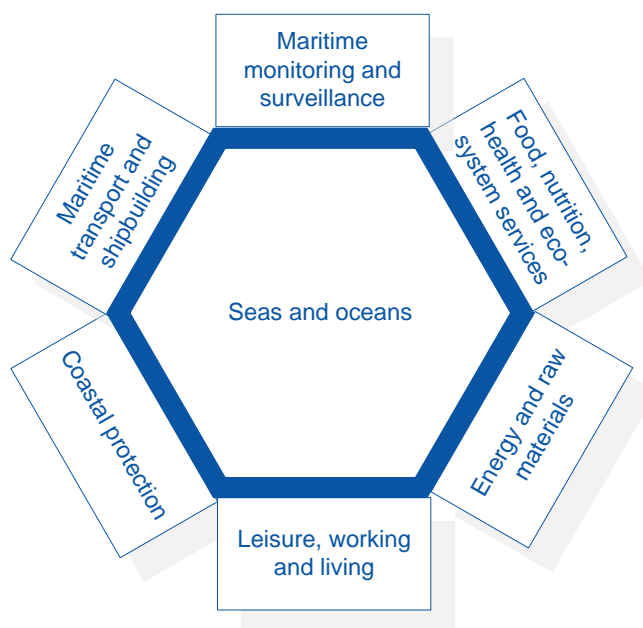
#### Maritime functions and sub-functions

The challenges and potential of the European seas, coasts and oceans are manifold and complex. Maritime economic sectors active on and near the seas are interacting with other sectors in value chains and economic clusters. To establish a comprehensive view on economic activities that are related to sea or sea-resources we have followed an approach which is linked to these resources, by addressing the main maritime functions of the oceans, seas and coasts. We define maritime functions as the possible uses of seas and oceans by mankind.

Six maritime functions have been defined:

1. Maritime transport and shipbuilding
2. Food, nutrition, health and eco-system services
3. Energy and raw materials
4. Leisure, working and living
5. Coastal protection
6. Maritime monitoring and surveillance

Figure 3.1 Maritime functions

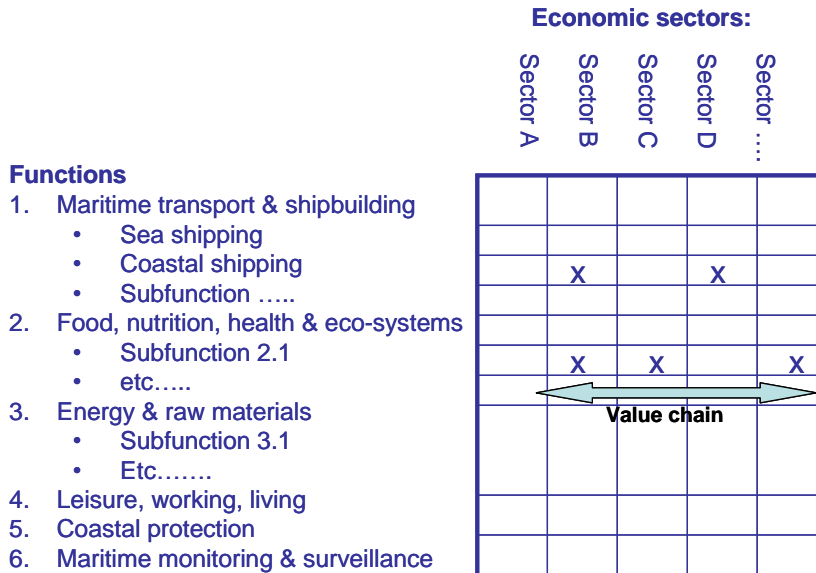


Within the scope of Work package 1, each function has been elaborated and sub-functions have been defined. This chapter reports on the scope of each function considered and the sub-functions identified (section 3.2).

**Sub-functions** are subsets within the function which can be clearly separated as they are covering a specific value chain (for example within the nutrition, health and eco-system services, among others aquaculture and fishery for human consumption can be distinguished as sub-functions).

For each (sub-)function **economic sectors** can be identified that are relevant to each function (see figure 3.2). For example for oil exploration it is building offshore drilling platforms, offshore services to install these platforms, oil exploration activities and as a follow up activity oil refinery and distribution – some of these activities are sea-based (the focus of this study) and some of them are land-based. In fact, all these activities are interrelated in one **value chain** which describes the relations between economic activities that are relevant for a sub-function.

**Figure 3.2 Maritime functions, sub-functions and value chains**



To standardise the elaboration of maritime functions and underlying sub-functions, function profiles have been drafted and guidelines to apply these. Centrally in the methodology are the following elements:

- Performance indicators, providing insight into the current size and recent trends within the function and sub-functions. Economic and employment indicators have been assessed.
- External drivers, i.e. external developments that are of influence for the past and future development of the (sub-)function.

The sub-functions are summarised in this chapter, while **sub-function factsheets** presenting further details on each sub-function are included in Annex 3, including key references to sub-function specific literature. These factsheets are based on underlying **function profile reports** (internal working documents that will be further elaborated for selected sub-functions), which contain a more extensive overview of relevant sources. For the selected sub-functions in Work Package 2 a further exhaustive in-depth publication analysis is foreseen, thus providing the state of the art in insight and knowledge on the selected sub-functions.

In addition, Work Package 2 includes an extensive interview programme with relevant actors and stakeholders in a selected set of sub-functions. An overview of proposed interviews is included in Annex 2.

### **Selection of sub-functions for in-depth analysis (section 3.3)**

On the basis of their characteristics a first selection of 21 sub-functions is made consisting of:

- the top-7 biggest sub-functions of today,
- the top-7 fastest growers over the last five years, and
- the top-7 sub-functions in terms of their future potential.

Sensitivity tests are made to test the robustness of the resulting selection.

On the basis of the above selection a proposal is made for the further selection of (clusters of) sub-functions that will be retained for further elaboration and in-depth analysis in Work package 2.

## 3.2 Maritime functions and sub-functions

### 3.2.1 Maritime functions

As a first step, a clear definition of each **maritime function** has been made. For each of the six functions, profiles describing the key characteristics of the function and the main underlying sub-functions are drafted. A short summary of each function is provided below. An extensive review of the functions is presented in the function profile reports, which will be presented at a later stage. The key findings per sub-function have been elaborated in the factsheets, which are presented in Annex 3.

#### Function 1: Maritime transport and shipbuilding

This function concerns the transport of goods by sea and the services associated to this. Traditionally, the prime function of seas and oceans is **sea trade and sea transport**. More than 90% of the EU external freight trade is seaborne – and on-going globalisation has made this flow ever more important. Furthermore, short-sea shipping represents 40% of intra-EU exchange in terms of ton-kilometres.<sup>2</sup> Sea transport is seen as a relatively sustainable mode of transport although the sector will face significant challenge to improve its environmental performance. The long tradition of sea navigation in many European countries has led to a relatively strong development of **maritime services** that support the sea trade and sea transport function (ranging from brokerage and insurance to classification and inspection and education and R&D). **Sea ports** are also part of the function as nodes of freight handling and concentrations of services as well as employment. Finally, the **shipbuilding industry** contributes to this function by providing the necessary equipment, which does not only cover ships but also the marine equipment in which European industries play an important role (Ecorys, 2009).

#### Function 2: Food, nutrition, health and eco-system services

This function concerns the capacity of the maritime system to supply resources for direct consumption or for procession into food products or other consumer products. Historically, the **fishing industry** has been at the forefront of this function, providing the market with valuable proteins. Production and employment in this industry have declined over the last 15 years (Anderson and Guillen, 2009). **Aquaculture** has evolved from a traditional shellfish base (mussel, oyster) to modern fish operations (salmon, seabass, seabream, turbot, cod) which are more resource-intensive (animal feeding, medication, protection, sometimes heat). **Algae production** (exploitation and aquaculture) are still at a very low scale in Europe although some algae products are widely used in the industry (agar agar, carrageenan and alginates for example). Start-up companies are working on the industrialisation of micro-algae growing facilities for producing oils destined to animal feeding, human nutrition (omega-3 and omega-6 for example) and biofuel production. Other uses for marine resources are the **extraction of bio-molecules** for the cosmetics and pharmaceutical industries, which are already using algae components in several products but are also engaged in more R&D to exploit the potential of the marine biodiversity (e.g. research on some marine worms to produce artificial blood).

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<sup>2</sup> EC, COM(2006)275, GREEN PAPER Towards a future Maritime Policy for the Union: A European vision for the oceans and seas, p8.

### Function 3. Energy and raw materials

This function covers the exploration and production of energy and of raw materials on and from the seas. The seas and oceans are expected to play a (an even more) vital role in meeting the future energy demand. Substantial amounts of **oil, gas and methane hydrates** are still to be explored and exploited from the sea, although drilling needs to take place at ever greater depths. **Offshore wind** power offers unprecedented potential, as it allows an up-scaling of the industry and the outputs, as it bypasses the opposition from residents and leaves landscapes untouched. Other offshore renewable energy sources include **wave, tidal, Ocean Thermal Energy Conversion (OTEC) and blue (osmotic) energy**. Finally, in relation to energy production lies the research into **carbon capture and storage (CCS)**, which seeks to make use of empty oil and gas fields and other favourable geological formations.

Besides energy sources, the seas and oceans also contain huge stocks of other **raw materials** and minerals, including iron ore, tin, copper, manganese, gold, sulphides, phosphorites, diamonds, lime and aggregates including siliceous sand and gravel. These raw materials are vital for a wide range of manufacturing sectors, including high-tech manufacturing.

Last but not least, the oceans can be an abundant source of **drinking water** once desalination techniques have been put in place.

### Function 4. Leisure, working and living

This function covers three distinct components. The **leisure** component covers economic activities related to coastal tourism. Because of the presence of the oceans and seas and the attractive natural environment the coastal zone also has an important tourist function. Over the last decade the EU tourism industry has become a sector of major importance in the European economy. According to the European Commission, the EU tourism industry generated in 2006 in its most narrow definition more than 4% of the EU GDP representing almost 8 million jobs (EC 2006a, p.2).. Marine tourism is estimated to represent 3 million jobs (EC 2008c, p4). Besides the tourism sector in coastal regions offers many other employment opportunities, particularly in the service sector. The component of working relates to the approx. 75 million people working in the coastal regions of EU member States (Eurostat 2011). The component of **living** relates to coastal regions as living location for EU citizens. The landward part of the coastal zone plays an important role as a place for human settlement. In 2007, 196 million people or 43% of the inhabitants of the 22 EU Member States lived in EU coastal regions (Eurostat 2009).

### Function 5. Coastal protection

**Coastal protection** is different from the other sectors as it is not an economic function in itself, but rather a *conditio sine qua non* for the use of coastal areas and for allowing other functions to flourish. Still its economic relevance might be substantial, and massive efforts in research and technological development are made to improve sustainable and safe coastal regions. Because of its specific nature we have chosen therefore to define coastal protection as a separate maritime function rather than including it in one of the other functions.

### Function 6. Maritime monitoring and surveillance

This function concerns the monitoring and surveillance of activities taking place at seas, as well as the monitoring of the environmental state and development of the seas and coastal areas in which these activities take place. Especially since the 9/11 event, the international political attention for **maritime surveillance** has increased extensively. With regard to international relations this mainly falls within the maritime transport function (think of ISPS code, port state control requirements, container scans etc.). Furthermore international awareness for security on the high seas has raised,

for example through coordinated actions against piracy. The Integrated Maritime Surveillance initiative was launched by the European Commission (EC 2009f), following the adoption of its IMP.

Whereas maritime surveillance is mostly focused on human related activities, **environmental monitoring** addresses the physical, biological, chemical etc. state of the seas and oceans. This is an increasingly important area in relation to marine observation, management of marine resources marine research and climate change issues.

### 3.2.2 Identified sub-functions

In line with our methodology sub-functions are identified within the functions, which consist of delineated sub-sets of economic activities representing a separate value chain. The following table summarises all sub-functions that have been identified per function. For each sub-function a very short description is included.

**Table 3.1 Overview of sub-functions**

Function	Sub-function	Short description
1. Maritime transport and shipbuilding	1.1 Deepsea shipping	International (freight) transport by sea with large vessels that often sail fixed routes (containers, major bulks) or tramp shipping.
	1.2 Shortsea shipping (incl. RoRo)	National and international freight transport within Europe and to/from neighbouring countries with medium sized ships. The same segments are found as under deepsea shipping.
	1.3 Passenger ferry services	Transporting passengers on fixed sea routes, national and international. Mainly intra-European. Sometimes this is combined with RoRo transport.
	1.4 Inland waterway transport.	Freight transport on inland waterways in Europe, consisting of both fixed link services and tramp services.
2. Food, nutrition, health and eco-system services	2.1 Catching fish for human consumption	Extracting wild natural resources (i.e. fish, crustaceans, molluscs, algae, etc.) for human consumption. The final product is either raw or processed fish.
	2.2 Catching fish for animal feeding	Extracting wild natural resources (essentially fish) for animal consumption. The final product is mainly fishmeal and fish oil, which can be used by agriculture and aquaculture.
	2.3 Growing aquatic products	Farming of aquatic organisms, mainly for human consumption (mainly fish and molluscs)
	2.4 High value use of marine resources (health, cosmetics, well-being, etc.)	Using wild and farmed aquatic living resources as precursors of bio-molecules used for high value products. It is about unravelling the potential of the biodiversity of a specific earth compartment for the benefit of the rest of the economy.
	2.5 Agriculture on saline soils	Development of agriculture on saline soils, through improving existing crops or adapting salt tolerant plants.
3. Energy and raw materials	3.1 Oil, gas and methane hydrates	Extraction of liquid fossil fuels from offshore sources
	3.2 Offshore wind energy	Construction of wind parks in marine waters, and exploitation of wind energy by generating electricity offshore
	3.3 Ocean renewable energy resources (wave, tidal, OTEC, thermal, biofuels, etc.)	Offshore development and exploitation of a variety of renewable energy sources excluding wind, including wave energy, tidal energy, Ocean Thermal Energy Conversion, Blue energy (osmosis) and biomass.
	3.4 Carbon capture and storage	Caption of CO2 at large emitters and ship these to empty



Function	Sub-function	Short description
	3.5 Aggregates mining (sand, gravel, etc.) 3.6 Marine mineral resources 3.7 Securing fresh water supply (desalination)	offshore fields and other favourable geological formations for long term storage as a means to contribute to sustainability targets. Extraction of marine aggregates (sands and gravels) from the seabed. Deep sea mining of raw materials other than aggregates., including critical materials which have a risk of supply shortage Desalination of sea water for fresh water usage (agriculture irrigation, consumer & commercial use)
4. Leisure, working and living	4.1 Coastline tourism 4.2 Yachting and marinas 4.3 Cruise including port cities 4.4 Working 4.5 Living	Shore based sea related tourist and recreational activities. Construction and servicing of seaworthy leisure boats and the required supporting infrastructure including marina ports. Tourism based on people travelling by cruise ship, having the ship itself as their home base of holidays and making visits to places passed during the trip. Employment and economic activities taking place in coastal regions. Residential functions and associated services in coastal regions.
5. Coastal protection	5.1 Protection against flooding and erosion 5.2 Preventing salt water intrusion 5.3 Protection of habitats	Monitoring, maintaining and improving the protection of coastal regions against flooding and erosion. Measures associated with coastal protection works aiming at the prevention of salt water intrusion as a measure to protect fresh water functions in coastal regions. Measures associated with coastal protection works aiming at protecting natural habitats.
6. Maritime monitoring and surveillance	6.1 Traceability and security of goods supply chains 6.2 Prevent and protect against illegal movement of people and goods 6.3 Environmental monitoring	Equipment and services used for security purposes in the field of maritime transportation. Monitoring and surveillance of the EU coastal borders using a variety of services, technologies and dedicated equipment. Marine environmental monitoring is not a clear-cut function. It may cover water quality, temperature, pollution, fisheries etc.

From these sub-functions a selection is made of sub-functions on the basis of size, growth and future potential. The sub-functions 4.4 “Working on coastal areas” and 4.5 “Living in coastal areas” are excluded from this selection as these are not directly economic activities themselves but mainly are the reflection of activities in other sub-functions or important (external) drivers for other functions, such as coastal protection (5.1), water supply (3.7), or energy demand (3.1-3.3).

### 3.3 Selection of sub-functions for in-depth analysis

Within the Blue Growth study we have made a selection of the most relevant sub-functions that are retained for a further in-depth analysis on their future potential. As a first step 21 sub-functions are selected on the basis of:

- their current size (7);
- their historical growth (7); and

- their future potential (7)

As explained earlier, a further selection of the most promising sub-functions is made. In doing so various interrelated sub-functions are clustered for various reasons which will be explained later (see section 3.3.4). Furthermore account is taken of ongoing research work by DG MARE as to prevent overlap with other work and keep this study complementary.

### 3.3.1 Selection of the top-7 biggest sub-functions of today

#### Methodology

For the selection of today's largest sub-functions in terms of their economic importance, we have used two primary indicators, viz. value added (in Euro) and employment. In those cases where value added data could not be obtained, turnover or production value figures have been taken as a proxy for the order of magnitude.

It is noted that for several functions, available statistical data do not distinguish between sub-functions. For instance data on employment in shipping does not give figures for deep sea or short sea shipping separately. Indicatively the relative importance of each sub-function can be estimated using function specific indicators, in this case for the example the volumes of cargo transported. In the underlying function reports, these estimates are given. In the main table below the overall data are presented, while for the selection of the top-7 sub-functions the underlying function specific data have been used as necessary.

#### Results

The table below present the main size indicators for each of the sub-functions, along with comments or notions where these are applicable. As mentioned in section 3.1, a sub-function entails an entire value chain and thus goes beyond the scope of just one maritime sector. This implies that for instance figures on value added or employment are bigger than those of the core sector only (example: employment in the deepsea shipping sub-function not only covers ship's crews but also employment in associated shipbuilding, port services and other related economic activities). This may also cause some double-counting between sub-functions as some supportive sectors may contribute to multiple functions and data could not always be split.

**Table 3.2 Indicative size of sub-functions**

	Current size		Sources	Comments
Function / sub-function	Value added (€ bn)	Employment (*1000)		(See annex 4 for further elaboration and underlying data)
1. Maritime transport and shipbuilding				
1.1 Deepsea shipping	106	1,402	Eurostat database (2011)	Data 2007; share in total shipping based on freight volumes
1.2 Shortsea shipping (incl. RoRo)	63	823	Eurostat database (2011)	Idem
1.3 Passenger ferry services	20	200-300	Eurostat database (2011) (passenger statistics), Annual reports of operators (staff data)	Data 2009; employment calculated based on staff/pax for several large operators. GVA share assumed relative to employment

	Current size		Sources	Comments
Function / sub-function	Value added (€ bn)	Employment (*1000)		(See annex 4 for further elaboration and underlying data)
1.4 Inland waterway transport	6	43	Eurostat database (2011)	Data 2007
<b>2. Food, nutrition, health and eco-system services</b>				
2.1 Catching fish for human consumption	7.9	200-240	Anderson and Guillen 2009	Data 2007
2.2 Catching fish for animal feeding	0.2	5.7	Eurostat database (2011)	Data 2007
2.3 Growing aquatic products	3.3	64	Eurostat database (2011), Framian 2007	Production data 2007, employment data 2005
2.4 High value use of marine resources (health, cosmetics, well-being, etc.)	0.6	<0.5	Lloyds Evans (2005) (turnover), own estimate for employment	Assumed 1/3 of world production in EU
2.5 Agriculture on saline soils	<0.25	<0.5	no data, own estimate based on literature (see annex 3 on this specific sub-function)	
<b>3. Energy and raw materials</b>				
3.1 Oil, gas and methane hydrates	107-133	25-50	Eurostat database (2011) + own estimate for offshore share	Data appear unreliable; probably much larger
3.2 Offshore wind energy	1.3	7	EWEA (2010), Euroobserver (2010)	Share based on MW installed offshore compared to onshore
3.3 Ocean renewable energy resources (wave, tidal, OTEC, thermal, biofuels, etc.)	<0.25	<0.5	Own estimate based on installed power. Data IEA (2011)	
3.4 Carbon capture and storage	<0.25	<0.5	No data, own estimate based on literature (see annex 3)	
3.5 Aggregates mining (sand, gravel, etc.)	0.7	4.3	Eurostat database (2011); British Geological survey (2007)	Offshore share estimated. Employment estimate based on UK data
3.6 Marine mineral resources	<0.25	<0.5	No data, own estimate based on literature (see annex 3)	
3.7 Securing fresh water supply (desalination)	0.7	7	Global Water Intelligence (2010)	EU share estimated at 10% of global industry
<b>4. Leisure, working and living</b>				
4.1 Coastline tourism	121	2,350	ECB (2011) (GVA), Eurostat database (2011) (employment)	GVA calculated based on assumed share in EU total

	Current size		Sources	Comments
Function / sub-function	Value added (€ bn)	Employment (*1000)		(See annex 4 for further elaboration and underlying data)
4.2 Yachting and marinas	23.4	253	Ecotec (2006)	Data for 2005.
4.3 Cruise including port cities	14.1	143	European Cruise Council (2010)	Based on expenditure data for 2009
4.4 Working	4,108	75.1 mln	Eurostat database (2011)	GVA in coastal regions (NUTS 3), 2008 data
4.5 Living	n/a	177 mln	Eurostat database (2011)	Population in coastal regions (NUTS-3), 2008 data
<b>5. Coastal protection</b>				
5.1 Protection against flooding and erosion	1.0-5.4	10-50	EuroSION (2004), IPCC (2009), EC (2004), Hinkel (2010) (GVA), own estimate (employment)	2008 data
5.2 Preventing salt water intrusion	<0.25	<0.5	no data, own estimate based on literature (see annex 3)	Sub-function is strongly linked to 5.1
5.3 Protection of habitats	<0.25	<0.5	no data, own estimate based on literature (see annex 3)	Sub-function is strongly linked to 5.1
<b>6. Maritime monitoring and surveillance</b>				
6.1 Traceability and security of goods supply chains	0.6-1	5-10	Own estimate based on EC (2006)	Figures include only direct costs related to transport related activities. Based on fleet size & investment & operating costs
6.2 Prevent and protect against illegal movement of people and goods	1.1	10	Own estimate based on EC (2006)	Figures include only direct costs related to transport related activities, whereas the activity is wider than this. Figure calculated based on costs per port
6.3 Environmental monitoring	0.1-0.2	1-1.5	Ecorys (2010)	Sub-function still in early stage of its development

The resulting data on value added and employment are higher than those found in the study of Policy Research Corporation (2008), which is mainly due to the broader definition of maritime functions chosen here as compared to the 'areas' defined in their study, which were more concentrated on specific economic sectors. Secondly their study covered three maritime areas whereas now several other maritime functions are also taken into account. Furthermore some changes are related to development over time between their study and the current situation.

On the basis of the above data the following top-7 most important sub-functions in size/volume are identified, ranked by size. The ranking is based on both indicators by taking the sum of GVA \* 10 + employment assuming a ballpark figure of € 100,000 GVA per employee (if in the above table, ranges are given, the average of the range was taken).

**Table 3.3 Top-7 sub-functions based on current size**

Rank	Sub-function	GVA (mln EUR)	Employment (*1000)	Score
1	4.1 Coastline tourism	121	2,350	1,780
2	1.1 Deepsea shipping	106	1,402	1,235
3	1.2 Shortsea shipping	63	823	725
4	3.1 Oil, gas and methane hydrates	120	37.5	620
5	4.2 Yachting and marinas	23.4	253	245
6	1.3 Passenger ferry services	19	250	220
7	2.1 Catching fish for human consumption	7.9	236	160

The robustness of this top-7 selection has been tested by assessing the resulting rank if data from previous years would be taken. The test results are presented in annex 4. from these tests it is concluded that the top-7 list would be the same and therefore is robust for data used.

### 3.3.2 Selection of the top-7 fastest growers over the last 5 years

#### Methodology

For selecting the top-7 sub-function on the basis of the highest relative growth in the past 5 years, the same indicators have been applied as for selecting the currently largest sub-functions, i.e. added value and employment. Based on the available time series data, compound annual growth rates have been calculated. Where available these are based on GVA and employment data, or alternatively using other indicators resembling economic growth. This is then indicated in the comments column. If no quantitative data could be found for this, qualitative scores have been applied (- / 0 / +).

#### Results

The table below present growth rates where data have been available. Again this entails the growth of the entire sub-function including all related underlying economic sectors. In addition a number of specific remarks and notions are made.

**Table 3.4 Recent relative growth of sub-functions**

	Recent growth		Sources	Comments
Function / sub-function	Value added (€ bn)	Employment (*1000)		(See annex 4 for further elaboration and underlying data)
1. Maritime transport and shipbuilding				
1.1 Deepsea shipping	8.5%	4.0%	Eurostat database (2011)	Data for 2002-2007
1.2 Shortsea shipping (incl. RoRo)	6.1%	6.1%	Ecorys (2009)	Data for 2002-2007. Based on volume growth of intra-EU
1.3 Passenger ferry services	0/+	-0.2%	Eurostat database (2011)	Based on trend in passengers, data 2004-2009
1.4 Inland waterway transport	0	0/-	no data; based on sector specialists' statements	
2. Food, nutrition, health and eco-system services				

	Recent growth		Sources	Comments
Function / sub-function	Value added (€ bn)	Employment (*1000)		(See annex 4 for further elaboration and underlying data)
2.1 Catching fish for human consumption	4.0%	-4.0%	Anderson and Guillen (2009)	Data for 2003-2007
2.2 Catching fish for animal feeding	-5.8%	-	Green (2010)	Based on production decline 1998-2008
2.3 Growing aquatic products	4.6%	+	Eurostat (2010)	Based on production value increase 1998-2008
2.4 High value use of marine resources (health, cosmetics, well-being, etc.)	+	+	no data, score based on literature review (see annex 3)	Sub-function still in early stage of its development
2.5 Agriculture on saline soils	+	+	no data, score based on literature review (see annex 3)	Sub-function still in early stage of its development
<b>3. Energy and raw materials</b>				
3.1 Oil, gas and methane hydrates	-4.8%	-4.8%	Eurostat database (2011)	Data for 2003-2008, based on production of oil & gas
3.2 Offshore wind energy	21.7%	21.7%	Eurostat database (2011)	Data for 2003-2008, based on growth of energy output
3.3 Ocean renewable energy resources (wave, tidal, OTEC, thermal, biofuels, etc.)	+	+	no data, score based on literature review (see annex 3)	Sub-function still in early stage of its development
3.4 Carbon capture and storage	+	+	no data, score based on literature review (see annex 3)	Sub-function still in early stage of its development
3.5 Aggregates mining (sand, gravel, etc.)	5.9%	-0.4%	Eurostat database (2011)	Data 2004-2008. Based on total production (land + sea)
3.6 Marine mineral resources	0/+	0/+	no data, score based on literature review (see annex 3)	Sub-function still in early stage of its development
3.7 Securing fresh water supply (desalination)	12.3%	12.3%	Global Water Intelligence (2010)	
<b>4. Leisure, working and living</b>				
4.1 Coastline tourism	2.8%	2.8%	Eurostat database (2011)	data for 2003-2008, based on tourist growth
4.2 Yachting and marinas	5.0%	+	SRN/Ecorys/ Euromapping (2007)	
4.3 Cruise including port cities	12.3%	12.3%	European Cruise Council (2010)	Data 2005-2009, CAGR, output growth
4.4 Working	4.5%	4.5%	Eurostat database (2011)	data 2003-2008, growth of total GVA in coastal regions
4.5 Living	0.1%	0.1%	Eurostat database (2011)	growth of inhabitants
<b>5. Coastal protection</b>				
5.1 Protection against	4.0%	+	Eurosion (2004)	based on 7 year old data

	Recent growth		Sources	Comments
Function / sub-function	Value added (€ bn)	Employment (*1000)		(See annex 4 for further elaboration and underlying data)
flooding and erosion				
5.2 Preventing salt water intrusion	+	+	no data, score based on literature review (see annex 3)	Will growth with the pace of coastal protection, faster due to sea level rise
5.3 Protection of habitats	+	+	no data, score based on literature review (see annex 3)	Will grow with increased attention for nature development
<b>6. Maritime monitoring and surveillance</b>				
6.1 Traceability and security of goods supply chains	+	+	no data, score based on literature review (see annex 3)	
6.2 Prevent and protect against illegal movement of people and goods	+	+	no data, score based on literature review (see annex 3)	
6.3 Environmental monitoring	+	+	no data, score based on literature review (see annex 3)	

In order to rank the top-7 growers, the average of both indicators has been calculated. Where qualitative scores were given, + has been valued at 2.5% growth, - at 2.5% decline, and 0 at zero.

On the basis of this method we have come to the following top-7 fastest growers.

**Table 3.5 Top-7 sub-functions on the basis of recent growth**

Rank	Sub-function	GVA (mIn EUR)	Employment (*1000)	Score
1	3.2 Offshore wind energy	21.7%	21.7%	21.7
2	4.3 Cruise including port cities	12.3%	12.3%	12.3
3	3.7 Securing fresh water supply (desalination)	12.3%	12.3%	12.3
4	1.1 Deepsea shipping (& 1.2 shortsea shipping)	8.5%	4.0%	6.2
5	4.2 Yachting and marinas	5.0%	+	3.8
6	2.3 Growing aquatic products	4.6%	+	3.6
7	5.1 Protection against flooding and erosion	4.0%	+	3.3

Again the robustness of this selection has been tested by making similar calculations for other year series. The results of this are presented in Annex 4. From these tests it is concluded that the selection is robust for the data applied.

### 3.3.3 Selection of the top-7 high potential sub-functions

#### Methodology

The third set of 7 sub-functions is based on their future outlook. That is, the sub-functions that are *most promising to result in genuine new activities/markets in the future*. They are considered to be *the inspiring areas on which future projects could focus*. For selecting these, the methodology can

not be based on mere statistics, first of all because the future lies still ahead of us, and secondly because the future potential calls for a broader set of indicators.

A number of (qualitative) indicators are used to assess the future potential of sub-functions. These are combined with a number of key external drivers which will determine their importance in future:

- Innovativeness, i.e. the relevance of R&D and innovations into technology improvements or new applications for the sub-function.
- Potential for competitiveness of EU industry, in comparison to the global industry in the respective segments
- Employment creation (including attention to geography)
- Relevance for EU-based policy initiatives
- Spill-over effects and synergies with other sub-functions
- Sustainability and environmental considerations

For each area of relevance, scores have been given based on expert views derived from the function teams. The overall score is defined by summing the scores of the underlying areas. Scores are based on the analysis of each sub-function including all associated economic components, which can be found in annex 3.

Sub-functions that are currently rather mature are expected to score lower on **innovation**, since they are further in their life cycle. Analysis of these sub-functions indicates that technology development is mainly process oriented or covering improvements of existing technologies. Sub-functions that are still in their development phase however are expected to strongly impact on innovation, as this area will define the feasibility of realising the future potential of the segment. In many sub-functions the success of technological breakthrough is the basis for commercialisation.

The indicator **competitiveness** reflects the expected position of the European industries in the respective sub-function in the future. In mature sub-functions, this can be a positive score if the segment currently already has a strong position globally and is expected to maintain this. For sub-functions that are mainly regionally oriented, competition with other world regions may be of less relevance.

**Employment** in mature sub-functions is often expected not to further grow substantially. Its relevance however can still be large if overall European employment is high. New sub-functions that are developing will grow, but some will be based more on technology than on job creation.

The **policy relevance** of a sub-function can be viewed from various perspectives. For many sub-functions, the environmental ambitions of the EU2020 strategy are important, because of their contributions to sustainability. This not only holds for developing sub-functions in the energy field, but also for mature sub-functions that seek to improve their environmental impact. Also sub-functions that are mature and declining, such as catching fish for human consumption, remain important from a policy perspective because of the social implications and because of the EU's contribution to global policies for nature conservation and environmental management.

Some sub-functions clearly deliver **spill-over effects** to other sub-functions. This may be through technology transfer or the re-use of facilities.

Although all sub-functions do have a **sustainability** impact, for some these are not automatically positive. For example the deepsea shipping sub-function faces the requirement to green its operations which may be more difficult than for the intra-European oriented shortsea shipping sub-function. While sub-functions such as catching fish or aggregate mining aim to operate with



minimum disturbance to the environment, still impacts often are considered negative. The same holds for oil, gas and methane hydrates. For each of these however policy initiatives are being taken aiming to raise the sustainability levels of these activities.

## Results

The below table gives values for the indicators chosen. These are based on the elaboration of the sub-functions which are included in annex 3. The above scores have been based on expert evaluation, combining views from the functional team leaders with those of the core team. Only three options were applied: +, indicating positive impact of the sub-function on this indicator; 0, indicating stability or no extraordinary change with regard to this indicator, or -, if decline or negative impact is expected. In some cases of doubt or uncertainty the score '?' is applied.

Overall scores are defined as the sum of all '+' scores minus the sum of all '-' scores.

**Table 3.6 Future potential of sub-functions**

Function	Sub-function	Indicator						Overall score
		Innovativeness	Competitiveness	Employment creation	Policy relevance	Spill-over effects	Sustainability	
1. Maritime transport and shipbuilding	1.1 Deepsea shipping	0	+	-	0	0	-/+	0
	1.2 Shortsea shipping (incl. RoRo)	0	0	0	+	0	+	++
	1.3 Passenger ferry services	0	0	0	+	0	+	++
	1.4 Inland waterway transport	-	+	0	+	0	+	++
2. Food, nutrition, health and eco-system services	2.1 Catching fish for human consumption	+	-	0	+	-	-/+	0
	2.2 Catching fish for animal feeding	+	-	0	+	-	-/+	0
	2.3 Growing aquatic products	+	+	+	+	?	?	++++
	2.4 High value use of marine resources (health, cosmetics, well-being, etc.)	+	+	+	+	+	+	+++++
	2.5 Agriculture on saline soils	+	?	+	+	?	+	++++
3. Energy and raw materials	3.1 Oil, gas and methane hydrates	+	0	-	+	+	0	+
	3.2 Offshore wind energy	+	+	+	+	+	+	+++++
	3.3 Ocean renewable energy resources (wave, tidal, OTEC, thermal, biofuels, etc.)	+	+	?	+	+	+	+++++
	3.4 Carbon capture and storage	+	+	-	+	+	0	+++
	3.5 Aggregates mining (sand, gravel, etc.)	0	0	+	0	0	-	0
	3.6 Marine mineral resources	+	+	?	+	+	?	++++
	3.7 Securing fresh water supply (desalination)	?	0	?	+	?	+	++
4. Leisure, working and living	4.1 Coastline tourism	0	0	+	0	+	0	++
	4.2 Yachting and marinas	+	+	+	0	+	0	++++
	4.3 Cruise including port cities	+	+	+	0	+	0	+++++
	4.4 Working	0	0	0	0	0	0	0
	4.5 Living	0	0	0	0	0	0	0
5. Coastal protection	5.1 Protection against flooding and erosion	+	+	+	+	+	+	+++++

Function	Sub-function	Indicator						Overall score
		Innovativeness	Competitiveness	Employment creation	Policy relevance	Spill-over effects	Sustainability	
	5.2 Preventing salt water intrusion	?	0	?	+	?	+	++
	5.3 Protection of habitats	?	0	?	+	?	+	++
6. Maritime monitoring and surveillance	6.1 Traceability and security of goods supply chains	+	+	+	+	+	0	+++++
	6.2 Prevent and protect against illegal movement of people and goods	+	?	0	+	+	0	+++
	6.3 Environmental monitoring	+	+	0	+	+	+	+++++

From the above table, the following top-7 set is derived (ranked by score).

**Table 3.7 Top-7 sub-functions based on future potential**

Rank	Sub-function	Score
1	2.4 High value use of marine resources (health, cosmetics, well-being, etc.)	6+
	3.2 Offshore wind energy	6+
	5.1 Protection against flooding and erosion	6+
4	3.3 Ocean renewable energy resources (wave, tidal, OTEC, thermal, biofuels, etc.)	5+
	6.1 Traceability and security of goods supply chains	5+
	6.3 Environmental monitoring	5+
7	3.6 Marine mineral resources <sup>3</sup>	4+

### 3.3.4 Proposal for sub-functions to be analysed in-depth

The overview of the three sets of 7 sub-functions is presented in the following table.

**Table 3.8 Sets of top-7 sub-functions ranking in order of size/growth/scores**

Top-7 current size	Top-7 recent growth	Top-7 future potential
4.1 Coastline tourism	3.2 Offshore wind energy	2.4 High value use of marine resources (health, cosmetics, well-being, etc.)
1.1 Deepsea shipping	4.3 Cruise including port cities	3.2 Offshore wind energy
1.2 Shortsea shipping (incl. RoRo)	3.7 Securing fresh water supply (desalination)	5.1 Protection against flooding and erosion
3.1 Oil, gas and methane hydrates	1.2 Shortsea shipping (& 1.1 deepsea shipping)	3.3 Ocean renewable energy resources (wave, tidal, OTEC, thermal, biofuels, etc.)
4.2 Yachting and marinas	4.2 Yachting and marinas	6.1 Traceability and security of goods supply chains
1.3 Passenger ferry services	2.3 Growing aquatic products	6.3 Environmental monitoring

<sup>3</sup> Several sub-functions were reaching the same score (4+). Of these, sub-functions 2.3 Growing aquatic products, 3.6 Marine mineral resources, 4.2 Yachting and marinas and 4.3 Cruise including port cities are already covered through the top-7 of recent growers Sub-function 2.5 Agriculture on saline soils is expected to remain smaller than 3.6 Marine mineral resources, 3.4 Carbon Capture and Storage is proposed to be linked to 3.1 Oil, gas and methane hydrates.

Top-7 current size	Top-7 recent growth	Top-7 future potential
2.1 Catching fish for human consumption	5.1 Protection against flooding and erosion	3.6 Maritime raw materials

In total, the three top-7 lists result in 17 sub-functions, due to overlap between the three categories. The fact that few of the highest ranked sub-functions are included in more than one group indicates that the maritime economy is changing.

### Methodology

The project proposal did foresee in a selection of 12 sub-functions to be retained for further in-depth analysis in the subsequent Work Package. While working on the selection it was decided to include an additional sub-function as to create a comprehensive set covering the broad maritime context. The selection is explained in this section.

To arrive at a final selection first a number of sub-functions have been combined since they are logically connected.

- The 3.1 and 3.4 offshore energy sub-functions have interactions and it may well be that market players currently active in 3.1 (oil & gas) will shift their resources and activities to 3.4 Carbon Capture and Storage. Also equipment used will be similar and ownership may be an incentive to become involved in CCS activities. This implies that the value chains are highly correlated and would benefit from bringing these sub-functions together for the cluster analysis.
- 4.2 Yachting and marinas seems to be growing mainly in combination with tourism growth, based on factors like welfare, aging and population growth. The demand for yachting and especially for the construction and operation of marina port infrastructure is largely located on coasts and cooperates with other coastal tourism facilities. It is therefore proposed to look at its potential within 4.1 Coastline tourism. Technology trends may also become visible within 4.3 cruise tourism.
- 6.1 Traceability and security of goods supply chains will also cover technologies developed that relate to 6.2 Prevent and protect against illegal movement of people and goods, as both are highly government driven and technologies developed have large spill-overs between the two sub-functions.

The proposed list of sub-functions is selected using the following criteria:

1. select all top-7 with regard to future potential
2. add to this sub-functions that have shown strong recent growth
3. add to this the largest of the top-7 with regard to current size if they are also showing (smaller or larger) recent growth and if the list hasn't arrived at the desired number of sub-functions yet

This methodology ensures that a focus is laid with sub-functions that are important in terms of their future potential, and that may need policy support to enable maturing. On the other hand this selection mechanism leaves sufficient basis for covering mature sectors that are currently large and therefore important in terms of their contribution to the EU's economy. Especially if no decline is expected for the future it will be important for Blue Growth policy measures to ensure maintaining this contribution. Notice is made of the fact that some of these are so large currently that they may not be passed in size by any of the future potential sub-functions within the next decade, because of the large difference in baseline.

Based on these selection criteria, the following 13 sub-functions are proposed:

- 1.2 Shortsea shipping (incl. RoRo)

- 2.3 Growing aquatic products
- 2.4 High value use of marine resources (health, cosmetics, well-being, etc.)
- 3.1 + 3.4 Oil, gas and methane hydrates i.c.w. Carbon Capture and Storage
- 3.2 Offshore wind energy
- 3.3 Ocean renewable energy resources (wave, tidal, OTEC, thermal, biofuels, etc.)
- 3.6 Marine mineral resources
- 3.7 Securing fresh water supply (desalination)
- 4.1 + 4.2 Coastal tourism i.c.w. yachting and marinas
- 4.3 Cruise including port cities
- 5.1 Protection against flooding and erosion
- 6.1 + 6.2 Traceability and security of goods supply chains / Prevent and protect against illegal movement of people and goods
- 6.3 Environmental monitoring

If the list would be limited to the original 12 sub-functions included in the project proposal, sub-function 3.1 Oil, gas and methane hydrates would not be selected. The consultant however considers this of sufficient importance to extend the scope of the study.

Several of the larger sub-functions thus are not proposed in the list of selected sub-functions. For instance sub-function 1.1 Deepsea shipping is not covered but 1.2 Shortsea shipping was chosen because of the latter's stronger link to European policy and to the European ability to steer the development of this sub-function. On the other hand it should be noted that many trends and developments in the shortsea segment cannot be separated from deepsea shipping. Therefore while focussing on shortsea shipping, developments arising in the deepsea field affecting this sub-function are automatically covered.

Also sub-function 2.2 Catching fish for human consumption is not selected. Currently this segment is quite large (in the top-7 of today), but it is already receiving substantial attention in ongoing policy and research initiatives of DG MARE, which do not need to be repeated as this study aims to be complementary to ongoing work (see also Chapter 2.1 above).

The sub-functions 5.2 Preventing salt water intrusion and 5.3 Protection of habitats are strongly linked to 5.1 Protection against flooding and erosion, especially through the working with nature principles that are more and more applied in this area. Therefore relevant developments for these sub-functions will be covered through the analysis of sub-function 5.1 Protection against flooding and erosion.

Additionally for the work of WP2 the following is noted:

- 1.2. Shortsea shipping: with respect to RoRo traffic we also cover the RoRo ferry services with the remark that data will not always allow to distinguish between pax/RoRo ferries completely.
- 3.3 Offshore renewables other than wind contains a great variety of techniques to produce energy from renewable sea resources. Their principles may however greatly vary and therefore for a further analysis it will be necessary to distinguish between each of them. Some categories may promise a bright future while others may not be among the most promising future components of this sub-function. For WP2 it is proposed to analyse them and elect which components to be given focus.



## 4 Scenarios

### 4.1 Introduction

#### 4.1.1 *The role of scenarios*

As the Blue Growth study is directed at the future there is a clear need to develop different alternative scenarios as part of the foresight process. Based on an in-depth analysis of key drivers and foresight of cutting-edge technology and innovation, the study should, according to the Terms of Reference “*sketch sustainable economic growth scenarios to guide future policy strategies covering all relevant maritime policy areas as well as for programming research, technological development and innovation activities*”. These scenarios should cover the period from 2010 to 2025.

“Nobody can predict, therefore one should not try. The only relevant discussions about the future are those where we succeed in shifting from the question whether something will happen to the question: What will we do if it happens ?”

Arie de Geus, Former Head of Planning, Shell

These scenarios are not intended to be developed in isolation but should be discussed and tested with relevant stakeholders (industry, academia, NGOs, etc.) given the explorative nature of the study and the relative uncertainty of findings.

In the literature, many definitions of scenarios can be found. Also scenarios are often used in different meanings, e.g. as a policy option, a blueprint, a prediction, a tool to map probabilities, a series of options, one of which can be chosen. Following the purpose of scenarios in this study we have opted for the following definition: ‘*Scenarios are visionary and plausible stories, sketching a coherent picture of possible future developments*’. (Nekkers, 2006). Scenarios understood in this sense are about uncertainty. They focus on developments in the external environment and their consequences for the own organisation. They provide is a guiding line for a strategic conversation: how can we react to uncertain outcomes.

#### 4.1.2 *General scenarios versus micro-futures*

In the Blue Growth project we will use two different types of scenarios (at two levels):

- **General Scenarios.** Background scenarios of at an aggregate level which are adopted as background reference for the study and provide a general understanding of possible future trends with an impact of all maritime functions and all European sea basins; these scenarios are developed based on key external drivers and trends that are most relevant for maritime functions as a whole. General scenarios have a strong top-down character; The general scenarios develop a shared view on the possible pace and direction of future growth (on the basis of different economic assumptions including impact on GDP, price of raw materials, international trade, climate change impacts, social and political stability, path of innovation and economic sustainability, etc. As such they are used to facilitate the strategic conversation amongst stakeholders throughout the project cycle<sup>4</sup>.

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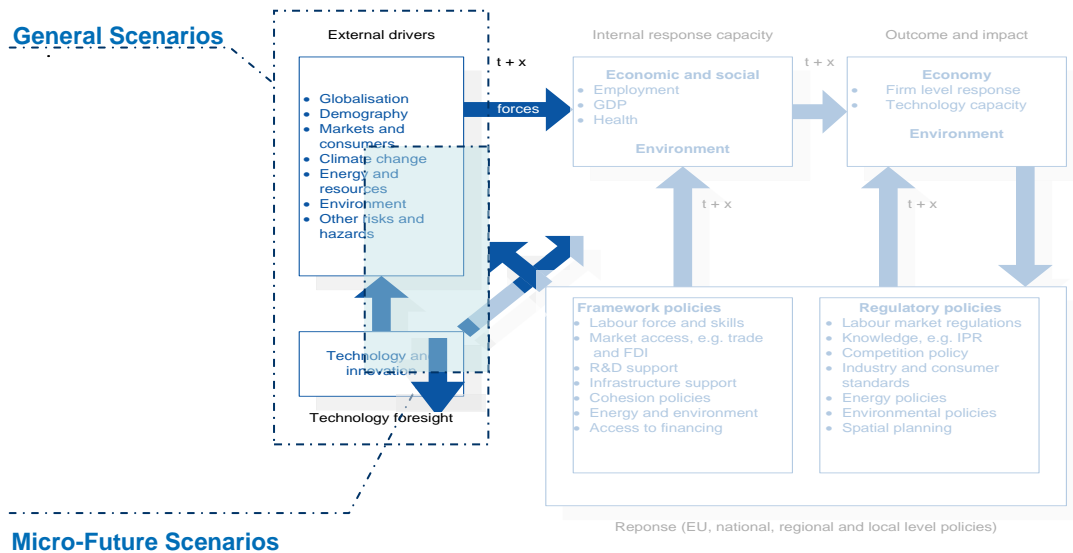
<sup>4</sup> Van der Heijden, K (1996) Scenarios, The art of strategic conversation. Wiley and Sons, Chichester, UK.

- **Micro-Future Scenarios.** Within the overall context of the general scenarios more specific scenarios are developed to determine the true potential of a sub-function. They focus on the key drivers and critical factors that determine whether a function will indeed succeed and might include more detail on e.g. specific tipping points that are relevant (e.g. price levels of oil and raw materials), required technologies and specific economic and/or regulatory impediments and dilemmas that may hinder the development of a sub-function. Opposite to the general scenarios these micro-futures have a strong bottom-up character.

The two levels of scenarios strongly complement each other. Whereas the general scenarios present the background to the development of maritime functions, the micro-future focus on specific determinants and critical factors.

Figure 4.1 below illustrates how scenarios fit in the overall approach of the project. In fact the micro-futures are a more detailed specific sub-set within the overall future framework of the general scenarios that influence the future potential of (sub-)functions.

**Figure 4.1 Role of scenarios in assessing external drivers, presented within the methodological framework**



## 4.2 Methodology

Whereas the two levels of scenarios are interrelated and complementary also the methodology in their development is complementary, reflecting the respective top-down versus bottom-up character of the general scenarios and micro-futures.

### 4.2.1 General scenarios

For the specific development of General Scenarios, the adopted method is based on a “baseline-scenario” and two other different “possible futures” (see among others Stopford, 2009). Stopford highlights the risk of greatly relying on forecasts to understand future development, particularly when it comes to the maritime economy. In fact, he states, “*in theory this technique allows the user of the forecast to understand the sensitivity of the forecast to small changes in assumptions, but in the maritime economy there are many interrelationship which cannot be quantified with sufficient clarity to make this sort of sensitivity totally ‘automatic’*” (p. 723).

The advantage of this scenario approach, if compared to other methodologies such as those historically developed and promoted by Shell<sup>5</sup>, is that it keeps the scenario-planning relatively straightforward by avoiding constructions based on multiple-axis, although also more recent development with scenarios within Shell are moving in a similar direction<sup>6</sup>. The approach is also consistent to the most recent development of the Shell model<sup>7</sup>,

The trends and drivers in the general scenarios are based on the review and assessment of relevant existing international foresight and reports. To ensure that scenarios are based on a robust set of assumptions the results will also be included in the discussion and interview with relevant stakeholders in both in WP II (selected interviews) and WPIII (Intermediate hearing with further relevant stakeholders).

In the methodology in drafting the general scenarios a 4-step approach is followed.

**Table 4.2 Methodological steps in drafting general scenarios**

Step 1. Identification of most important issues to determine how events develop	
	Main emerging issues have been identifying by reviewing and assessing list was developed with existing future scenario studies as a starting point. A full list is provided in the bibliography; two important sources are: 'The world in 2025; rising Asia and socio-ecological transition' by DG-Research (2009) and 'The European Environment; state and outlook 2010' by the European Environment Agency (2010). From these studies major trends and drivers have been identified and attributed to categories (Demography, Economy, Sociology, Technology, Ecology and Politics). The results are included in Annex 6.1.
Step 2. Listing/discussion of key issues to establish the facts that will be important in future.	
	This step was carried out by identifying the most relevant trends and drivers per maritime function. The result is a structured overview of trends and drivers in the maritime functions, connected to trends and drivers on a more global scale. The overview is presented in Annex 6.2.
Step 3. Rank key issues in order of importance and degree of consensus/disagreement	
	Global drivers and trends were ranked in terms of relevance and degree of certainty (see Annex 6.3).
Step 4. A "continuation of present trends" scenario is derived (baseline scenario) and alternative scenarios are established in which the most important variables are changed. The storylines for each of these scenarios are developed in such a way that the scenarios are plausible and internally consistent, while at the same time containing challenging elements. Possible discontinuities are included in the analysis.	
	Apart from the "baseline-scenario", the two alternative scenarios are created by a) identifying two main future developments, based on the most relevant and uncertain driver emerging from the reviewed literature, and then b) constructing two different "narratives" (scenarios) based on the possible implication for those drivers that have emerged as most relevant for all maritime functions.

#### 4.2.2 Micro-futures

Micro-futures will be developed for a selected number of sub-functions following the Hybrid Strategic Scenario method (HSS)<sup>8</sup>, as described in the Technical Proposal of the study. The HSS strategic method is divided into three stages or levels.

<sup>5</sup> Cornelius P., Van de Putte A., Romani M (2005) Three Decades of Scenario Planning in Shell

<sup>6</sup> The main difference being the absence of a "baseline-scenario" in the Shell methodology

<sup>7</sup> [http://www.shell.com/home/content/aboutshell/our\\_strategy/shell\\_global\\_scenarios/](http://www.shell.com/home/content/aboutshell/our_strategy/shell_global_scenarios/)

<sup>8</sup> Miller, Riel, (2007) "Futures Literacy: A Hybrid Strategic Scenario Method", Futures: the journal of policy, planning and future studies, 39, Elsevier, Pp. 341-362



- Level I: **Setting the framework for future expectations (develop a storyline)**. Identification of main driving forces at a generic level that determine the scenarios
- Level II: **Rigorous Imagining**: Constructing in-depth scenarios in more detail and establishing out-of-the box extreme developments that may impact the future.
- Level III: **Develop strategic (micro-future) scenarios**. Synthesizing the results of the previous two stages and making strategic choices.

Taking these levels one step further leads to the following six steps:

**Level I: Setting the framework for future expectations (develop a storyline).**

- step 1. Identification of the trends and possible tipping points that determine the future growth potential (in terms of size, continuity, market share etc), based on the information from the interviews).
  - definition of future growth potential for the sub-function in terms of size, continuity, market share, etc.
  - detailed elaboration of the trends per sub-function as identified in Annex 6.2; if and where possible attribute ranges and probabilities
- step 2. Identification of critical factors
 

These are the preconditions that must be met in order to reach the full potential of the sub-function. Examples are: clear and reliable legislation; availability of exploration technologies for instance for deep sea mining.
- step 3. Development of a set of storylines from combinations of the trends and critical factors
 

Goal of these storylines is to raise awareness and make explicit the views on what is deemed desirable and probable.

**Level II: Rigorous Imagining:**

step 4. Finalisation of alternative futures

The goal of this step is to explore the complete field of possible futures for the sub-function under study, while not being limited by the prevailing notions of desirability or probability. This is achieved by checking the trends and critical factors from step 3 against the external drivers and trends, mentioned in the overview in Annex 6.2.

**Level III: Develop strategic (micro-future) scenarios.**

step 5. Identification of response capacity by the sector

Inventory of response options and their effects

step 6. Composing the actual Micro-Future scenarios

Taking from step 3 the desired direction; from step 4 the probable directions; from step 5 possible roads towards the desired future, alternative futures are defined. Emphasis is put on 'probable' futures. These are derived from step 3 and developed in analogy to the baseline scenario in the General Scenarios, using central estimates wherever available. Next to the 'probable' futures due attention will be given to alternative futures, defined by deviating developments in key trends (step 1), critical factors (step 2) and response capacity (step 5). The question to be answered with these variants is not 'how are the odds of this actually happening' but rather 'how will we react if it does happen'. Because sector responses depend on the external trends these scenarios will be developed in an iterative way.

**Box 4-1 Example of MicroFuture scenario development: Desalination**

*(disclaimer: the example is fictitious, intended only to illustrate the six steps above)*

### **Step 1. Future growth potential**

**Leading question, to be answered by the stakeholders: which uncertain trends determine success or failure of the subfunction?**

The growth is a result of a) increasing demand by economic development (increase in coastal tourism and increase in capital-intensive horticulture), and b) decreasing supply by climate change, leading to more intense and more frequent droughts. Counteracting trends, endangering future growth, are a) a sharp increase in energy prices, and b) environmental considerations related to the effects of desalination (CO<sub>2</sub>-production, brine).

All in all, the demand for desalination is expected to increase, especially in the Mediterranean, from a consumption of X m<sup>3</sup>/day in 2010 to XX m<sup>3</sup>/day in 2025, representing an economic value of XX euro/year and an employment of YY jobs.

### **Step 2. Identification of critical factors.**

- an oil price above X dollar per barrel practically excludes further development of the sector, because of the high energy input required for desalination
- the investment plan must take account of the odds of a series of wet years and subsequent reduction in water demand
- development of technology or scale, leading to a reduction of energy demand by X percent

### **Step 3. Storylines on desirable and probable developments**

**Leading questions, to be answered by the stakeholders: what do the stakeholders expect to happen, what do they prefer?**

- The expected growth of demand for desalinated water is based on expected growth in tourism and horticulture and on regional climate change effects. The resulting baseline scenario for water demand is supplemented with two variants to sketch upper and lower limits of growth.
- Preferred developments: we could assume that the sub-function flourishes (apart from the obvious high growth) under conditions of moderate but stable growth, low volatility in energy and raw material prices: the 'good' or desired scenario. A 'bad' or feared scenario is defined by its opposite: major uncertainties in short-term demand and production costs.

### **Step 4. Rigorous imagining**

**Leading question, to be answered by desk research and presented during the Intermediate Hearing: how could things develop, irrespective of what we wish or think probable?**

In this step, the future potential of desalination is reconsidered taking the six categories of external trends (Annex 6.1: Demography, Economy, Socio-Culture, Technology, Environment, Politics) as a starting point. For example, connecting the trend of globalisation to desalination: Will globalisation favour or harm the European competitive position? Have we been complete in our considerations on relevant technological developments? etc.

The new insights from step 4 result in a revision of the storylines of step 3, based on the most relevant uncertain trends; we assume: a) energy price and b) water demand from tourism and horticulture.

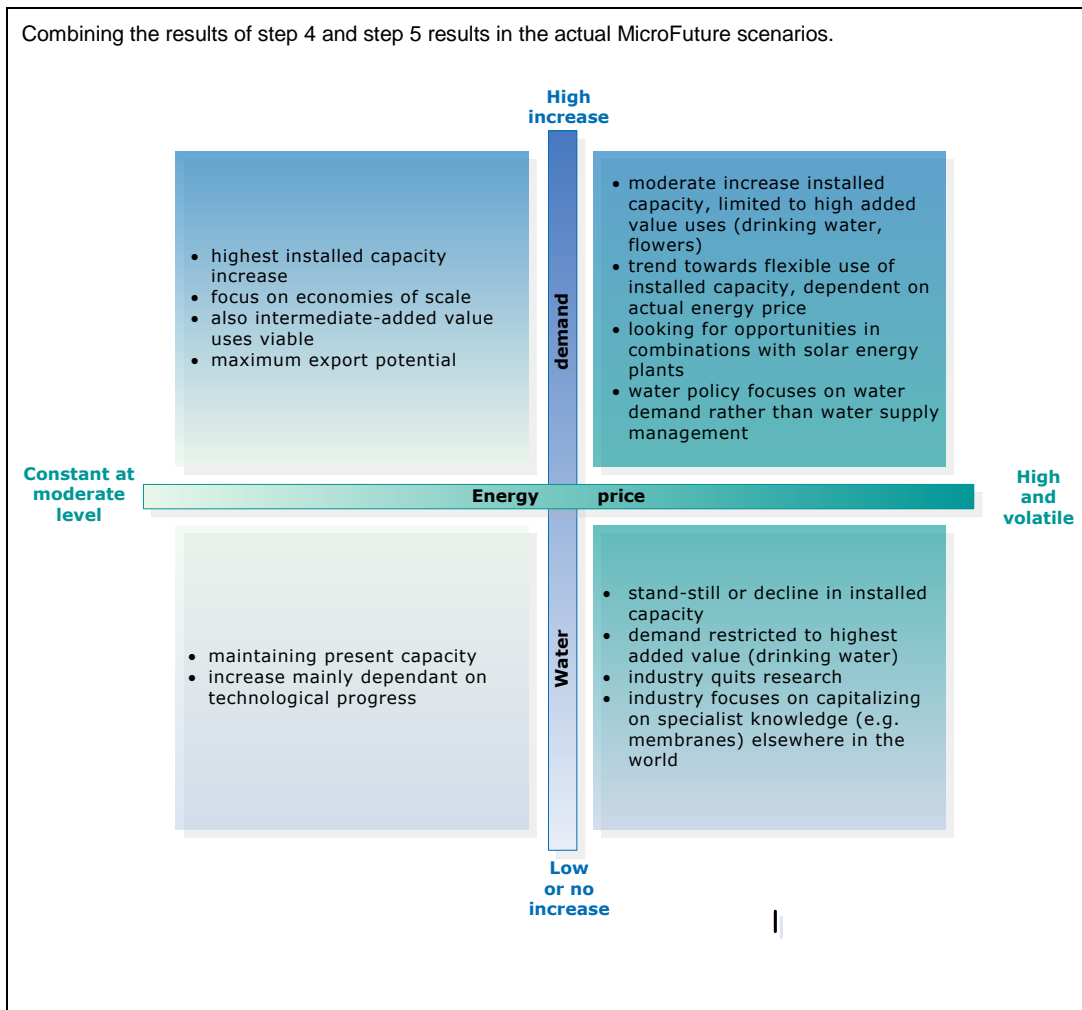
### **Step 5. Response capacity by the sector**

**Leading question, to be answered by the stakeholders and presented & revised during the Intermediate Hearing: What can and will the sector do to adjust to various scenarios**

Develop storylines for potential response by the sector in intermediate scenarios from step 4. For the case of increased demand and increased energy prices, this could involve stepped-up research efforts or development of installations that can be used flexibly, dependent on energy prices. In the case of high and volatile energy prices and low demand, the sector will develop exit strategies, e.g. by focusing on specialist know-how that can be applied in desalination plants elsewhere in the world. .

### **Step 6. Composing the MicroFuture scenarios**

Combining the results of step 4 and step 5 results in the actual MicroFuture scenarios.



In Work Package 1 the General Scenarios have been developed to provide the overall storyline for the micro-futures per sub-function. In Work Packages 2 these micro-futures will be further developed per sub-function as described above. In Work Package 3 the Micro-Future Scenarios will be presented and tested with key stakeholders during the Intermediate Hearing.

### 4.3 Description of the General Scenarios

Based on the methodology described in the previous section three General Scenarios have been developed. The main external factor which drives the alternating storylines (in comparison to the base-line scenario) is the being the extent to which a greater sustainable globalisation or a greater regional fragmentation would influence global economy. Due to the specific focus on sustainable growth of the current study we have focussed our scenarios on the impact of such external trends in reshaping the current trend in low-carbon sustainable economy (i.e. commitment of the private and public sectors in promoting global binding agreements towards a low-carbon economy).

We have then developed a “storyline” for each of the three General Scenarios, by illustrating the consequences of such trends for economic growth, employment (for skilled and un-skilled workers), climate change mitigation, eco-innovation and knowledge-sharing. For each General Scenarios sketched a first assessment of the possible impact for maritime economy is provided, through general description of possible values for key indicators (table. 4.1).

**Table 4.1 General scenarios storyline and key indicators**

Core future trend	Storyline	Key Indicators
<b>Scenario 1: Future as Usual (baseline scenario)</b>		
The future much like today	<ul style="list-style-type: none"> <li>• Mix of international agreements and bi-lateral discussions</li> <li>• Moderate economic growth (and recovery in the mid/long-term)</li> <li>• Sustainability is a concern, although lacking clear global commitment</li> <li>• Growing evidence of climate change, mitigation actions still sub-optimal</li> <li>• Some efforts on developing new green technologies but without much strong commitment from the private sector</li> <li>• Unemployment only partially recovered from crisis</li> </ul>	<ul style="list-style-type: none"> <li>• GDP: Slow catch up to pre-crisis</li> <li>• Employment: High unemployment, employment growing for niches</li> <li>• Energy Prices: High grow, scarcity of resources</li> <li>• Environment (CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>x</sub>): Some mitigation, but not enough</li> <li>• Others: Enduring inequality in/amongst regions, continuing conflicts</li> </ul>
<b>Scenario 2: Low-carbon Global Economy</b>		
Enhanced sustainable globalisation	<ul style="list-style-type: none"> <li>• Mutual trust prevails, prosperity achieved by getting connected</li> <li>• Stronger sustainable economic growth, ensured by eco-innovation</li> <li>• Global commitment in tackling climate change (adaptation/mitigation)</li> <li>• Commitment of the public/private sectors in developing new green technologies: wind, wave, solar in large interconnected units</li> <li>• Greater need for knowledge-intensive job, with difficulties for low-skilled</li> <li>• Great inequality possibly remaining amongst north/south and rich/poorer</li> </ul>	<ul style="list-style-type: none"> <li>• GDP: Strong growth</li> <li>• Employment: Employment growing for high-skilled (not low-skilled)</li> <li>• Energy Prices: High grow, scarcity of resources, renewable-based</li> <li>• Environment (CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>x</sub>): Strong mitigation (technology shift)</li> <li>• Others: Lower inequality, although latent conflicts to possible emerge</li> </ul>
<b>Scenario 3: Jeopardised Sustainability</b>		
Enhanced regional fragmentation	<ul style="list-style-type: none"> <li>• Securing of own interests prevails</li> <li>• Much effort on monitoring, control, security</li> <li>• Fostering own identity and possible escalation of social conflicts</li> <li>• Self-sufficiency achieved where possible, increasing bilateral relations</li> <li>• Climate change is tackled by some regions with no global commitment</li> <li>• Some economies are dynamic, other largely rely on public subsidies</li> <li>• Different abilities to innovate and exchange knowledge amongst regions</li> </ul>	<ul style="list-style-type: none"> <li>• GDP: Mixed patterns, overall mild/low growth</li> <li>• Employment: High employment (some innovation, but mostly subsidies)</li> <li>• Energy Prices: High grow, reaching the peak later</li> <li>• Environment (CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>x</sub>): Mixed patterns, overall poor mitigation</li> <li>• Others: Growing inequality between regions, possible new conflicts</li> </ul>

The General Scenarios are presented in this Interim report serve as a basis for further discussion and elaboration during WP II. On the basis of these reflections more detailed storylines will be developed and a broader list of relevant indicators will be established and quantified.

## 5 Work plan for WP II

Work Package II builds on the outputs of WPI. Its key starting point is the list of selected sub-functions for detailed elaboration (cluster analysis). The subsequent work in WP II is divided into three tasks:

- Task II.1: Cluster-specific Desk Research
- Task II.2: Cluster-specific Interviews (including Case studies)
- Task II.3: Comparing and ranking clusters reviews (including Case studies)

### 5.1 Task II.1: Cluster-specific Desk Research

#### Aim

Identify, collect and assess information on the 13 clusters selected in task I.2 (see section 3.3.4). Identify, contact and interview key experts and stakeholders for qualitative information on selected clusters and “case studies” at the sea basin level and generate imaginative distinctive and operationally detailed scenarios of future outcomes.

#### Approach

On the basis of the analysis provided in the previous task, further primary and secondary sources of information are selected for each of the identified clusters and the “case studies” in each sea basin. The most relevant institutions, private organisations and research centres in EU and OECD countries will be considered as a source of information for specific clusters and case studies. Both quantitative and qualitative information is assessed and analysed to rank clusters and provide narratives for the case studies.

The foreseen output of this task, complemented with task II.2, is consisting of cluster profile reports of indicatively 10-15 pages each. An indicative overview of the contents of the cluster profile reports is given in box 5.1.

#### Box 5-1 Contents of the cluster profiles

The cluster profile reports need to contain the following relevant contents:

##### I. State of Play

1. Summary description of the nature of the cluster
2. Description of the current cluster structure (sectors involved) and its economic size (quantitative where possible, qualitative otherwise); Focus on GVA, number of companies, employment
3. SWOT analysis for the cluster
4. Competitive position of the cluster (position EU versus other world players, market conditions, level playing field)

##### II. Future developments

5. Identification of relevant research fields and technological developments; particular attention to breakthrough technologies and time-frame for these to come to market;
6. Assessment of the commercialisation potential of technology developments, and of the essential requirements and skills to materialise these potentials.
7. Drivers affecting the performance of the cluster

8. Barriers that prevent the cluster from further development
9. Most likely medium-term (until 2025) development of the cluster in the baseline scenario as well as the two alternative scenario's portrayed – estimates on GVA/number of companies/employment
10. Imagine the long-term development (beyond 2025) of the cluster in the above scenarios
11. Impacts/consequences of these developments for the various European sea basins in the cluster (response capacity)
12. Indicative review of possible synergies and tensions with other maritime functions and cluster (dependencies).

### III. Role of Policy

13. Domains where policy can be most relevant (see policy grid table from maritime function profile)
14. Domains where EU-policy can be most relevant
15. Description of policy actions to be considered by the EU

This cluster-specific research will be complemented by a number of cross-cutting tasks, notably central collection of basic data and 'research & technology-mining' – which consists of the analysis of publication data (making use of Thomson Reuter's database) and an analysis of the Framework Programs of the European Commission.

### Activities

1. Data collection, analysis and literature review:
  - a. Central collection of basic data for all clusters studied (using Eurostat data)
  - b. Identify the most adequate indicators to assess and rank the clusters' performance in terms of outcome and input
  - c. Research and select further data and literature on the clusters and cases at the sea basins level, as identified in the previous task
  - d. Review selected data and literature on identified clusters and cases, with a particular focus on existing agreements/divergences on the following aspects:
    - State of the art of each clusters for the cases identified
    - Adjustment capacity of organisations and markets, as well as reactivity to external pressures, for the clusters in the selected cases
    - Future potentials and ideal incentives needed at the firm, sector, cluster level to fully exploit such potentials
    - Possible consequences of key drivers on the clusters for each case
  - e. Identify specific cases to be studied in EU sea basins for the selected clusters
2. Research and Technology mining (see Chapter 3 of our technical proposal for a broader explanation of this method):
  - a. Patent and publication mining (cross-cutting analysis). The selection of the relevant body of publications and patents will be done by applying a so-called 'keyword' based search. A search strategy will be rolled out that allows identifying relevant patents and publications by applying the search strategy on the titles and abstracts of patents and publications. Validation of the findings, again through expert consultation, is essential and will take place in the subsequent interview task.
  - b. Analysis of FP6 and FP7 (cross-cutting analysis). Core projects managed by DG MARE will be identified (with the support of DG MARE). Second, by applying a keyword based search strategy, projects and project applications will be identified that are managed by other DG's,

for example DG Environment or even DG Research that manages several relevant thematic priorities.

3. Assessment of the information emerging from cluster-specific desk research:

Assess the potentials of each emerged clusters in terms of:

- Current/Future contribution towards greater outcomes
- Current/Future receptivity and adaptability to new technology/knowledge
- Ambition amongst the stakeholders operating within the value chain
- Impact of the potential outcomes towards greater EU policy objectives
- Overall data/sources accessibility and reliability
- Finalise the list of stakeholders previously presented

#### Required Inputs

- Approval of First Interim Report
- Acceptance of the list of interviewees

#### Output/results

- Full list of selected data and literature for each cluster/case
- Draft cluster profiles, including finding emerging from secondary data on:
  - Current/Future receptivity and adaptability to new technology/knowledge
  - Ambition amongst the stakeholders operating within the value chain
  - Impact of the potential outcomes towards greater EU policy objectives
  - Overall data/sources accessibility and reliability
  - List of selected cases-studies to be provided through interviews
  - List of proposed stakeholders to be interviewed for each case/cluster

#### Planning and Timing

- End of Month 5.

## 5.2 Task II.2: Cluster-specific Interviews (including Case studies)

### Aim

Collect in-depth views and assessments with regard to the potential and ambition of the cluster, in light of possible external drivers and catalysts; deepening of distinctive and detailed scenarios for future outcomes.

### Approach

On the basis of the information collected so far, we will contact maximum 10 interviewees per cluster, and assess whether these can be interviewed face-to-face or alternatively by telephone, using a structured interview agenda in reporting format. The outputs of all interviews are then used to draft an overview (SWOT analysis) of actual and future performances of clusters in different sea basins, which will be linked to the Analytical framework. Opportunities and threats will be considered external drivers, while Strengths and Weaknesses present the key elements of the internal response capacity of the cluster.

Cluster profiles of indicatively 10-15 pages are created through a mix of quantitative and qualitative data. The main story emerging from interview and literature review is presented in the document. Quantitative data are presented in clearly intelligible charts, whilst qualitative data and emerging stories and narratives are presented as further evidence in separated boxes. The main emerging



findings that could be of interest and use for the cluster analysis are jointly presented in a separate document.

Within this task the cluster profile requirements will be further elaborated.

### Activities

1. Interview key experts and stakeholders for the selected clusters/cases:
  - a. Select amongst the list previously provided the key experts grouped by clusters, sea basin, case and typology of stakeholders
  - b. Provide a semi-structured grid of analysis for the interviews depending on the addressed clusters, interviewees, relevant sea basins, and the cases to be assessed
  - c. Piloting interviews for 2 clusters
  - d. Refine the methodology and complete the analysis
  - e. Execute interviews with key experts and stakeholders (face-to-face or by telephone)
  - f. Report on the interview process and results
2. Assemble and assessment of primary and secondary information:
  - a. Collect and review the information gathered through data and interview analysis
  - b. Provide SWOT analysis for each cluster
  - c. Identify barriers for future growth
  - d. Assess common emerging findings
3. Drafting of emerging stories:
  - a. Write the main narratives for each cluster and case through SWOT analysis
  - b. Select key qualitative/quantitative information to be presented
  - c. Define the most adequate form to present the selected information
4. Production of the cluster profiles and case studies:
  - a. Provide a draft final report for each profiles and studies
  - b. Submit the profiles and studies to peer/quality review
  - c. Finalise the reports for each cluster profile and case study
  - d. Provide a separate document with key lessons for the cluster assessment

### Required Inputs

- Approval of the 13 key clusters to be investigated
- Approval of the list of stakeholders to be interviewed
- Approval of the analysis grid for the interviews

### Output/results

- Reports for all the selected case studies
- Report with transversal lessons for cluster assessment
- Annexes with list of interviews, intermediate reports, used sources

### Planning and Timing

- End of month 7.

## 5.3 Task II.3: Comparing and ranking cluster reviews

### Aim

Compare and rank the clusters on the basis of the cluster profiles prepared above, taking full account of the indicators.

### Approach

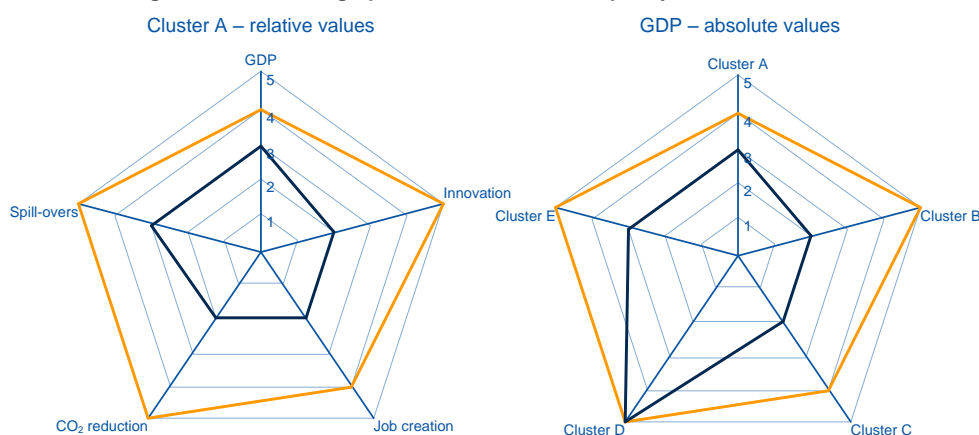
The analysis will focus on the 13 selected clusters that have been shortlisted on the basis of their potential. These 13 will be classified and ranked on the basis of key selected indicators, as previously agreed with the Commission and building on the indicator table as presented in Chapter 3. We will thereby use as a guideline the following questions:

- What is the current performance of each cluster?
- What are the full potentials considering possible technological/innovation developments up to 2025?
- What is the force that external factors (drivers) could apply on such clusters?
- What could be the internal response capacity of each cluster?
- What are the main barriers that limit such response capacity?
- What the consequent response in terms of outcomes and impact?

Ideally, comparisons can be made amongst each cluster performances, by:

- Assigning relative values to each indicators (on a 0 to 5 scale for each identified objective/impact, how much is the cluster performance in 2010? How much could they potentially perform in 2025?)
- Assigning absolute values to each cluster (for each identified objective/impact indicators, how much is the performance of each cluster in 2010? How much could they potentially perform in 2025?)

**Figure 5.1 Ranking of clusters through possible economic and policy indicators**



### Indirect Effects

Input/Output analysis to assess linkages with the rest of the economy

There are important linkages between the maritime clusters and the rest of the economy in the European Union. The economic significance of the maritime clusters exists of a direct and an indirect component. The direct component is generated essentially within the clusters themselves. These activities however generate an indirect effect on the rest of the economy via purchases by maritime sectors from other sectors in the country of origin or elsewhere in the EU. This indirect effect creates turnover, value added and employment in the supply-industry, which in turn creates an impact at its own suppliers, and so on.

## Method

To determine the indirect economic impact of the cluster on the rest of the economy, in the study we shall perform a so-called input-output analysis (see textbox). This will give insight in the direct effects for each country and the indirect (backward) implications for the EU as a whole. ECORYS has extensive experience with (inter-regional) input-output analysis and has in-house custom-designed software (IRIOS) to perform the analysis. For the analysis we will make use of the most recent input-output table of the European Union.

### Box 5-2 Input-output analysis

Input-Output analysis can be used to evaluate the impact of different policies on macroeconomic variables such as gross domestic product, employment, consumption, productivity, competitiveness, etc, as well as on the environment. It also clarifies the interaction between different economic sectors. Moreover, input-output techniques allow quantitative impact assessment of policy actions either for regional, national or international levels.

The result of input-output analysis is an assessment of the indirect impacts of the maritime clusters on employment and value added in other sectors in the EU27.

## Activities

1. Provide the overall ranking of the Clusters:
  - a. Rank the clusters on the basis of the value for the indicators selected to understand economic and political relevance (for 2010 and 2025), taking account of their indirect effects on other parts of the European economy.
  - b. If needed, provide different rankings on the basis of different ranges of emerging values for the indicators: “cautious” (values lower than average), “commonly accepted” (average), “extreme” (values higher than average)
  - c. Review and assess the emerging rankings and reflect on the implication that the interplay of external drivers, their pressure and the clusters adjustment capacity can have on the prospected performance in 2025
  - d. Understand the implication for policy-makers at the EU and sea-basins level in order to provide incentives to minimise backlash and maximise potentials
  - e. Provide a final cluster ranking paper that presents the emerging findings.
2. Assess implications for scenarios
  - a. Assess main commonalities and differences per cluster
  - b. Identify possible synergies and conflicts per cluster and sea basin
3. Prepare the Work Plan for the next stage:
  - a. Review and present main tasks delivered and outcomes achieved in this WP
  - b. Review and detail the work plan for the next WP
  - c. Highlight possible risk and propose risk management responses
  - d. Prepare guidelines and templates for the next Work package (including cluster profiles and criteria for the selection of case studies)

## Required Inputs

- First Interim Report approved
- Primary and secondary data for clusters
- Emerging lessons from case studies

## Output/results

- Clusters profiles (for all the selected clusters)
- Cluster ranking paper (transversal analysis of cluster profiles)

- Second Interim Report

#### **Planning and Timing**

- 2nd Interim Report (Month 8)
- The Consortium will align where appropriate and possible its planning to the DG MARE internal planning related to Blue Growth



# Annexes

- Annex 1: Overview of literature consulted to date
- Annex 2: Overview of proposed interviews
- Annex 3: Factsheets on the sub-functions
- Annex 4: Explanatory notes on sub-functions data and selection
- Annex 5: Initial findings on horizontal research programmes
- Annex 6: Trends and drivers for the scenarios



## Annex 1: Overview of literature consulted to date

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## Annex 2: Overview of proposed interviews

Below table presents list of interviews for each sub-function (10 interviews max., plus in several cases additional names should the first set not be fully possible). In below table, additions and corrections made between 27<sup>th</sup> May and 28<sup>th</sup> June have been incorporated, and the status is indicated.

	<b>1.2 Short-sea shipping</b>	<b>List submitted on 26/05/2011</b>			
	<i>Interviewee</i>	<i>Organisation</i>	<i>City/country</i>	<i>Specific theme</i>	<i>Status</i>
1	Tbd	European Shortsea Network	Hoogvliet – NL	European umbrella for national shortsea promotion councils (www.shortsea.nl)	Refused
2	Antonis Michail, Policy Advisor	European Sea Ports Organisation	Brussels - BE	European umbrella for Sea Ports	Planned
3	Secretary General Alfons Guinier	European Community Shipowner's Association	Brussels - BE	Has a working group on short sea, chairman unknown but representatives per country (www.ecsa.be)	Pending
4	Head of shipping division: Peder Gellert Pedersen, Business area head North Sea: Kell Robdrup, Baltic Sea: Anders Refsgaard.	DFDS Seaways	Copenhagen - DK	Operator - Mainly North Sea and Baltic	
5	Tbd	Grimaldi Lines	Naples - Italy	Operator - West-Mediterranean	Pending
6	Tbd	Grandi Navi Veloci	Palermo - Italy	Operator - West-Mediterranean	
7	Tbd	Seago	Copenhagen - DK	Container feeders/shortsea: very recently established JV of Maersk and Safmarine. All of Europe.	Pending
8	Sara Ravazza - NL Office Leader	MSC	Rotterdam - NL	Container feeders/shortsea: largest in Europe, covers all of Europe. Headoffice is in Geneva, but they have an office in Rotterdam	
9	Tbd	CMA CGM	Rhoon - NL	Container feeders/shortsea: 3rd largest in Europe. Headoffice is in Marseille, but they have an office in Rhoon	
10	Director Business Development: Jon Risvig	UNIFEEDER	Arhus - DK	Dedicated container feeder company: 4th largest in Europe, serves North Sea and Baltic only	
11	Linda Maclean, Business Manager Shortsea	Rotterdam Port	Rotterdam - NL		Pending
12	Charles Abela, sr manager ports - Peter Darley general manager or Wye Keong Lai operations manager	Transport Malta	Malta		
13	Peter Darley general manager or Wye Keong Lai operations manager	Valletta Gateway Terminals	Malta	Port operator ro-ro	Planned



14	Tbd	Riga or Ventspils			
15	Eddy vd Voorde	ITTMA University	Antwerp - BE	ITMMA of the University of Antwerp is one of the world's premier suppliers of highly specialized academic and practice-based maritime and logistics ...	Pending
16	Yannick Texier, Project Officer on Ship Reporting	European Maritime Safety Agency / DG Move		It is important to better understand the policy needs, as this is partly a policy-driven demand (i.e. CO2 emission reduction)	Planned
17		Finnlines	Helsinki – FI	Roro operator Baltics	
18		IMO - International Maritime Organisation	London, UK		Pending
19		Det Norske Veritas			Pending
20	Reinhard Lüken	CESA			Pending
21		Wärtsilä			
22		Hamworthy			

<b>2.3 Growing aquaculture products</b>		<b>List approved on 12/05/2011</b>			
	<i>Interviewee</i>	<i>Organisation</i>	<i>City/country</i>	<i>Specific theme</i>	<i>Status</i>
1	Jean Guezennec	IFREMER	Brest, France	R&D on biofouling	Completed
2	Corentin Renard	Société Gloria Maris Production	Ajaccio, France	Aquaculture producer known to face important biofouling issues	Completed
3	Dr Tim Atack	Vikingfish Farms Ltd; Ardtoe Marine Laboratory	Argyll - UK	R&D aquaculture	Completed
4	Pierre Caleja	Fermentalg	France	Microalgae production - heterotrophic without light	Completed
5	Dr Martin Ecke	Roquette Klötze GmbH & Co. KG	Germany	Microalgae production	Completed
6	Aad Smaal	Institute for Marine Resources and Ecosystem Studies	The Netherlands	RAS technologies	Completed
7	Dr. Willem Brandenburg	Plant Research International - Wageningen University	Netherlands	R&D microalgae aquaculture	Completed
8	Pr Jérélmy Pruvost	GEPEA - Université de Nantes	France	Marine bioprocesses	Completed
9	Álvaro Naranjo Villalonga	BTM (Biotecnología de Microalgas)	Spain	Microalgae production - photobioreactor	Completed
10	Pål Bakken	Seaweed Energy Solutions AS	Norway	Macroalgae for energy	Pending

<b>2.4 High value use of marine resources (health, cosmetics, well-being, etc.)</b>		<b>List submitted on 20/05/2011</b>			
	<i>Interviewee</i>	<i>Organisation</i>	<i>City/country</i>	<i>Specific theme</i>	<i>Status</i>
1	Dr Hordur G. Kristinsson	Matis Ltd	Iceland	New molecules - extremophiles	Pending
2	Dr Xavier Briand	BiotechMarine (high tech lab from Groupe Roullier)	France	Development in cosmetics	Pending

3	Dr Catherine Boyen	Station Biologique de Roscoff	France	Identifying new marine organism	Planned
4	Dr Jan Buch Andersen	ArcticZymes AS	Norway	Innovative molecules sources from fish & shellfish	Planned
5	Dr Werner Müller	BIOTEC marin GmbH	Germany	Molecules from marine sponges	Completed
6	Luis Mora	Pharmamar	Spain	Marine drug development, from discovery to marketing	Pending
7		l'OREAL	France	Commercialisation of marine cosmetics	Pending
8	Christine Bodeau	Laboratoire Sciences et Mer	France	Marine Cosmetics	Pending
9	Dr Charlie Bavington	GlycoMar Limited	UK	Biodiscovery biopharmaceutical, cosmeceutical and nutraceutical compounds	Pending

<b>3.1 + 3.4 Oil, gas and methane hydrates i.c.w. Carbon Capture and Storage</b>		<b>List submitted on 20/05/2011</b>			
	<i>Interviewee</i>	<i>Organisation</i>	<i>City/country</i>	<i>Specific theme</i>	<i>Status</i>
1	Brian Roberts	Chevron	Voorburg, The Netherlands	Offshore exploration and production	Refused
2	Ernest Long	ExxonMobil	Antwerpen, Belgium	Marine installation and HSE	Pending
3	Barry Quinn	ConocoPhillips	Hamburg, Germany	Crude oil processing	Refused
4	Ilona Naplocha	ConocoPhillips	Tananger, Norway	Offshore oil and gas production	Refused
5	Alan Norrie	National Oilwell Netherlands B.V.	Beverwijk, Netherlands	Deepwater: Supplier of equipment: hardware for oil and gas exploration and production	Refused
6	Ali Mecirdi	Schlumberger	Cedex, France	Deepwater: Supplier of equipment: deepwater drilling/new regions/non-conventional oil	Pending
7	Dave Hornigold	Cameron	Leeds, United Kingdom	Deepwater: Drilling & Production Systems	Pending
8	Dave Seekon	Halliburton	Emmen, Netherlands	Support services for early stage oil exploration	Pending
9	Linda Maris	Oil and Gas observer	Voorburg, The Netherlands	Data management support and discussion on themes	Pending
10	Richard Hall	OGP	London, United Kingdom	International Association of Oil and Gas Producers (EU)	Pending
11	Max Clement	Ospar Commission	London, United Kingdom	Protection and conservation of marine resources	Pending
12	Cor-Jan Stam	Van Oord	Rotterdam, the Netherlands	Dredging and Marine contractors	Pending
13	Klaus Wallmann	IFM-GEOMAR Research centre	Leibniz, Germany	Marine geosciences	Pending
14	Allan Smith	Shell	Den Haag, Netherlands	Offshore oil and gas production	Refused
15	Joanna Janiak	European Petroleum Industry Association	Brussels, Belgium	Association	Pending

16	Prof. Aad Correlje - Olie-economie en - infrastructure at the TU Delft.	Technical University	Delft, NL	Oil economy and infrastructure	Pending
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<b>3.2 Offshore wind energy</b>		<b>List commented on 23/05/2011</b>			
<i>Interviewee</i>	<i>Organisation</i>	<i>City/country</i>	<i>Specific theme</i>	<i>Status</i>	
1	Jasmine Cargill and Michael Holm	Vestas	Denmark	Wind offshore - turbine production and installation	Planned
2	Frans van Bommel	Siemens Wind	Germany	Wind offshore - turbine production and installation	Pending
3	David van Tendeloo	Enercon	Germany	Wind offshore - turbine production and installation	Refused
4	Vilma Radvilaite and Filippo Gagliardi	EWEA	Brussels	Wind offshore association	Planned
7	Pieter Tavenier	Eneco wind	Netherlands	Wind offshore exploitation	Planned
8	Bart Alexander Oberink	RWE	Germany	Wind offshore exploitation	Pending
9	Chris Westra	We@Sea	Netherlands	Wind offshore research	
10	Lex Hartman	TenneT	Netherlands	TSO	Refused
11	Gianluca Gigliucci	ENEL	Italy	Wind offshore exploitation	Pending
12	Benj Sykes	The Carbon Trust Ltd	UK	Wind offshore innovations	Pending
13	Lars Thaaaning Pedersen	Dong Energy	Leibniz, Germany	Wind offshore exploitation	Pending
14	Hans Halmström	ABB	Netherlands	TSO	Refused
15	Robert Pollock	Argyll	UK	Wind offshore - economics and funding	Completed

<b>3.3 Ocean renewable energy sources (wave, tidal, OTEC, thermal, biofuels, etc.)</b>		<b>List approved on 16/05/2011</b>			
<i>Interviewee</i>	<i>Organisation</i>	<i>City/country</i>	<i>Specific theme</i>	<i>Status</i>	
1	Remi Blokker	Bluerise	Delft, NL	RES - OTEC	Completed
2	Kas Hemmes	Technical University Delft	Delft, NL	RES - blue energy	Completed
3	Nathalie Rousseau	European Ocean Energy Association	Brussels, BE	RES - all	Completed
4	Stein Erik Skilhage	Statkraft	Oslo, Norway	RES - Osmotic energy	Completed
5	Emmanuel Brochard	DCNS	Paris, France	RES - all	Completed
6	Eoin Sweeney	Sustainable Energy Authority Ireland	Dublin, Ireland	RES - all	Completed
7	Roberto Lacal-Arantegui	JRC	Petten, Netherlands	RES wave and tidal	Completed
8	Sian George	Aquamarine Power	Edinburgh, Scotland	RES - all	Completed
9	François Lienard	IMI	Brussels, Belgium	RES - all	Completed
10	Oliver Wragg	RenewableUK	London, UK	RES - all	Completed

<b>3.6 Marine mineral resources</b>		<b>List submitted on 20/05/2011</b>			
<i>Interviewee</i>	<i>Organisation</i>	<i>City/country</i>	<i>Specific theme</i>	<i>Status</i>	
1	Cindy Lee Van Dover	Duke University	US	Seafloor venting	Pending
2	Jochen Halfar	University of Toronto	Canada		Pending
3	Craig R. Smith	University of Hawaii	US	Ecology of marine sediments (ISA Expert)	Pending

4	Prof. Dr. Uwe Jenisch	Christian Albrecht University	Kiel/ Germany	Law of the Sea	Pending
5	Micheal Jarowsky	MC Marketing Consulting	Kiel/ Germany	Marine mineral raw materials studies	Pending
6	Dr. Hermann-Rudolf Kudrass	Federal Institute for Geoscience and Natural Resources (retired)	Hannover/Germany	1984 last publication???	Pending
7		Sub-Atlantic	Aberdeen, SCO	Remotely operated underwater vehicle (ROV) manufacturer	Pending
8		Neptune Minerals	London/UK	Explorer of Seafloor Massive Sulphur deposits	Pending
9		Nautilus Minerals Inc	Canada/ PNG	Seafloor Copper & Gold Exploration	Pending
10		IHC Merwede	Sliedrecht, NL	Deep sea mining concepts	Pending
11	Catherine Meval	European Consortium for European Ocean Research Drilling (ECORD)		Industry association	Pending
12	Julien Denegre	Technip	Paris/France	Deep sea mining integrator	Pending
13	Stephan Lutter	International WWF Centre for Marine Conservation	Hamburg/Germany	NGO	Pending
14		International Seabed Authority	Jamaica	International Organisation	Pending
15	Dr. Ing. Torsten Pfitzenreuter	Fraunhofer Anwendungszentrum Systemtechnik	Germany	Autonomous Underwater Vehicles	Pending
16	Henryk Karas	KGHM Copper mine		European Technology Platform on Sustainable Mineral Resources	Pending

<b>3.7 Securing fresh water supply (desalination)</b>		<b>List submitted on 23/05/2011</b>			
<i>Interviewee</i>	<i>Organisation</i>	<i>City/country</i>	<i>Specific theme</i>	<i>Status</i>	
1	Lute Broens	President of European Desalination Society	Enschede/ The netherlands	Desalination market in general	Pending
2	Professor Dr.-Ing. Thomas Melin	Aachen University	Aachen/Germany		Planned
3	Prof. Dr. Thomas Wintgens	Hochschule für Life Sciences Institut für Ecopreneurship	Muttenz/ Switzerland		Planned
4	Virginie Leroux	Veolia Water Solutions & Technologies	Saint Maurice Cedex/ France	Financing, construction and operation of a desalination plant	pending
5	Antonio Casanas Gonzalez	AEDyR (association of organisations dealing with desalination in Spain)	Madrid/ Spain		Pending
6	Sabine Lattemann	University of Oldenburg	Oldenburg/Germany	environmental impacts of seawater desalination	Planned
7	Peter Moss	Koch Membrane Systems	Stafford/UK	technology	Refused
8	M. Scoullas	Project coordinator Horizon 2020 capacity building /Mediterranean Environment Programme			Pending

<b>4.1 + 4.2 Coastal tourism i.c.w. yachting and</b>		<b>List approved on 06/05/2011</b>		
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	<b>marinas</b>				
	<i>Interviewee</i>	<i>Organisation</i>	<i>City/country</i>	<i>Specific theme</i>	<i>Status</i>
1	Jean Paul Chapenau (President)/Andrea Cagnotti	Jeanneau	Paris,FR/Roma, IT	Shipbuilding of yachts	Completed
2	Dr Michael Frenzel (Chairman)	TUI AG	Hanover, DE	Coastal Tourism Operators	Planned
3	Óscar Perelli del Amo (Head of Research)	Exeltur	Madrid, ES	Coastal Tourism/post-economic crisis aspects	Completed
4	Glenn Wastyn (Commercial Director)	BCD Travel	Mechelen, BE	Coastal Tourism/supply chain & consumers	Completed
5	Damien PÉRISSÉ (Director - Responsible for innovation and competitiveness and follow-up of the Baltic Sea Commission)	Conference of Peripheral Maritime Regions of Europe (CPMR)	Brussels, BE/Rennes, FR	Coastal Tourism/regional issues	Completed
6		Brighton University - Centre for Tourism Policy Studies - Coastal Tourism Research (CTR)	Birghton, UK	Coastal Tourism/sustainability	Refused, refer Kent Business S (added)
	Mark Hampton	Kent Business Schook, Centre for Tourism in Islands & Coastal Areas	Kent, UK	Coastline Tourism	Completed
7	Nathalie Dumay (Coordinator)	The Association des Ports Locaux de la Manche (APLM)	Saint-Brieuc, FR	Coastal Tourism/sustainability	Refused
8	Alex Hekman	Grontmij	Alkmaar, NL	Marina development	Completed Con
9	David Mitchell	ATM	Gainesville, USA	Marina & Waterfront development	Completed
10	Jan Kappel	European Anglers Alliance	Netherlands	Sea fishing	Planned
11	Ceri Williams	IWA international windsurfing	UK	Windsurfing	Planned
12	PhD Tihomir Luković	University of Dubrovnik, University of Lulea, Sweden and University of Lapland, Finland	Croatia	Nautical tourism	Completed
13	Mirna Cieniewics	European Boating Industry	EU	Marinas and yachting	Completed
14	M. Tempelman	Kenniscentrum Kusttoerisme	Netherlands	Coastal tourism	Completed

	<b>4.3 Cruise including port cities</b>	<b>List submitted on 23/05/2011</b>			
	<i>Interviewee</i>	<i>Organisation</i>	<i>City/country</i>	<i>Specific theme</i>	<i>Status</i>
1	Tom Jenkins	European Tour Operators Association (ETOA)	London, UK	Tourism industry (general)	Pending
2	Mrs. Eva Aimable/ Mrs. Olivia Ruggles-Brise	World Travel & Tourism Council (W TTC)	London, UK	Tourism industry (general)	Pending
3	Mr. Michel de Blust (Secretary General)	European Travel Agents & Tour Operators Association (ECTAA)	Brussels, BE	Tourism industry (general)	Pending
4	Mr. Rob Franklin (Executive Director),	European Travel Commission	Brussels, BE	Tourism industry (NTO's)	Planned
5	Mr. Tim Marking, Secretary General	European Cruise Council	Brussels, BE	Cruise operators, lobby	Planned
6	Dr Michael Frenzel	TUI Cruises	Hamburg, Germany	Cruise operator	Pending

	(Chairman)				
7	Tbc	Holland America Line	UK	Cruise operator	
8	Mr. Michael Thamm (president), Mr. Jörg Eichler (Senior Vice President Marketing & Sales)	AIDA cruises	Rostock, Germany	Cruise operator	Pending
9	Tbc	Stena Line	Hoek van Holland,	Cruise ferry concept	
10	Mr. Thomas Weigend, Mr. Christian Wolken, Mr. Hermann-Josef Mammes	Meyer Werft	Papenburg, Germany	Cruise shipbuilding	Completed
11	Mr. Giuseppe Bono (Chief Executive Officer)	Fincantieri	Italy	Cruise shipbuilding	Pending
12	Mr. Eric Breux (HR and Communications Director)	STX Europe	France/Finland	Cruise shipbuilding	Pending
13	Mr. Jose alberto Carbonell Camallonga (General Manager Port de Barcelona)	Barcelona Cruise Port	Spain	Cruise Port	Pending
14	Mr. Hans Gerson (Chairman)	Amsterdam	Netherlands	Cruise Port	Pending
15	tbc	St Petersburg Cruise Port	Russia	Cruise Port	
16	Mr. Lorenzo Gui	Venice International University	Venice, Italy	Cruise market economics	Pending
17	Mr. Antonio Paulo Russo	University Rovira i Virgili	Vila-seca/ Spain	Cruise market research	Pending

<b>5.1 Protection against flooding and erosion</b>		<b>List submitted on 23/05/2011</b>			
	<i>Interviewee</i>	<i>Organisation</i>	<i>City/country</i>	<i>Specific theme</i>	<i>Status</i>
1	Luigi Cipriani	Regione Toscana	Italy	Governance (Southern part of Europe)	Planned
2	Dr Robin McInnes	Isle of wight	United Kingdom	Governance (UK)	Planned
3	Per Sørensen	Danish Coastal Authority	Denmark	Governance (Northern Europe)	Planned
4	<i>President or senior staff</i>	Central Dredging Association (CEDA)	Europe	Response capacity of industry and impacts	Pending
5	Dr. Stefan Aarninkhof	Royal Boskalis and Ecoshape	The Netherlands	Research, technology and impact	Planned
	Dr. Anneke Hibma	Van Oord and Ecoshape	The Netherlands	Research, technology and impact	Planned
6	Prof. Dr. Robert J. Nicholls	University of South-Hampton	Europe	Research and scenario's	Pending
7	Soraya van Donink	Policy Research Association	Europe	Economics	Planned
9	Alan Pickavar	Coastal and Marine Union (EUCC)	Europe	Environmental impacts	Pending
10	Barbara Zanuttigh	University of Bologna	Italy	Research and technology development	
11	Rob Steijn	Arcadis	Europe	Governance	Pending
12	tbc	IUCN / European Habitats Forum	Europe	Impacts	
13	Prof. Stive / Prof. Vrijling	Technical University Delft	The Netherlands	Research and technology development	Pending

<b>6.1 + 6.2 Traceability and security of goods supply chains</b>		<b>List submitted on 23/05/2011</b>			

<b>/ Prevent and protect against illegal movement of people and goods</b>					
	<i>Interviewee</i>	<i>Organisation</i>	<i>City/country</i>	<i>Specific theme</i>	<i>Status</i>
1	Peter Marlow	Cardiff University	Cardiff, UK	Security at sea (piracy, terrorism)	Pending
2	Nicola Iarossi	EOS (surveillance industry association)	Brussels, BE	Overview of industry	Planned
3	Dieter Kaspereit	EC DG TAXUD	Brussels, BE	Digital customs and traceability of imported goods	Pending
4	Jacques Mouysset	DCNS	Brussels, BE	Economic aspects of industry	Completed
5	Michel Morel	DCNS	Toulon, FR	Technical aspects of industry	Planned
6	Prof René Leray	University St Louis	Brussels BE	Benefits of CISE for society	Completed
7	Prof. Georges Estievenart	Sciences Po	Paris, FR	Fight against illegal trafficking	Completed
8	Emmanuelle GALLOUET	University of Aix en Provence	Aix en Provence, FR	Legal aspects to CISE	Planned
9	Michel GARI		Brussels, BE	Military aspects of CISE	Pending
10	Mr Lennart Dreier	Swedish CoastGuard	Sweden	"MARSUNO' pilot project Benefits of CISE for society"	Completed
11	Mr Olivier Plessiet	Secretariat Général de la Mer	Paris, FR	"BluemassMed' Pilot project Benefits of CISE for society"	Pending
12	Mr Oliver Seiffarth	DG HOME	Brussels, BE	Benefits of CISE for society	Pending
13	Christophe Cornu	NATO	Brussels, BE	Military aspects of maritime surveillance	Pending
14	Jean-Francois MIRIGAY	CECLAD	France	National case study - France	Planned

<b>6.3 Environmental monitoring</b>					
<b>List approved on 06/05/2011</b>					
	<i>Interviewee</i>	<i>Organisation</i>	<i>City/country</i>	<i>Specific theme</i>	<i>Status</i>
1	Trine Christensen	EEA Project manager - Marine and maritime assessment	Copenhagen, DK	EEA Marine Assessments	Completed
2	Dave Mills	CEFAS, member of EMECO	Lowestoft, UK	EMECO	Planned
3	Franciscus Colijn	MODEG		FerryBox	Completed
4	Pierre Bahurel	Mercator Ocean	France	MyOcean	Completed
5	Dick Schaap	MARIS, representative of SeaDataNet consortium	Netherlands	SeaDataNet	Completed
6	Seppo Kaitala	SYKE	Finland	Operational monitoring	Completed
7	Stephen Hodgson	MRAG Ltd, Brussels representative	Brussels	Costs of monitoring	Completed
8	John Shaw	Mainstream Renewable Power (Energies)	Dublin, Ireland	Data user	Completed
9	Luca Zaggia	CNR	Italy		Pending
10	Iain Shepherd	DG MARE	-	EMODnet	Completed

## Annex 3: Factsheets on sub-functions

This annex contains the factsheets that have been drafted for all sub-functions. They are ordered by function. The order of factsheets included in this annex is given in the table below.

Function	Sub-function
1. Maritime transport and shipbuilding	<ul style="list-style-type: none"> <li>1.1 Deepsea shipping</li> <li>1.2 Shortsea shipping (incl. RoRo)</li> <li>1.3 Passenger ferry services</li> <li>1.4 Inland waterway transport.</li> </ul>
2. Food, nutrition, health and eco-system services	<ul style="list-style-type: none"> <li>2.1 Catching fish for human consumption</li> <li>2.2 Catching fish for animal feeding</li> <li>2.3 Growing aquatic products</li> <li>2.4 High value use of marine resources (health, cosmetics, well-being, etc.)</li> <li>2.5 Agriculture on saline soils</li> </ul>
3. Energy and raw materials	<ul style="list-style-type: none"> <li>3.1 Oil, gas and methane hydrates</li> <li>3.2 Offshore wind energy</li> <li>3.3 Ocean renewable energy resources (wave, tidal, OTEC, thermal, biofuels, etc.)</li> <li>3.4 Carbon capture and storage</li> <li>3.5 Aggregates mining (sand, gravel, etc.)</li> <li>3.6 Marine mineral resources</li> <li>3.7 Securing fresh water supply (desalination)</li> </ul>
4. Leisure, working and living	<ul style="list-style-type: none"> <li>4.1 Coastline tourism</li> <li>4.2 Yachting and marinas</li> <li>4.3 Cruise including port cities</li> <li>4.4 Working</li> <li>4.5 Living</li> </ul>
5. Coastal protection	<ul style="list-style-type: none"> <li>5.1 Protection against flooding and erosion</li> <li>5.2 Preventing salt water intrusion and water quality protection</li> <li>5.3 Protection of habitats</li> </ul>
6. Maritime monitoring and surveillance	<ul style="list-style-type: none"> <li>6.1 Traceability and security of goods supply chains</li> <li>6.2 Prevent and protect against illegal movement of people and goods</li> <li>6.3 Environmental monitoring</li> </ul>



## 1. Maritime Transport and Shipbuilding



## 1.1 Deep-sea shipping

### 1.1.1 Definition and description

The sub-function of Deep-sea shipping is defined as all activities associated to freight transport by sea beyond European waters, between major ports in multiple continents, using large sized ships. Within deep-sea shipping, three segments can be identified:

- Container liner shipping, with fixed sailing schedules and itineraries. Mainlines link to feeder services at hub ports where containers are transhipped;
- Shipping with fixed contracts, mainly for dry bulk (ores, coal, cereals) or liquid bulk (crude oil, LNG, fuels, base chemicals), often under long term contracts (most commonly five to ten years) and often using large vessels for the transport of bulk commodities between two ports. Large vessels are less flexible and can call at limited number of ports;
- Tramp shipping: spot contracts for single voyages, usually medium-sized vessels (handysize and panamax), which can call at all or nearly all seaports.

### 1.1.2 Value chain / economic sectors

Shipping itself is a service to many other functions. The shipping value chain consists of:

- Shipbuilding and marine equipment – delivering the transport equipment including repair;
- Operation of ships – shipping freight;
- Port services and logistics – operating terminals, handling cargoes, storage, VAL, port management;
- Other maritime services (bunkering, ship repair, pilotage, etc.);
- Maritime works – constructing ports, maintaining access channels.

### 1.1.3 Economic performance

Statistics do not distinguish deep-sea from short-sea shipping, instead a distinction is made between intra vs extra EU. The extra-EU share of maritime transport was 62% of freight handled in 2009, equalling 1,683 mln tonnes (Eurostat database, 2011). In 2008 this was 63% equalling 1,958 mln tonnes (Eurostat database, 2011) Intercontinental freight handling is concentrated in countries with hub ports such as the Netherlands, Belgium and Germany, and – for containers – at transshipment ports in several Mediterranean countries.

Total port volume of EU27 main ports (deep and short sea) is 3,333 mln tonnes, of which 42% liquid bulk, 23% dry bulk, 18% containers, 11% roro and 5% other cargo<sup>9</sup> (Eurostat database, 2011).

Total employment in the water transport sector amounts to 2.475 mln jobs (Eurostat, 2007 data). Of this figure, 84% covers jobs in ports (Ecorys, 2009). This includes passenger ferry services, which we have estimated at appr. 250,000 jobs (see the factsheet on sub-function 1.3 passenger ferry services). Of the remaining 2.225 mln jobs, we estimate the share of deepsea shipping to be relative to the freight volumes handled. On the one hand this may be an overestimation for the shipping itself, as large vessels require less crew per unit of cargo. On the other hand for in-port activities such as handling, customs and other services this scale factor may be less relevant. The resulting estimate of employment amounts to 1.4 mln jobs in the deepsea sub-function.

The Gross value added of this sub-function is taken to have the same share in the overall water transport function as employment. This implies that out of a total € 188 bn (Eurostat, 2007 data), the

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<sup>9</sup> Main ports are ports of >1 mln ton throughput. Total EU27 port volume differs from shipping as the latter is corrected for double counting (in and out)

deepsea shipping sub-function contributes some € 106 bn. Again of this amount 82% is realised in ports.

Trends are:

- Growth of scale: average vessel size increases in search of lower unit transport costs;
- Growth of volumes: economic crisis set aside, deepsea maritime transport volumes have grown quite significantly. In Europe, growth was most striking in container shipping and less so in the bulk markets;
- Gradual shift in weight visible from North Sea to Mediterranean ports, especially in container shipping.

Over the past five years, GVA of the entire water transport sector has grown 8.5% per year on average (Eurostat data 2002-2007). As the deepsea and shortsea segments are highly integrated and dependant upon each other, we have assumed this figure to apply for both sub-function 1.1 and 1.2. Over the same period, employment has grown by 4% per year on average (Eurostat, data 2002-2007).

#### *1.1.4 Environment*

- Trend towards greener shipping, based on fuel price growth and policy & regulatory pressure;
- Two European sea basins (Baltic Sea and North Sea) declared Emission Control Areas (ECA) with stricter regulations on emissions from ships;
- CO<sub>2</sub> emissions of shipping are estimated to be 276.7 million tons in 2006 (CE Delft 2009);
- Emissions are highest in the Mediterranean, covering almost 50% (based on 2000 data, IIASA);
- About 45% of emissions originate from ships sailing under the EU flag (IIASA);
- EU strives to reduce CO<sub>2</sub> emissions from shipping by 40% (if feasible by 50%) in 2050 compared to 2005 levels.

#### *1.1.5 Regulatory environment*

- Regulations are developed on a worldwide level, by IMO and ILO. EU realises that a maritime level playing field needs to be created through these organisations.
- At EU level, EC shipping law covers competition, safety, security, port, employment and environmental aspects.

#### *1.1.6 Key external drivers*

- GDP growth and globalisation drives international trade volume and patterns;
- Containerisation of goods drives the specific segment to grow faster than any other;
- Price competition drives ship sizes increase and the growth of transshipment hubs;
- Environmental policies and fuel price increases causes pressure for greening ships.

#### *1.1.7 Crucial new technologies implemented*

No crucial new technologies have been implemented in the past decade or are expected to be implemented in the next decade. The outlook is for the further development and improvement of existing technologies.

#### *1.1.8 Expected global competitive position*

- Building of container and bulk ships has already shifted to Asia;
- Ownership is however still concentrated in Europe based on financing capacity;
- European share of employment in shipping is decreasing, but remains important in port services and other port related activities.

### 1.1.9 Future potential

Overall score for future growth potential: 0

- Volume growth to continue with global economic and trade growth;
- Employment in shipping is declining with low interest from EU labour market and increased non-EU low wage crews. However, in port services employment will remain constant with increased freight handling balanced by efficiency improvements;
- Relevance of shipbuilding is declining in the EU, however marine equipment industry is supplying heavily in this segment;
- Marine equipment industry to serve demand for energy efficiency increase of ships.
- Sustainability may improve through legislative and sectoral programmes such as IMO's Environmental index, the EC plans for emission trading schemes, or the assignment of sea basins where strict environmental rules apply.

### 1.1.10 Links to other sub-functions

Sub-function 1.2 Shortsea shipping (container feeding).

### 1.1.11 Concluding assessment

- The current size of the deep-sea sub-function is estimated at € 106 bn added value and 1.4 mln jobs (Eurostat database 2011, data 2007). This makes the sub-function to be second in line on the ranking of sub-functions based on current size, just after sub-function 4.1 (coastline tourism).
- The recent growth of the sub-function is estimated at 8.5% in terms of added value and 4.0% in terms of employment growth (Eurostat database, 2011, data for the period 2002-2007). This makes the sub-function to be ranked fourth in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "0". Therefore the sub-function is not ranked among the top-7 in terms of future potential

Based on these scores, the main developments, trends and drivers of this sub-function are taken up in the selection of 13 sub-functions that will be elaborated in WP2, by combining it with those of shortsea shipping (sub-function 1.2). The reason for this is that while its size is larger than that of sub-function 1.2 (shortsea shipping), the future potential of the latter is larger and the EU policy involvement within the latter is more pronounced as well. Developments from deep-sea shipping that are relevant for shortsea shipping will therefore be covered.

### 1.1.12 Key references (up to ten most recently published)

- Drewry, Annual review and container market forecast 2003 and 2008-2009
- International Transport Forum, Statistics Brief, March 2011
- Technical support for European action to reducing Greenhouse Gas Emissions from international maritime transport, CE Delft, December 2009.
- Environmental and climate change issues in the shipbuilding industry, OECD, November 2010.
- IIASA (2007), Analysis of Policy Measures to Reduce Ship Emissions in the Context of the Revision of the National Emissions Ceilings Directive
- Baltic NECA-economic impacts, University of Turku, Centre for Maritime Studies, October 2010
- Study on the Labour Market and Employment Conditions in Intra-Community Regular Maritime Transport Services Carried out by Ships under Member States' or Third Countries' Flags, Ecorys, December 2009
- European Commission (2011), White Paper on Transport COM(2011) 144 final, 28 March 2011

## 1.2 Short-sea shipping

### 1.2.1 Definition and description

The sub-function of Short sea shipping (SSS) is defined as all activities associated to shipping freight in and between countries within Europe. Compared to intercontinental shipping, it is much more dominated by European companies, including the use of European crew. It is also more often than international shipping seen as part of a multimodal logistics chain, in which a single logistics provider offers door-to-door transport within Europe. Within SSS, three segments can be identified:

- Container liner shipping, with fixed sailing schedules and itineraries. Feeder services, linking hub ports to feeder ports, can all be considered as short sea shipping.
- Shipping with fixed contracts, mainly for dry bulk (ores, coal, cereals) or liquid bulk (crude oil, LNG, fuels, base chemicals), often under long term contracts (most commonly five to ten years) for the transport of bulk commodities between two ports. In short sea shipping there are only small to medium-sized vessels, whereas large vessels dominate this segment in intercontinental shipping.
- Tramp shipping: spot contracts for single voyages, usually medium-sized vessels (handy size and panamax), which can call at all or nearly all seaports.

### 1.2.2 Value chain / economic sectors

Shipping itself is a service to many other functions. The SSS value chain is the same as that of intercontinental shipping and consists of:

- Shipbuilding and marine equipment – delivering the transport equipment
- Operation of ships – shipping freight
- Port services and logistics – operating terminals, handling cargoes, storage, VAL, port management
- Other maritime services (bunkering, ship repair, pilotage, etc.)
- Maritime works – constructing ports, maintaining access channels

### 1.2.3 Economic performance

Intra-EU and domestic shipping accounted for respectively 25% and 11% of all EU maritime transport in 2009. This equals 978 mln tonnes of freight; down from 1,088 mln tonnes in 2008.

- Total port volume of EU27 main ports (deep and short sea) is 3,333 mln tonnes, of which 42% liquid bulk, 23% dry bulk, 18% containers, 11% ro-ro and 5% other cargo<sup>10</sup>.
- Total shipping function employs appr. 2.5 mln FTE (Eurostat, 2007 data), 84% of which in ports. (Ecorys, 2009); Following the same methodology as applied for the deepsea shipping sub-function, the share of shortsea shipping in this figure amounts to appr. 820,000 jobs.
- Total shipping function value added is appr. 188 bn EUR (Eurostat, 2007 data), 82% of which in port services. Linking this to the sub-function's share in employment, this implies about € 63 bn GVA for the shortsea sub-function.

Trends are:

- Growth of volumes: economic crisis set aside, SSS transport volumes have grown quite significantly. In Europe, growth was most striking in container and ro-ro shipping and less so in the bulk markets.
- Overall GVA growth of the water transport sector as a whole was 8.5% annually over the past five years (Eurostat, data 2002-2007). It is taken that this figure also contributed to shortsea shipping growth.
- Growth of employment was slower than GVA growth with appr. 4% annually over the past five years (Eurostat, data 2002-2007), assuming this to be similar to deepsea shipping.

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<sup>10</sup> Main ports are ports of >1 mln ton throughput. Total EU27 port volume differs from shipping as the latter is corrected for double counting (in and out)

#### 1.2.4 Environment

The environmental issues are similar to those in intercontinental shipping, but the pressure to become more environmentally sustainable is even more urgently felt in the European SSS sector.

- Trends towards greener shipping, based on fuel price growth and policy and regulatory pressure;
- Two European sea basins (Baltic Sea and North Sea) declared Emission Control Areas with stricter regulations on emissions from ships;
- On a worldwide level, regulations are developed by the IMO and ILO. EU realises that a maritime level playing field needs to be created through these organisations;
- CO<sub>2</sub> emissions of shipping are estimated to be 276.7 million tons in 2006 (CE Delft 2009)
- Emissions are highest in the Mediterranean, covering almost 50% (based on 2000 data, IIASA);
- About 45% of emissions originate from ships sailing under the EU flag (IIASA);
- EU strives to reduce CO<sub>2</sub> emissions from shipping by 40% (if feasible by 50%) in 2050 compared to 2005 levels.

#### 1.2.5 Regulatory environment

- Regulations are developed on a worldwide level, by IMO and ILO. EU realises that a maritime level playing field needs to be created through these organisations.
- At EU level, EC shipping law covers competition, safety, security, port, employment and environmental aspects.

#### 1.2.6 Key external drivers

- GDP growth and globalisation drive international trade volume and patterns
- Containerisation of goods drive the specific segment to grow faster than any other
- Price competition drives ship size increase and the growth of transshipment hubs; however this trend is felt stronger in intercontinental shipping than in SSS as the latter also serves many smaller trade links where economies of scale cannot be realised.
- Environmental policies, including emission trading and the assignment of sea basins with strict environmental rules, and fuel price increases cause pressure for greening ships. This is felt more strongly in European SSS than in intercontinental shipping.
- The EU is actively promoting SSS for its role in European integration, in alleviating capacity bottlenecks in continental (road) infrastructure, and in contributing to a more environmentally sustainable transport system.

#### 1.2.7 Crucial new technologies implemented

No crucial new technologies have been implemented in the past decade or are expected to be implemented in the next decade. The outlook is for the further development and improvement of existing technologies.

#### 1.2.8 Expected global competitive position

- Building of container and bulk ships already shifted to Asia, EU yards are still relatively active in producing Ro-ro and Ro-pax ships
- Ownership mostly concentrated in Europe, based on financing capacity
- European share of employment in shipping decreasing, though less so than in intercontinental shipping

#### 1.2.9 Future potential

Overall score for future growth potential: +

- Volume growth to continue with global economic and trade growth

- Employment in short sea shipping is declining, however less so than in international shipping. In port services employment will remain constant with increased freight handling balanced by efficiency improvements;
- Relevance of shipbuilding for SSS in EU still relatively large, especially in the Ro-ro and Ro-pax sectors, though risk of shift to Asian shipbuilders exists. Marine equipment industry is supplying heavily in this segment;
- Marine equipment industry to serve demand for energy efficiency increase of ships;
- Short sea shipping can potentially relieve road congestion and contribute to a more environmentally sustainable transport system.

#### *1.2.10 Links to other sub-functions*

Deep-sea shipping

#### *1.2.11 Concluding assessment*

- The current size of the shortsea sub-function is estimated at € 63 bn added value and 823,000 jobs (Eurostat database 2011, data 2007). This makes the sub-function to be third in line on the ranking of sub-functions based on current size, after sub-function 4.1 (coastline tourism) and 1.1 (deepsea shipping).
- The recent growth of the sub-function is estimated at 6.1% in terms of added value as well as in terms of employment growth (Ecorys, 2009, data for the period 2002-2007). This makes the sub-function to be ranked fourth in terms of recent growth, jointly with sub-function 1.1 (deep-sea shipping).
- The future potential of this sub-function is scored qualitatively and the overall score is “++”. Therefore the sub-function is not ranked among the top-7 in terms of future potential

Based on these scores, the sub-function IS included in the selected set of 13 sub-functions that will be elaborated in WP2. The reason for this is that while its size is smaller than that of sub-function 1.1 (deep-sea shipping), the future potential of shortsea shipping is considered larger and the EU policy involvement is more pronounced as well. Developments from deep-sea shipping that are relevant for shortsea shipping will be covered.

#### *1.2.12 Key references (up to ten most recently published)*

- International Transport Forum, Statistics Brief, March 2011
- Technical support for European action to reducing Greenhouse Gas Emissions from international maritime transport, CE Delft, December 2009.
- Environmental and climate change issues in the shipbuilding industry, OECD, November 2010.
- IIASA (2007), Analysis of Policy Measures to Reduce Ship Emissions in the Context of the Revision of the National Emissions Ceilings Directive
- Baltic NECA-economic impacts, University of Turku, Centre for Maritime Studies, October 2010
- Study on the Labour Market and Employment Conditions in Intra-Community Regular Maritime Transport Services Carried out by Ships under Member States' or Third Countries' Flags, Ecorys, December 2009
- European Commission (2011), White Paper on Transport COM(2011) 144 final, 28 March 2011



## 1.3 Passenger ferry services

### 1.3.1 Definition and description

The sub-function of Passenger ferry services is defined as all activities associated to the shipping of people as well as vehicles between fixed origins and destinations. This sub-function differs from deep-sea and shortsea shipping as it can be seen as a supportive service to road transport.

Furthermore this segment is responsible for the shipping of large numbers of passengers, giving them access to other regions, markets and jobs. The segment is mainly intra-European, with some links to neighbouring countries. The ferry sector transports some cargo on trucks, but it differs from Ro-Ro transport (included in the short sea shipping sector) in the sense that it is not primarily aimed at freight transport. Vice versa, Ro-Ro ferries also transport smaller amounts of passengers, but this is not their primary focus.

### 1.3.2 Value chain / economic sectors

Shipping itself is a service to many other functions. The ferry shipping value chain consists of:

- Shipbuilding and marine equipment – delivering the transport equipment
- Operation of ships – ferry shipping
- Port services and logistics – handling of passengers and their vehicles, to a limited extent also storage of cargo on trucks and trailers
- Other maritime services (bunkering, ship repair, pilotage, etc.)
- Maritime works – constructing ports, maintaining access channels

### 1.3.3 Economic performance

The total number of passengers embarking and disembarking in all EU-27 ports amounted to just over 400 mln in 2009. This figure is more or less constant; since 2002 it has been fluctuating around the 400 mln passenger mark (with a high of 414 mln in 2007 and a low in 2005 of 395 mln). Statistics do not give data on the number of trucks and trailers transported by ferries.

Statistics do not distinguish this sub-function from other maritime transport sub-functions.

Therefore, to arrive at a reasonable estimate, use was made of figures on employment taken from several passenger ferry operators' annual reports (Stena Line, Hellenic Seaways), which provided ballpark figures on the number of staff required relative to the passenger performance. Combining this with the total number of passengers this results in an estimated 150,000 jobs in this sub-function. However as smaller companies – for which no annual reports are published – may serve less passengers per staff member, and as also landside services are not fully included, this figure is an underestimation. Therefore we assume the employment to be in the range of 200-300,000 in this sub-function.

The GVA is estimated using the assumption that it relates to the total water transport sector similarly to its employment share, resulting in an estimated € 19 bn of value added.

Trends indicate a growth in the size of companies, as well as gradually increasing vessel sizes. This suggests that employment would not have grown very much over the past years. Based on the number of passengers, a slight decline of 0.2% over the period 2004-2009 would be assumed (Eurostat data).

### 1.3.4 Environment

- Trend towards greener shipping, based on fuel price growth and policy and regulatory pressure.



- Two European sea basins (Baltic Sea and North Sea) declared Emission Control Areas with stricter regulations on emissions from ships; these are also basins with a dense network of ferry links.
- Biogas is explored as a new fuel for ferries; by 2020 the first biogas propelled ferries are expected to be in operation;
- EU strives to reduce CO<sub>2</sub> emissions from shipping by 40% (if feasible by 50%) in 2050 compared to 2005 levels.

### 1.3.5 Regulatory environment

- Regulations are developed on a worldwide level, by IMO and ILO. EU realises that a maritime level playing field needs to be created through these organisations.
- At EU level, EC shipping law covers competition, safety, security, port, employment and environmental aspects.

### 1.3.6 Key external drivers

- Increase in size of ferry for links with larger volumes of passengers and vehicles. Smaller links continue to be served by smaller vessels.
- Competition from new infrastructure (Channel Tunnel, Oresund, Fehmarn Belt link) and from low cost airlines.
- Security is increasingly becoming an issue, especially since security in the air transport market is much tighter than on the ferry market (see security subfunctions 6.1 and 6.2).

### 1.3.7 Crucial new technologies implemented

No crucial new technologies have been implemented in the past decade or are expected to be implemented in the next decade. Technological development will consist of further development and improvement of existing technologies.

### 1.3.8 Expected global competitive position

- Building of ferries for the European market still largely takes place in Europe, however Asian yards are directly targeting this segment using unfair trading practices (“dumping”).
- Ownership still concentrated in Europe.
- European share of employment in ferry shipping relatively large compared to deep sea and short sea shipping, but is declining.

### 1.3.9 Future potential

Overall score for future growth potential: +

- Volume of passengers has been more or less constant for years

### 1.3.10 Links to other sub-functions

Deep and short sea shipping

### 1.3.11 Concluding assessment

- The current size of the passenger ferry services sub-function is estimated at € 20 bn added value and 200,000-300,000 jobs (Data 2009, estimate Ecorys based on data from Eurostat database 2011, and annual reports of ferry operators). This makes the sub-function to be sixth in line on the ranking of sub-functions based on current size.
- The recent growth of the sub-function is estimated qualitatively at 0/+ in terms of added value and -0.2% in terms of employment growth (Eurostat database, 2011, data for the period 2002-2007, based on passenger statistics). This makes the sub-function to be outside of the top-7 in terms of recent growth.

- The future potential of this sub-function is scored qualitatively and the overall score is “++”. Therefore the sub-function is not ranked among the top-7 in terms of future potential

Based on these scores, the sub-function is NOT included in the selected set of 13 sub-functions that will be elaborated in WP2. The reason for this is that it is not among the top-7 for recent growth or future potential, nor is it the largest currently. It is noted that developments related to cruise ferries (the convergence between ferry services and cruise activities) are addressed in sub-function 4.3 (cruise tourism), which is selected for elaboration in WP2.

#### *1.3.12 Key references (up to ten most recently published)*

- Ecotec (2006), Employment trends in all sectors related to the sea or using sea resources
- Eurostat (2008), Shipbuilding and repair: From tankers to pleasure boats. Statistics in focus, 16/2008
- Stena Line (2010), annual report 2009.
- Hellenic Seaways (2010), annual report 2009.
- European Commission (2011), White Paper on Transport COM(2011) 144 final, 28 March 2011

## 1.4 Inland shipping (sea-borne cargoes)

### 1.4.1 Definition and description

The sub-function of inland shipping is defined as all activities associated to the shipping of freight along inland waterways in Europe. Inland Waterways Transport (IWT) has traditionally played an important role in the intra-European shipping of freight and existed before the European road network and before road trucks entered the stage. Since then the IWT market share has declined to around 6% overall in terms of modal share compared to road (73%), rail (17%) and pipelines (4%). The Netherlands, Belgium and Germany account for over 80% of this amount and in these countries the modal share is much higher (over 30% in the Netherlands, over 10% in Belgium and Germany). The IWT sector dominates the transport of dry bulk commodities (ores, coal, agricultural products), while on more dense corridors it also serves large volumes of container shipping.

Geographically the sector is very much concentrated along two main waterways: the Rhine and the Danube. The tributaries of the Rhine are navigated particularly frequently, while in the lower sections (Belgium, Netherlands, parts of Germany) numerous canals also exist which allow the sector to serve many economic centres. In the upper sections of the Rhine, as well as along the Danube, service activity is more closely located to the main river. Outside these main corridors some other areas are of relevance:

- Small canals in Northern France, which give access to agricultural sites in this region.
- Southern France, with the Rhone as the main artery connecting Marseille seaport to Lyon and other industrial centres.
- North- East Germany and Poland

Furthermore in some regions niche activities take place, such as the transport of wood in Finland.

### 1.4.2 Value chain / economic sectors

Inland shipping is itself a service to many other functions. The inland shipping value chain does not differ much to that of deep sea or short sea shipping and consists of:

- Building of barges and equipment – delivering the transport equipment
- Operation of barges – shipping freight
- Inland port services and logistics – operating terminals, handling cargoes, storage, VAL, port management
- Other services (bunkering, repair)
- Inland waterway works – constructing and maintaining inland ports, locks, and canals

### 1.4.3 Economic performance

The overall share of the IWT transport in inland transport is 6%, equalling a performance of 145 bn ton-km. The IWT sector in the EU27 employs about 43.4 thousand people and accounts for some 9,000 enterprises and a turnover of € 6.1 bn (Eurostat, data 2007). Its activity is highly concentrated in countries along the Rhine and Danube corridors, with the Netherlands accounting for about one quarter of employment and one third of enterprises. Germany and France are also important with over 1,000 companies each. In Western Europe the market is dominated by 'one ship companies', usually family owned and operated, while for the Danube market larger companies operating multiple barge fleets are active.

For its recent development, no use could be made of Eurostat time series as data for several important IWT countries are lacking. Over the past few years, while volumes have been fluctuating upwards and downwards, the ongoing increase of scale has caused employment to be stable at best, and added value the same way.

Sector specialists report on the so-called 'IWT paradox' indicating that in the long run, the sector should have a bright future because of road congestion, increased demand for sustainability, the growth of container trades and the development of inland terminals. On the short term however the sector faces overcapacity, weak financial position of entrepreneurs and competition of railways.

#### *1.4.4 Environment*

The trend of greening transport is an incentive to shift freight from roads onto the more environmentally friendly inland waterways, which have a lower emission per ton km than road traffic. The greening trend in the IWT sector has aided the development of cleaner engines, diesel/electric propulsion and optimisation of drive train efficiency, etc. Shippers are increasingly made aware through promotional actions and certification measures. Port authorities use environmental pricing to attract the greenest ships. The Rhine Commission is defining criteria for clean vessel categories similar to the Euro 4-5-6 classes in road freight transport.

#### *1.4.5 Regulatory environment*

IWT regulation is arranged in at several international levels:

- Central Commission for Navigation on the Rhine (CCNR), guaranteeing free access to the waterway and uniform regulations for inspections, customs, crew and vessels.
- Danube Commission, with similar regulations as the CCNR, with the difference that member states are allowed to charge for the use of the waterway.
- EU, where several transport regulations apply to IWT too. Specific IWT regulations exist for crew, safety and River Information Services (RIS).
- UN Economic Commission for Europe (UNECE), with the Convention for the Carriage of Goods by Inland Waterways (CMNI), the European Agreement on Main Inland Waterways of International Importance (AGN) and the European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN).

#### *1.4.6 Key external drivers*

- GDP growth and globalisation drive international trade volume and patterns.
- Environmental policies and fuel price increases cause pressure for greening IWT ships.
- Price competition due to overcapacity in the wake of the economic crisis. The overcapacity situation is likely to persist in the medium term.
- The EU is actively promoting modal shift to IWT as a way to alleviate road congestion and to make transport more environmentally sustainable.
- Major infrastructure investments in waterways, locks, bridges to resolve bottlenecks may form a constraint.

#### *1.4.7 Crucial new technologies implemented*

The IWT sector traditionally is not known for its innovativeness. No crucial new technologies have been implemented in the past decade or are expected to be implemented in the next decade. Technological development will consist of further development and improvement of existing technologies.

#### *1.4.8 Expected global competitive position*

Not relevant to IWT transport in Europe.

#### *1.4.9 Future potential*

In EU policy, as well as from the viewpoint of various Member States' governments, IWT is to be promoted to accommodate transport volume growth and to alleviate congested highways. A volume growth of 38% until 2030 is forecast by the EU.

#### *1.4.10 Links to other sub-functions*

Demand for IWT services is strongly linked to maritime transport, both deep sea and short sea.

#### *1.4.11 Concluding assessment*

- The current size of the inland shipping sub-function is estimated at € 6 bn added value and 43,000 jobs (Eurostat database 2011, data 2007). This makes the sub-function to be outside of the top-7 based on current size.
- The recent growth of the sub-function is estimated qualitatively at 0 in terms of added value and 0/- in terms of employment growth (based on sector specialists' statements). This makes the sub-function to be ranked outside of the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is “++”. Therefore the sub-function is not ranked among the top-7 in terms of future potential.

Based on these scores, the sub-function is NOT included in the selected set of 13 sub-functions that will be elaborated in WP2.

#### *1.4.12 Key references (up to ten most recently published)*

- European Commission (2006), Promotion of Inland Waterways Transport “NAIADES”, COM(2006)6, 17 January 2006
- Ecorys (2008), Sectorstudie van zee- tot binnenhaven, 1 July 2008.
- EBU (2010), The Power of Inland Navigation
- Eurostat (2011), Statistical database
- European Commission (2011), White Paper on Transport COM(2011) 144 final, 28 March 2011
- ING Economisch Bureau (2011), Binnenvaart in de greep van overbrugging. January 2011.

## 2. Food, nutrition, health and ecosystems services



## 2.1 Fish for human consumption

### 2.1.1 Definition and description

This sub-function is defined as all activities associated to the extraction of wild natural resources (e.g. fish, crustaceans, molluscs) for human consumption. The final product delivered to the market is either raw or processed fish.

### 2.1.2 Value chain / economic sectors

The key sectors of this sub-function are Fishing, Fish wholesale and Food processing.

- “Fish wholesale” is very specific to the fishing sector is highly specialised as these businesses only trade fish. Most wholesale activities take place on or close to the quayside and are closely linked to the fishing vessels. Moreover the distinction between wholesale and processing is sometimes not clear as wholesale traders may also run processing operations like gutting or filleting.
- “Food processing” is an optional step in the supply chain as raw fish can be sold directly on the final market.
- “Fishing” needs “Seaports” to operate and “Ship building” to renew its vessels. “Maritime services” and “Maritime equipment” are support services. “Shipping” and “Land transport” are needed for the logistics between fishing grounds, fish markets and fish processing units.

### 2.1.3 Economic performance

Fishing for human consumption and fishing for animal feeding are aggregated in official statistics, but some indications about their relative importance can be extrapolated from Eurostat data:

- For 2007, total production from fishing was estimated to be €7.6 billion, with a contribution to GDP of €3.6 billion and employment levels of approximately 120 000. However, these figures are only partial as Spain and Greece have not reported economic data (Anderson & Guillen 2009 and Eurostat).<sup>11</sup>
- The fishing sector is declining both in terms of firms (vessels) and employment. The European fleet is declining in size and is suffering from low profit margins for several years (Anderson and Guillen 2009).
- The industrial share, dedicated to the production of fishmeal and fishoil (sub-function 2.2) represents 2.6% of the total value annually landed in Europe (based on Eurostat data).

Some data limitation applies for fish processing, which aggregates wild fish and aquaculture processing:

- The latest GDP figures from 2007 are €4.3 billion for fish processing and employment levels of 116 000, which account not only for sub-function 2.1 (Catching fish for human consumption), but also 2.2 (Catching fish for animal feeding) and 2.3 (Growing aquatic products). (Eurostat and Döring & Guillen 2009)<sup>12</sup> Döring & Guillen (2009) do not publish any useful ratio concerning the sourcing between aquaculture and the catching sector for most part of the European fish processing sector.
- By sourcing its raw material on the international market and from the aquaculture sector, the fish processing sector is less and less dependent on the European catching sector, increasing its resilience to fluctuations in European fishing resources. Döring & Guillen (2009) give typical examples of national sectors with diversified supply routes (such as Belgium, Denmark, UK).

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<sup>11</sup> Economic data for the catching sector are derived from Anderson & Guillen (2009) which are based on the Data Collection Regulation (DCR, which is now the Data Collection Framework or DCF). It has been chosen to use data until 2007, as DCF data for 2008 are less complete (for 2007 Spain and Greece data are missing, for 2008 no GVA has been calculated for Spain, Greece, Ireland and the Azores). These data are cross referenced with Eurostat data.

<sup>12</sup> For the processing sector, the data used are sourced from Eurostat as they seem more consistent than the one published by Döring & Guillen (2009).

- Overall, employment levels slightly declined over the 2003-2007 period (Eurostat). Most of the workforce is low-educated: it has been reported for example that in 2009 22% of the UK fish processing workforce had no qualification while only 7% had higher education qualification (ImproveSkills 2011).

#### 2.1.4 Environment

- Overfishing has led to the decline of European production over the last two decades, limiting the input of the sector to the rest of the supply chain.
- It has been shown that climate change has already had an effect on European marine ecosystems. Although researchers acknowledge that anthropogenic influence on marine ecosystems is important in European waters, they already show that species have adapted to the increase in water temperature observed over the last century in European waters, triggering the geographic displacement of species populations northwards, with northern species being replaced by species from further South (Moth-Poulsen 2008). More recently, analysis done during the RECLAIM project<sup>13</sup> show that climate change may have a mixed impact on European stocks, positive for some (like mackerel in the North Sea), negative for others (like plaice in the North Sea).
- CO<sub>2</sub> contribution of the fishing sector is not available in official data.<sup>14</sup>

#### 2.1.5 Regulatory environment

European fisheries are regulated in the framework of the Common Fishery Policy (CFP), initiated in 1983 and currently under revision. Following last reform (2002), the aim of the CFP is to promote “sustainable fisheries and aquaculture in a healthy marine environment which can support an economically viable industry providing employment and opportunities for coastal communities”. The CFP has four major pillars which are:

- the conservation policy aims at protecting the fish resources;
- the structural policy helps the fishing and aquaculture industries to adapt to resource and market constraints;
- the market policy maintains a common organisation of the market in fish products;
- the international policy negotiates conservation aspects at the international level and sets up fisheries agreements with other countries.

#### 2.1.6 Key external drivers

- Climate change is an ongoing process which calls for drastic actions to be taken at the global level. Species compositions will continue to be affected, with consequences not only for the fishing sector but also the rest of the supply chain as the processors will have to adapt to new species (Moth-Poulsen 2008).
- Without drastic measures at European level, for example through the CFP reform, most fishing stocks in European waters may not achieve the Maximum Sustainable Yield (MSY) in the next ten years (Froese & Proelß 2010).
- Consumer awareness towards sustainability is increasing and demand for sustainable certified fish is expected to grow (Baranger et al. 2010)

#### 2.1.7 Crucial new technologies implemented

- IT has significantly increased fishermen’s ability to target fish because both detection and global positioning have improved. The combination of these two types of technologies allows

<sup>13</sup> RECLAIM for REsolving CLImAtic IMpacts on fish stocks (FP6-2005-SSP-5A)

<sup>14</sup> Disaggregated data concerning the CO<sub>2</sub> footprint do not exist for these sectors at the European level. It has been chosen not to make assumptions, as CO<sub>2</sub> emissions may vary widely from one fleet to another (see van Marlen 2009 for example).



fishermen to have a better knowledge of their fishing grounds. This allows them to be more efficient, thus indirectly increasing the potential effort, but also gives them the ability to avoid offshore surface and sub-sea hazards (for example when using the free Kingfisher services in UK waters). The increase of fishing effort through technology (the technological creep) may be a positive outcome for fishing vessels in a context of TAC properly enforced, as it may help them to improve their economic efficiency.

- Research in energy efficiency has three main components for fishing vessels; hull design, engine design and fishing gear. Recent research has shown that improved hull design and engine fitting would allow fishermen to reduce their energy costs. Trials to lower the impact of the most energy demanding gears have shown that adjustments and gear changes can significantly decrease fuel-dependency (van Marlen 2009).
- The rationalisation of the fishing vessel operations is not really a technological innovation but rather one of management. In the 70s and 80s, fishing vessels were used to transport fish to the landing port where the sale took place. In the 90s, new operations have been developed as some fishing vessels land in an “advanced base” close to the fishing grounds and the catch is shipped to the auctions by lorry.
- Regarding the fish processing industry, packaging improvement allowing a better conservation of the fish while decreasing the overall weight of the product is the major driver for the sector. Increasing the product shelf life diminishes wastage of processed products and opens new market opportunities.

#### *2.1.8 Expected global competitive position*

Non EU countries currently produce cheaper fish and transform it at a better yield than European processors (Garrett et al. 2008, Garrett and Tyedmers 2008)

#### *2.1.9 Future potential*

Overall score for future growth potential: 0/+

- Depending on future fishing stock improvements and recoveries, the fishing sector will improve its profitability. However, it may not be an important contributor to job-creation at the European level.
- There is a high atomicity of the fishing and the fish processing sectors: as a result there are very few large players, there seems to be little communication between operators.
- Low profit levels have weakened the fishing sector which will not be able to absorb important shocks (such as high energy prices) (Anderson & Guillen, 2009).
- Education policy will be vital for the catching and processing sectors as a large part of the workforce is low-educated. Focused education policies would allow those workers to acquire more versatile skills which would also interest other industries and increase job market fluidity.
- Energy policies are vital for the catching sector, although the European Commission has almost no power to affect the trend in energy prices. It can nonetheless push for new energy solutions which will be profitable for the whole economy (transport) but also the fishing industry.

#### *2.1.10. Links to other sub-functions*

Co-products and waste can be valorised by sub-function 2.2 (fishmeal) and 2.4 (new molecules)

#### *2.1.11 Concluding assessment*

- The current size of the sub-function ‘catching fish for human consumption’ is estimated at € 7.9 bn added value and 200,000-240,000 jobs (Anderson and Guillen, 2009, data 2007 – these data do not cover all EU countries as stated above). This makes the sub-function to rank 7<sup>th</sup> in terms of current size.

- The recent growth of the sub-function is estimated at 4.0% in terms of added value and -4.0% in terms of employment growth (Anderson and Guillen, 2009, data 2003-2007). This makes the sub-function to be ranked outside of the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is “0”. Therefore the sub-function is not ranked among the top-7 in terms of future potential

The sub-function is NOT included in the selected set of 13 sub-functions that will be elaborated in WP2. An important additional reason for this lies in the fact that this study does not seek to explore domains which are specific and exclusive to Common Fisheries Policy as they are covered elsewhere. However we will seek to identify complementarities with the CFP where appropriate and relevant, and aim to identify existing or new synergies with it.

#### *2.1.12 Key references (up to ten most recently published)*

- Anderson J. & Guillen J. (eds.) (2009) “The 2009 Annual Economic Report on the European Fishing Fleet”. Report EUR 24069 EN. Scientific, Technical and Economic Committee for Fisheries (STECF). Ispra.
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- Failler, P. (2007) “Future prospects for fish and fishery products. 4. Fish consumption in the European Union in 2015 and 2030. Part 1. European overview.” FAO Fisheries Circular. No. 972/4, Part 1. Rome, FAO. 204p.
- FAO (2010) “The State of World Fisheries and Aquaculture”. Rome
- Froese, R. & Proelß, A. (2010) “Rebuilding fish stocks no later than 2015: will Europe meet the deadline?” Fish and Fisheries, 11(2), 1467-2979.
- Garrett A. & Tyedmers P. (2008) “CO2 emissions - Case studies in selected seafood product chains”. Seafish Briefing Paper. 20p.
- Garrett A. et al. (2008) “Availability of fish: implications for UK processing companies” Seafish Seafood Strategic Outlook 5.
- ImproveSkills (2011) “Fish Processing. Labour Market Information Profile 2010/2011”
- Moth-Poulsen T. (2008) “Effect of Climate Change on Fisheries and Aquaculture with emphasis on Central and Eastern Europe” FAO SEU, 5p.
- van Marlen B. (ed.) (2009) “Energy Saving in Fisheries” (ESIF) FISH/2006/17 LOT3 – Final Report. Report number C002/08.SEC(2009) 453

## 2.2 Catching fish for animal feeding

### 2.2.1 Definition and description

The sub-function of Catching fish for animal feeding is defined as the extracting of wild natural resources (essentially fish) for animal consumption. The final product delivered to the rest of the market is mainly fishmeal and fish oil, which can be used by the agriculture sector (pigs, poultry and cattle) and the aquaculture sector.

### 2.2.2 Value chain / economic sectors

Overall this sub-function has the same structure as catching fish for human consumption in terms of sectors involved. The main difference lies in the processing step which is mandatory in this supply chain, and which takes place in specific fishmeal factories. The supply chain is also sourcing raw material from other fish processing factories as fish trimmings are used to produce fishmeal (for example, it has been reported that the whole Spanish fishmeal production is based on trimmings).

### 2.2.3 Economic performance

European production of fishmeal has declined over the last decade: from 707 thousand tonnes in 1998 to 391 thousand tonnes in 2008 (Green, 2010). The fish oil production has followed the same trend: from 191 thousand tonnes in 1998 to 111 thousand tonnes in 2008.

It is estimated that the sub-sector represents 2.6% of the value landed by the fishing sector in Europe (Eurostat). The latest available figures for employment and GVA are quite old: in 2003 the sub-function was believed to represent 2222 FTEs and 137 million euros in value added (European Parliament 2004).

### 2.2.4 Environment

Most of the elements relevant for this sub-function are similar to those applying to sub-function 2.1 (Catching fish for human consumption):

- Overfishing has led to the decline of European production in the last two decades, limiting the input of the sector to the rest of the supply chain. In 2010 Sandeel landings were only a third of the landings known at the end of the 1990s. In the meantime, the TAC for blue whiting (which is caught for human consumption but also for industrial purposes) has been reduced by 93% in 2011 due to poor stock levels.
- It has been shown that climate change has already had an effect on European marine ecosystems (Moth-Poulsen 2008). The RECLAIM<sup>15</sup> study results indicate that some major stocks for fishmeal may be adversely affected by climate change (like for sandeel) although sometimes trends are not clear, positive in some sea basin, negative in others (like for sprat).
- CO<sub>2</sub> contribution of the fishing sector is not available in official data<sup>16</sup>.

### 2.2.5 Regulatory environment

European fisheries are regulated in the framework of the Common Fishery Policy (CFP), initiated in 1983 and currently under revision. Following last reform (2002), the aim of the CFP is to promote “sustainable fisheries and aquaculture in a healthy marine environment which can support an economically viable industry providing employment and opportunities for coastal communities”. The CFP has four major pillars which are:

- the conservation policy aims at protecting the fish resources;

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<sup>15</sup> RECLAIM for REsolving CLimate IMpacts on fish stocks (FP6-2005-SSP-5A)

<sup>16</sup> As mentioned in sub-function 2.1, disaggregated data concerning the CO<sub>2</sub> footprint do not exist for these sectors at the European level. It has been chosen not to make assumptions, as CO<sub>2</sub> emissions may vary widely from one fleet to another (see van Marlen 2009 for example).

- the structural policy helps the fishing and aquaculture industries to adapt to resource and market constraints;
- the market policy maintains a common organisation of the market in fish products;
- the international policy negotiates conservation aspects at the international level and sets up fisheries agreements with other countries.

#### *2.2.6 Key external drivers*

Most of the external drivers listed for the fishing sector (sub-function 2.1) can be applied to this sub-function:

- The production level achieved by the South-American fishery (Peru & Chile) which is the first production zone worldwide (representing 40% of the annual volume of fishmeal according to Green 2010) seems to some extent inversely linked to the El Niño phenomenon. According to NOAA, “the frequency of El Niños has increased in recent decades, a shift being studied for its possible relationship to global climate change.”
- Consumer awareness towards sustainability is increasing and demand for sustainable certified fish is expected to grow (Baranger et al. 2010, Chamberlin 2011). This trend also impacts the fishmeal/fishoil industry which has developed its own certification for fishmeal/fishoil processors, the Global Standard for Responsible Supply (IFFO-RS).

#### *2.2.7 Crucial new technologies implemented*

Most of the improvement developed by the fishing sector (sub-function 2.1) can be applied to this sub-function:

- IT has significantly increased fishermen’s ability to target fish because both detection and global positioning have improved. The combination of these two types of technologies allows fishermen to have a better knowledge of their fishing grounds. This allows them to be more efficient, thus indirectly increasing the potential effort, but also gives them the ability to avoid offshore surface and sub-sea hazards (for example when using the free Kingfisher services in UK waters). The increase of fishing effort through technology (the technological creep) may be a positive outcome for fishing vessels in a context of TAC properly enforced, as it may help them to improve their economic efficiency.
- Research in energy efficiency has three main components for fishing vessels; hull design, engine design and fishing gear. Recent research has shown that improved hull design and engine fitting would allow fishermen to reduce their energy costs. Trials to lower the impact of the most energy demanding gears have shown that adjustments and gear changes can significantly decrease fuel-dependency (van Marlen 2009).

#### *2.2.8 Expected global competitive position*

Europe only represents 8% of global fishmeal production, when Peru and Chile represent almost 40% of the production (Green 2010).

#### *2.2.9 Future potential*

Overall score for future growth potential: 0/+

- Although improvements in stock levels may have a positive impact on the sub-function profitability, it will not be an important contributor to Europe growth (in GDP or employment) due to its relative small size.

#### *2.2.10. Links to other sub-functions*

- Can recycle some of the waste produced by sub-function 2.1
- Aquaculture (sub-function 2.3) constitutes one of its major clients.

#### *2.2.11 Concluding assessment*

- The current size of the sub-function 'catching fish for animal feeding' is estimated at € 0.2 bn added value and 5,700 jobs (Eurostat database, 2011, data 2007). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at -5.8% in terms of added value (Green, 2010) and qualitatively at '-' in terms of employment growth. This makes the sub-function to be ranked outside of the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "0". Therefore the sub-function is not ranked among the top-7 in terms of future potential

Based on these scores, the sub-function is NOT included in the selected set of 13 sub-functions that will be elaborated in WP2.

#### *2.2.12 Key references (up to ten most recently published)*

- Anderson J. & Guillen J. (eds.) (2009) "The 2009 Annual Economic Report on the European Fishing Fleet". Report EUR 24069 EN. Scientific, Technical and Economic Committee for Fisheries (STECF). Ispra.
- Chamberlain A. (2011) Fishmeal and Fish Oil –The Facts, Figures, Trends, and IFFO's Responsible Supply Standard. International Fishmeal & Fish Oil Organisation, 30p.
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- Moth-Poulsen T. (2008) "Effect of Climate Change on Fisheries and Aquaculture with emphasis on Central and Eastern Europe" FAO SEU, 5p.
- van Marlen B. (ed.) (2009) "Energy Saving in Fisheries" (ESIF) FISH/2006/17 LOT3 – Final Report. Report number C002/08.SEC(2009) 453

## 2.3 Growing aquatic products

### 2.3.1 Definition and description

The sub-function of Growing aquatic products is defined as all activities associated to the farming of aquatic organisms, mainly for human consumption and all the associated processing activities. The final product delivered to the market is mainly fish and molluscs, but can also be in the form of bio-energy.

### 2.3.2 Value chain / economic sectors

The key sectors of this sub-function are “Aquaculture” and “Food processing”. Three major types of aquaculture can be distinguished:

- Bivalves aquaculture is a low input sector, which does not involve any feeding phase.
- Fish aquaculture is a high input sector, which is a client of the “Catching fish for animal feeding” sub-function. “Food processing” is an optional step in the supply chain as raw fish can be sold directly on the final market.
- Algae aquaculture is still in its infancy in Europe.

Aquaculture still needs “Ship building” to build and renew (maybe not for recent fish farms but at least for the more traditional part of the sector) its specific vessels. “Maritime services” and “Maritime equipment” are support services. “Shipping” and “Land transport” are needed for the logistic between aquaculture grounds, fish markets and fish processing units.

### 2.3.3 Economic performance

- Overall there is little information available on the economic performance of the sub-sector. According to the available data (Eurostat), the aquaculture sector is slightly declining in volume but growing in value at the European level: Total production is estimated to reach €3.3 billion for 1.31 million tonnes in 2007<sup>17</sup> compared to €2.4 billion for 1.38 million tonnes in 1998 (inland aquaculture production was worth €770 million in 2007). Over the period, the evolution was not steady: the value produced has increased from 1998 to 2001 (then reaching €3.1 billion), decreased from 2002 to 2004 (€2.6 billion) and rebounded since then.
- In 2006, employment was estimated to be 63 700 FTE (Framian 2009)

As reported in function 2.1, the European processing sector has increased its supplies from “European” aquaculture species such as salmon but also imported aquaculture products (tilapia, panga). In the absence of useful ratios in Döring & Guillen (2009) to avoid double counting, figures are only reported in sub-function 2.1

### 2.3.4 Environment

- Aquaculture development is sometimes considered to have a significant impact on the maritime environment like in Hoepffner (2006) which states that “*Intensive fish culture can lead to coastal eutrophication, due to the accumulation of nutrients from fish excretion and excess food supply in rejected waters, providing ideal conditions for algal blooms, occasionally driving to anoxia at depth*”. However, comments from Stirling University to the EC consultation indicates that “*the effects of fish farm effluents have been rather extensively studied and do not appear to be as far reaching as initially feared*”.
- Hoepffner (2006) considers also that aquaculture of carnivore fishes may stimulate sea fisheries through the use of fishmeal and fish oil (link between sub-functions 2.2 and 2.3), which may have contributed to certain stock reductions in the North Sea.
- CO<sub>2</sub> contribution of the aquaculture sector is not available in official data.

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<sup>17</sup> It has been chosen to use 2007 data, as Eurostat data for 2008 and 2009 do not report some key players production (Greece and in a lesser extent Germany).

### 2.3.5 Regulatory environment

Aquaculture operations are affected by several European framework legislations. The Common Fishery Policy and particularly the European Fisheries Fund aim at reducing the impact of aquaculture production on the environment and at improving the quality of produce and conditions in terms of human and animal health (EFF Priority Axis 2). The Water Framework Directive (WFD) consists in a set of environmental objectives, which include achieving good ecological and chemical status of surface water (Hedley & Huntington 2009). The WFD is relevant for internal waters and coastal water up to 1 nautical mile. The Marine Strategy Framework Directive is in essence the continuation of the Water Framework Directive beyond the 1 nautical mile limit. The concentration of aquaculture activities is currently lower outside the first nautical mile but that the development of offshore aquaculture might increase the relevance of this directive in the future (Hedley & Huntington 2009). The Council Regulation concerning use of alien and locally absent species in aquaculture aims to create a framework governing aquacultural practices in order to ensure adequate protection of the aquatic environment from the risks associated with the use of non-native species in aquaculture.

### 2.3.6 Key external drivers

- Onshore aquaculture (using water recirculation systems and sometimes heating) is very energy intensive and therefore sensitive to rising fuel prices.
- Genetically modified fish and algae might be one of the future drivers of aquaculture (Sturrock H. et al. 2008). There is however an issue of social acceptance for these GM products in Europe.
- Consumer awareness towards sustainability is increasing and demand for sustainable certified fish is expected to grow, affecting also suppliers to the aquaculture sector (Baranger et al. 2010, Chamberlain 2011). Friend of the Sea has already certified a certain number of aquaculture producers and the development of the Aquaculture Stewardship Council standards is a further step in that direction. Ecological aquaculture development may also benefit from the increase of consumer awareness towards sustainability.

### 2.3.7 Crucial new technologies implemented

- Nutrition improvement remains one of the main challenges of the aquaculture sector (carnivorous fish and crustaceans); how to source low value proteins and avoid wastage while maintaining productivity levels is a continuous challenge for the industry (The Research Council of Norway 2005). Although progresses have been made since 2005, the increase in fishmeal price on the international market which has more than tripled between 2005 and 2011<sup>18</sup> maintains the issue on the sector agenda.
- Development of cages allowing aquaculture to take place at a larger distance from the shore and thus to avoid direct competition for the inshore space (Sturrock et al. 2008).
- Species suitable for aquaculture, especially in the algae and micro algae sub-sector are still largely unknown. Selection and adaptation of new species (fish but also algae) is a continuous process (Sturrock et al. 2008).
- Onland sea-water aquaculture is burgeoning but still at an early stage: Pilot plants exist but scaled up facilities still have to prove their viability. Recirculation systems are being developed to allow aquaculture to take place almost anywhere (Bregnballe 2010).

### 2.3.8 Expected global competitive position

- Space and resource availability might be an issue for the aquaculture sector. Coastal aquaculture will face more competition for the use of maritime space, both in coastal and

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<sup>18</sup> Peruvian fishmeal was at \$585 per tonne FOB in 2005 (IFFO) and almost at \$1700 per tonne FOB in 2011 (chinafeed.info)



offshore zones, with various sectors depicted in other functions (e.g. wind and wave energy production, tourism, coastal protection; see Bostock et al. 2008).

- Intense competition at the international level, with non-EU countries producing cheap fish (such as tilapia, pangasius; see Garrett et al. 2008)

### 2.3.9 Future potential

Overall score for future growth potential: +

- Intensive aquaculture still has to find its place on land, as the technique still has to prove its scalability. Moreover the environmental risk associated with its development has not yet been fully evaluated (spillage...).
- Salt-water aquaculture still needs to undergo technological advancements to reach both offshore waters and inland spaces and not concentrate exclusively on the coastline
- Moreover, it needs to diversify the product it can offer to become more resilient. The R&D part of the sector needs a positive environment towards its development<sup>19</sup>.

### 2.3.10. Links to other sub-functions

- Sources some of its inputs from catching fish for animal feeding (sub-function 2.2)
- In conflict for space with wind and wave energy production, tourism, coastal protection.

### 2.3.11 Concluding assessment

- The current size of the sub-function 'growing aquatic products' is estimated at € 3.3 bn added value and 64,000 jobs (Eurostat database, 2011, data 2007; Framian, 2007). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated qualitatively at '+' in terms of added value and employment growth. This makes the sub-function to be ranked sixth in the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "++++". Therefore the sub-function is not ranked among the top-7 in terms of future potential

Based on these scores, the sub-function is included in the selected set of 13 sub-functions that will be elaborated in WP2 on the basis of its recent growth.

### 2.3.12 Key references (up to ten most recently published)

- Baranger L. et al. (2010) "Quel potentiel commercial pour des produits de la pêche écolabellisés ? Attentes et comportement des consommateurs". RICEP, AGLIA
- Bregnballe J. (2010) Guide to Recirculation Aquaculture. Eurofish, Copenhagen, Denmark. 66p.
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<sup>19</sup> In their conclusions, Bostock et al. (2009) indicate that "much of the industry has very limited scope for investment in innovation and especially R&D, indeed access to finance for basic investment and working capital are often difficult to obtain. The role of EU structural and framework RTD programmes funding is very important"



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- Hoepffner N. (ed.) (2006) "Marine and Coastal Dimension of Climate Change in Europe". A report to the European Water Directors. European Commission- Joint Research Centre. Ispra, Italy.
- Sturrock H. et al. (2008) "Prospective Analysis of the Aquaculture Sector in the EU. PART 2: Characterisation of Emerging Aquaculture Systems". IPTS JRC
- The Research Council of Norway (2005) "Aquaculture 2020 - Transcending the Barriers – as long as... A Foresight Analysis", 168p.

## 2.4 High value use of marine resources

### 2.4.1 Definition and description

The sub-function of 'High value use of marine resources is defined as all activities associated to the development of new usages of marine resources consisting of the use of wild and farmed aquatic living resources as precursors of bio-molecules used for high value products. The scope of this sub-sector is limited to R&D for the purpose of this study. In essence, marine cosmetics are not so different from cosmetics sourced from the Amazon forest – it is about unravelling the potential of the biodiversity of a specific earth compartment for the benefit of the rest of the economy. Major clients of this sub-function are the cosmetic and pharmaceutical sectors, but other sectors can also benefit from these products. In 2001, the European Science Foundation (ESF) suggested that marine biotechnology could provide new techniques to monitor and assess, restore, protect and manage marine environments (ESF 2001).

### 2.4.2 Value chain / economic sectors

The key sector of this sub-function is "Marine Services", in its Research and Development dimension. "Fishing" and "Aquaculture" provide the raw materials on which the R&D will perform its research.

- Micro-algae are already used to produce Omega-3 and Omega-6 fatty acids but also other important molecules for the pharmaceutical industry.
- Current research includes work on anti-oxidants, anti-inflammatory effects or artificial blood. Research focuses also on specific algae able to produce particular compounds for the energy industry (biofuels) or molluscs releasing glue which is active in wet environments (applications in the health sector but also in construction)

### 2.4.3 Economic performance

This sub-function currently has limited economic performance, as it is R&D centred. Moreover, it is very difficult to extract any meaningful information from the available data, as most of the firms involved are included in a category which encompasses all research and development in natural sciences and engineering. However, global market for marine biotechnology products and processes was estimated in 2002 to be \$2.4 billion (1/3 in the USA and 2/3 elsewhere) with an upwards trend (Lloyd-Evans L 2005a).

### 2.4.4 Environment

Most of the research has a low direct impact on the environment as little quantities are required: as reported by Harris O'Hanlon, a sample of one kilogramme is sufficient (Harris O'Hanlon 2006). If interesting molecules are discovered in marine organisms, the associated domestication for aquaculture has still to be undertaken, which might be a technological challenge according to Querellou (2010). Several potential benefits have been identified, such as cost-effective and non-toxic antifouling technologies or high-resolution biosensing technologies allowing environmental monitoring (Querellou 2010).

### 2.4.5 Regulatory environment

Sourcing new molecules from marine organisms is expected to be regulated under the Regulatory framework for the management of chemicals (REACH ) which is an integrated system for the registration, evaluation, authorisation and restriction of chemicals. However this would maybe not affect molecules sourced in this sub-function if they remain "naturally occurring and chemically unaltered substances" or if their annual production does not reach the different threshold tonnage of the directive. Some of the products sourced are expected to be affected by the Biocide Directive , especially in the development of active bio-substances for bio-fouling mitigation or pest control.

#### 2.4.6 Key external drivers

- Demand for new molecules is high from several sectors (cosmetics, pharmaceuticals).
- Biodiversity screening has been achieved for more than three decades in all biodiversity compartments (e.g. forests, seas).
- The development of 'omics' technologies is seen as the major driver by the ESF (Querellou 2010).

#### 2.4.7 Crucial new technologies implemented

The sub-sector has benefited from a significant number of technological achievements over the last 20 years:

- Most of them are related to the dissemination of molecular biology techniques which are now economically available even for Small and Medium Enterprises (SMEs). Improvements over the last two decades have allowed researchers and scientists to use chemical screening like chromatography (HPLC) and spectroscopy on a daily basis.
- Genetic techniques, such as genetic characterisation techniques (e.g. PCR) but also transgenesis are also more available for SMEs, allowing them to isolate sequence and replicate genetic material coding for promising molecules.

#### 2.4.8 Expected global competitive position

Research for new marine compounds is taking place in several OECD and non OECD countries.

#### 2.4.9 Future potential

Overall score for future growth potential: +

- This is a small subfunction but with high potential for new products and markets in the future. As the products developed by this sub-function can be used in almost all economic sectors, the impacts on the general economy can be huge in case of a technological breakthrough.
- Bioactive substances are searched for in all marine compartments: fish, crustacean, corals, mud, salt, water (see Kim, Ravichandran, Khan & Kim 2008)

#### 2.4.10. Links to other sub-functions

- Sources some of its inputs from catching fish for animal feeding.
- Could use developments in aquaculture to grow promising organism.
- New feedstocks for development of bioenergy.

#### 2.4.11 Concluding assessment

- The current size of the sub-function 'high value use of marine resources' is estimated at € 0.6 bn added value (Lloyd Evans, 2005) and less than 500 jobs (Eurostat database, 2011, data 2007). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at 4.6% in terms of added value (Eurostat, 2010) and qualitatively at '+' in terms of employment growth. This makes the sub-function to be ranked sixth in the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "+++ +++". Therefore the sub-function is ranked first among the top-7 in terms of future potential, jointly with sub-functions 3.2 (offshore wind energy) and 5.1 (protection against flooding and erosion).

Based on these scores, the sub-function is included in the selected set of 13 sub-functions that will be elaborated in WP2, on the basis of its future potential as well as its recent growth.

#### 2.4.12 Key references (up to ten most recently published)

- ESF (2001) "Marine Biotechnology: A European Strategy for Marine Biotechnology" ESF Marine Board Feasibility Study Group Report, 29p.

- Kijjoa A. & Sawangwong P. (2004) "Drugs and Cosmetics from the Sea" *Mar. Drugs*, 2, 73-82
- Lloyd-Evans L (2005a) "A study into the prospects for marine biotechnology development in the United Kingdom- volume 1 – strategy" FMP Marine Biotechnology Group – 02 – Volume 1, 86p.
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- Harris O'Hanlon L. (2006) "Scientists Are Searching the Seas for Cancer Drugs" *J Natl Cancer Inst* 98(10):662-663.
- Kim S., Ravichandran Y., Khan S. & Kim Y. (2008) "Prospective of the cosmeceuticals derived from marine organisms". *Biotechnology and Bioprocess Engineering*, 13(5):511-523.
- Querellou J. (coord.) (2010) "Marine Biotechnology: A New Vision and Strategy for Europe". Marine Board-ESF Position Paper 15, 96p.

## 2.5 Agriculture on saline soils

### 2.5.1 Definition and description

The sub-function of Agriculture on saline soils is defined as all activities associated to the development of agriculture on salted soils. The United Nation's Food and Agriculture Organization (FAO) estimates that approximately 20% of irrigated lands are affected by increasing salinity (Rozema and Flowers, 2008). In Europe, 26 countries have reported cases of salinisation with higher frequency in Mediterranean coastal areas (Flowers, 2004). Currently, there is no large-scale saline agriculture production. However, important research is currently being pursued in the following two areas:

- Improving existing crops (e.g. wheat, barley) to be cultivated salted soils; and
- Adapting existing halophyte (salt-tolerant plants) to large-scale cultivation practices.

The key outputs of this sub-function are the capacity to produce food from soils currently considered as improper for cultivation and the potential for biofuel feedstocks (e.g. *Salicornia*).

### 5.2.2 Value chain / economic sectors

Currently, this sub-function is at the R&D stage: The key sectors of this sub-function are "Marine Services", in its Research and Development dimension and "Agriculture R&D".

### 2.5.3 Economic performance

This sub-function has limited economic performance, as it is R&D centred. Moreover, it is very difficult to extract any meaningful information from the available data, as most of the firms involved are included in a category which encompasses all research and development businesses on natural sciences and engineering. However, the potential economic impacts are important at the European scale as soil salinity affects an estimated 1 million hectares in the European Union, mainly in Mediterranean countries, and is a major cause of desertification. In Spain 3% of the 3.5 million hectares of irrigated land is severely affected, reducing markedly its agricultural potential while another 15 % is under serious risk (Jones, Montanarella & Jones 2005). Developments achieved in this subfunction would allow not only the extension of agriculture in coastal areas, but also in places where soil conditions have been degraded due to improper irrigation practices or in semi-desertified territories.

### 2.5.4 Environment

Currently, salted lands are not considered as agricultural land, except for ultra localized productions. Freshwater species like wheat only tolerate a salinity threshold close to zero and productivity drops instantly with increasing salinity (Hoek J. 2010).

### 2.5.5 Regulatory environment

There does not seem to have a specific regulation concerning saline agriculture. Its development should be consistent with rules set up in the framework of the Common Agricultural Policy.

### 2.5.6 Key external drivers

Soil degradation is almost an irreversible process, resulting in increased salt concentrations which are hindering crop productivity. At the global scale, it is estimated that 20% of irrigated land is affected by increases in salt concentration (Rozema & Flowers 2008). Rising demand for food is exacerbating the issue in developing countries, where inadequate irrigation can lead to soil degradation and desertification (Parry et al. 2005)

### 2.5.7 Crucial new technologies implemented

The sub-sector has benefited from a significant number of technological achievements over the last 20 years:

- Most of them are related to the dissemination of molecular biology techniques which are now economically available even for Small and Medium Enterprises (SMEs). Improvements over the last two decades have allowed researchers and scientists to use chemical screening like chromatography (HPLC) and spectroscopy on a daily basis.
- Genetic techniques, such as genetic characterisation techniques (e.g. PCR) but also transgenesis are also more available for SMEs, allowing them to isolate sequence and replicate genetic material coding for promising molecules.

#### 2.5.8 Expected global competitive position

- Research for salt-tolerant crops is vital for several arid or developing countries: several countries have dedicated research centres, focused on salt-tolerant agriculture (Middle East countries and Pakistan).
- Australia is already actively working on the adaptation of wheat and barley to saline soils (Colmer, Munns & Flowers 2005)
- NASA has been conducting research on halophytes for several years (see for example Hendricks & Bushnell 2008)

#### 2.5.9 Future potential

Overall score for future growth potential: ++

- This is a small sub-function but which has important prospects of helping to maintain the agricultural yields in area suffering from soil salinisation.
- It may also have breakthrough on the bio-energy sector as some of the halophytes currently being developed are expected to be promising feedstocks (Salicornia among others)

#### 2.5.10. Links to other sub-functions

- In conflict for space with tourism and coastal protection if attempts are made to reclaim coastal land.
- Potentially new feedstocks for the bio-energy sector.

#### 2.5.11 Concluding assessment

- The current size of the sub-function 'agriculture on saline soils' is estimated at less than € 250 mln added value and less than 500 jobs (own estimate based on literature). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated qualitatively at '+' in terms of added value as well as in terms of employment growth. This makes the sub-function to be ranked outside of the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "++++". Therefore the sub-function is not ranked among the top-7 in terms of future potential

Based on these scores, the sub-function is NOT included in the selected set of 13 sub-functions that will be elaborated in WP2.

#### 2.5.12 Key references (up to ten most recently published)

- Colmer T., Munns R. & Flowers T. (2005) "Improving salt tolerance of wheat and barley: future prospects". Australian Journal of Experimental Agriculture 45, 1425–1443.
- Flowers T.J. (2004) "Improving crop salt tolerance". J. Exp. Bot. 55:307-319.
- Hendricks R. & Bushnell D. (2008) "Halophytes Energy Feedstocks: Back To Our Roots". 12th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery Honolulu, Hawaii, 11p.
- Hoek J. (2010) "Strategy for a Saline Environment". EU BIOSAFOR project, 2p.

- Jones A., Montanarella L. & Jones R. (eds) (2005) "The Soil Atlas of Europe". JRC, Ispra , 128p
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- Rozema J. & Flowers T. (2008) "Crops for a salinized world". *Science* 322:1478-1480.
- van Oosten H.J. & de Wilt J.G. (2000) "Bio-production and ecosystem development in saline conditions. Knowledge and innovation challenges". The Hague (The Netherlands), National Council for Agricultural Research (NRLO). NRLO Report 2000/10E.
- Yamaguchi T. & Blumwald E. (2005) "Developing salt-tolerant crop plants: challenges and opportunities". *Trends in Plant Science* 10(12):615-620.

### 3. Energy and raw materials





## 3.1 Oil, gas and methane hydrates production

### 3.1.1 Definition and description

This sub-function is defined as the economic activities associated to the exploration and production of offshore fossil fuels. We have identified two segments:

- Oil production; and,
- Natural gas production.

In addition, other sources of fossils fuels, known as unconventional fuels such as methane hydrates could be exploited provided their resources assessment, economics and environmental impact is fully understood.

Despite its economic importance, the transportation of fossils fuels will not be covered in this section. Most of the imports of fossil fuels into the EU are by sea. The vast bulk of oil and coal imports come by tanker and dry bulk carrier respectively. For natural gas, currently over 80% of imports are by pipeline, the rest is in the form of Liquefied Natural Gas (LNG), transported in tankers by sea and regasified in importing ports, or offshore, for transmission to Europe's natural gas networks<sup>20,21</sup>.

### 3.1.2 Value chain / economic sectors

The value chain for offshore oil and natural gas production consists of the three main elements elements, which are largely the same for both:

- Upstream:
  - Exploration: Where a range of methods are applied to find new oil and natural gas reserves;
  - Production: Brining oil and natural gas to the surface, either naturally or artificially;
- Midstream:
  - Refining: Natural gas is treated and purified to send to the gas markets, and crude oil is converted into finished petroleum products. Refining of natural gas is often done at the platform, removing water, impurities and heavier hydrocarbons. In contrast, crude oil is often transported to a refinery first, because the refining process is complex, for a whole range of different products;
  - Transportation: Natural gas is transported to the main land by pipelines, and crude oil by pipelines or shuttle tankers;
- Downstream:
  - Sales and marketing: Where the refined products are sold to the final consumers.

Because sales and crude oil refining is not an offshore activity per se, we exclude these elements of the value chain from further analysis. We are aware that this is an arbitrary decision, and if it is possible to distinguish on- and offshore refining and sales in work package 2 later stage (e.g. by interviews) we will include them still.

### 3.1.3 Economic performance

More than 80% of current European oil and gas production is offshore, mainly in the North Sea, but also in the Mediterranean, Adriatic and Black Seas. These fields are mature, with declining production and rising costs. In the baseline scenario (Primes 2007), primary production of oil in EU-27 is projected to decrease steadily, arriving at a 2030 production level of 30% of today's level. For natural gas, the decrease is less strong but still, 2030 production is projected to be less than half of

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<sup>20</sup> Roughly 250 bcm were imported to the EU in 2005 by pipeline, whereas only 50 bcm were imported as LNG-shipments; see <http://ec.europa.eu/comm/competition/sectors/energy/inquiry/index.html>

<sup>21</sup> Sec(2007)12863

today's production<sup>22</sup>. However, these domestic resources still can represent an important contribution to European security of energy supply over the next years, especially given high global fossil fuel prices and uncertainties about security of supply. Total turnover of crude oil production of the EU27 in 2008 was 82,122 million euros.

When looking in more detail at the Member States, the UK and Denmark cover more than 80% of the total production of crude oil in 2008. These countries predominantly produce oil offshore. Therefore, we estimated the offshore share of the total turnover to be between 80-90%, meaning the value of crude oil production ranges from 66 to 74 billion euros.

Applying a similar reasoning for natural gas production, the total turnover of natural gas production in the EU27 in 2008 was 90,355 million euros. The UK and the Netherlands, producing equal amounts, together cover 75% of total turnover in the EU. In the Netherlands, 30% is produced offshore; for the UK this is around 80%, which means that of 75% of European gas production, 55% is produced offshore. Extending this reasoning to the other gas producing Member States while applying a larger range, means that between 45-65% of natural gas is produced offshore, yielding a turnover of 41-59 billion euros. In a later stage, more potential quantitative indicators will be explored. For instance, it is envisaged that figures in term of tax revenues from the government could provide a helpful insight as well.

The number of people employed in this sector – that is the European on- and offshore oil and natural gas production industry – was almost 60,000 in 2007. This figure is derived from Eurostat, and some caution should be taken when making conclusions, since according to Eurostat employment fluctuated between 20,000 fte in 2004 and 80,000 in 2005, while production is steadily declining at 4% per year in the last decade. Again applying a very rough estimate, and a similar reasoning as for the turnover, we estimate the current employment in the European offshore oil and gas producing industry to be in the range of 25,000 and 50,000 fte.

There a number of strong, indirect socio-economic effects associated with European oil and gas production as well. So, when looking outside of the value chain as described above, additional effects are<sup>23</sup>:

- Satisfaction of ~50% of the oil and gas demand in Europe, fuelling the European economy
- Investments of €500 billion, contributed €440 billion tax since 1971
- Supports millions of jobs in Europe
- Supports European manufacturing and service industry

### 3.1.4 Environment

Activities associated with the offshore production of oil and natural gas risk seriously impacting the environment, as was demonstrated by the BP oil spill of 2010<sup>24</sup>. More specifically, the following impacts can be identified:

- Seismic surveys, offshore drilling and driving piles into the seafloor impact fish and marine mammals, and disrupt the seafloor and benthic communities. However, it has been noted that offshore construction also enriches marine life, creating suitable habitat for fish and benthic organisms;
- Water pollution linked to the disposal of drilling fluid, oil spills and leakages, which contains hydrocarbon products and heavy metals that is toxic for marine life and seabirds; and,

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<sup>22</sup> Baseline projection, see [http://ec.europa.eu/dgs/energy\\_transport/figures/index\\_en.htm](http://ec.europa.eu/dgs/energy_transport/figures/index_en.htm)

<sup>23</sup> <http://www.oilandgasuk.co.uk/>

<sup>24</sup> Jernelöv, A, 2011. The Threats from Oil Spills: Now, Then, and in the Future. *AMBIO: A Journal of the Human Environment* 39, pp. 353-366.

- Air pollution, through the flaring of burn-off gases, which are gases that are economically not worth transporting and selling to the gas market, and through the operation of the platforms themselves.

Conversely, in Europe there are rather stringent Health, Safety and Environment (HSE) regulations. In order to comply, the European oil and gas industry have taken several measures that lower the chance of accidents such as oil spills and reduce environmental pressures, including the installation of various kinds of safety mechanisms. Moreover, there are options for Carbon Capture and Storage (CCS; see sub-function 3.4 on CCS for more information), and offshore construction – or at least parts of it – to be used for more sustainable purposes such as offshore wind energy.

In work package 2, the potential environmental impacts will be further refined. This will be done by further literature analysis<sup>25</sup> and interview with the sector and stakeholders.

### 3.1.5 Regulatory environment

The most important European regulations regarding (offshore) oil and gas exploration and production are listed below:

- Council Regulation (EU, Euratom) No 617/2010 of 24 June 2010 concerning the notification to the Commission of investment projects in energy infrastructure within the European Union and repealing Regulation (EC) No 736/96
- Regulation (EC) No 663/2009 of the European Parliament and of the Council of 13 July 2009 establishing a programme to aid economic recovery by granting Community financial assistance to projects in the field of energy
- Council Regulation (EC) No 2964/95 of 20 December 1995 introducing registration for crude oil imports and deliveries in the Community
- Council decision 68/416/EEC of 20 December 1968 on the conclusion and implementation of individual agreements between Governments relating to the obligation of Member States to maintain minimum stocks of crude oil and/or petroleum products, as amended by Council Directive 72/425/EEC
- Council Directive 73/238/EC of 24 July 1973 on measures to mitigate the effects of difficulties in the supply of crude oil and petroleum production
- Council Decision 77/706/EEC of 7 November 1977 on the setting of a Community target for a reduction in the consumption of primary sources of energy in the event of difficulties in the supply of crude oil and petroleum products
- Council Directive 2009/119 of 14 September 2009 imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products
- Council Decision 1999/280/EC of 22 April 1999 regarding a Community procedure for information and consultation on crude oil supply costs and the consumer prices of petroleum products
- Directive 2009/73 /EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing
- Directive 2003/55/EC
- Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks
- Regulation (EU) No 994/2010 of 20 October 2011 concerning measures to safeguard security of gas supply

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<sup>25</sup> E.g. Special UNEP report (1993) Environmental management in oil and gas exploration and production. An overview of issues and management approaches

- Directive 2008/92/EC of the European Parliament and of the Council of 22 October 2008 concerning a Community procedure to improve the transparency of gas and electricity prices charged to industrial end-users
- Commission Decision 2003/796/EC of 11 November 2003 on establishing the European Regulators Group for Electricity and Gas

### 3.1.6 Key external drivers

In the list below, key potential external drivers that might affect the growth (or reduction) of the offshore oil and gas sector are provided.

- Supply, demand and price development
- Legislative framework and political landscape
- Infrastructure and services
- Funding and financial markets
- Physical influences
- Marine spatial planning and competition for space
- Technological development

In principal, all drivers are likely to play a role in the development of the energy and raw materials sector. The drivers that are likely to play the largest role, though, are probably supply, demand and price development, legislative framework and political landscape, and the availability of funding and development of the financial markets. If these drivers actually do affect the sector, and how, will be verified and assessed during interviews in work package 2.

### 3.1.7 Crucial new technologies implemented

There is ongoing research in enhanced exploration techniques for oil and gas and other raw material reserves. Geophysicists, biologists and petroleum geologists are constantly developing better geographical information systems, enhanced microfossil biostratigraphy, underwater exploration satellites and other techniques to find deposits more efficiently and effectively. Depending on the geological formation in which the oil and/or gas are stored in, the oil and gas can only be extracted partly from the field. Normally this ranges from somewhere between 20% and 60%.

Recently, techniques known as Enhanced Oil Recovery (EOR) and Enhanced Gas Recovery (EGR) have been developed. With these techniques, more oil and/or gas can be extracted from the fields, thereby providing a higher return on investment when developing a field and producing oil or gas. EGR can be linked with CCS, where the captured CO<sub>2</sub> is stored in a gas field, enabling an increase in gas production<sup>26</sup>.

Another option is exploring and producing in new territories, such as the ultra deep sea (beneath 2000 meter) or the Arctic. Vast oil and gas reserves are present in these areas – up to 25% of the undiscovered oil and gas reserves in the world are expected to be found within the Arctic region. To cope with problems in these remote regions, more research and technological development is needed.

Non-conventional hydrocarbon resources such as heavy oil/tar sands, coal base and coal mine methane and methane hydrates, are estimated to be very substantial<sup>27</sup>. Their exploitation, however, can present major risks and technical challenges. For methane hydrates, for example,

<sup>26</sup> E. Tzimas, A. Georgakaki, C. Garcia Cortes and S.D. Peteves. Enhanced Oil Recovery using Carbon Dioxide in the European Energy System. DG JRC Institute for Energy. December 2005

<sup>27</sup> See "Resources to Reserves – oil and gas technologies for the energy markets of the future" IEA 2005

Europe is leading the research into the risks and consequences of their accidental release, which could seriously contribute to the greenhouse effect<sup>28</sup>. Given their potential contribution to security of supply in the long-term, though, research is warranted.

### *3.1.8 Expected global competitive position*

The future production of crude oil and natural gas in the EU27 will decrease in the coming two decades with 4.2% and 0.9% per year, respectively. However, the world production of crude oil and natural gas will increase annually by 1.0% and 1.5% respectively in the coming 20 years. That means that the competitive global position for European oil and gas production will decline. Although statistics on the share of offshore production compared to total European production are not readily available, it can be assumed that no major changes in the share of offshore production will occur in the coming decade.

In a later stage (work package 2) the global context will be refined and where possible quantified. Impacts of entry of exit of new players on the global market and strong growth outside of the EU will be discussed in more detail. Moreover, special attention will be paid to Norway, an important player on the European offshore oil and gas market.

### *3.1.9 Future potential*

Overall score for future growth potential: -

As mentioned in the paragraph above, the size of the European offshore oil and gas industry is likely to decline slowly over the coming years. However, future technological development – such as exploitation of new territories, EOR and EGR, and mining of unconventional fossil fuels – as well as the development of prices could potentially counteract this decline, or even provide options for future growth.

The future potential will be worked out in more detail in the scenarios, and supplemented by visions from stakeholder by conducting interviews, in work package 2.

### *3.1.10 Links to other sub-functions*

The oil and gas industry could possibly link with wind energy, through multi-use platforms<sup>29</sup> and other offshore constructions, increased energy security, energy demand and supply patterns. Another link can be found with CCS, though usage of empty fields and potential for EOR and EGR. Finally, due to potential spatial competition and marine spatial planning, oil and gas is directly linked with all other sub-functions.

### *3.1.11 Concluding assessment*

- The current size of the sub-function 'oil, gas and methane hydrates' is estimated at € 107-133 bn added value and 25,000-50,000 jobs (Eurostat database, 2011, data 2007 + own estimate). This makes the sub-function to be ranked fourth in the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at -4.8% in terms of added value and in terms of employment growth. This makes the sub-function to be ranked outside of the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "+". Therefore the sub-function is not ranked among the top-7 in terms of future potential

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<sup>28</sup> See <http://www.metrol.org/>; <http://www.igme.gr/anaximander/>; <http://www.hydratech.bham.ac.uk/>; <http://www.geotek.co.uk/hyacinth/>; <http://www.crimea-info.org/project3/crimea0.htm>; <http://www.gashydat.org/>; <http://www.eu-hermes.net/>

<sup>29</sup> [http://cordis.europa.eu/fp7/energy/home\\_en.html](http://cordis.europa.eu/fp7/energy/home_en.html)

Based on these scores, the sub-function is included in the selected set of 13 sub-functions that will be elaborated in WP2 on the basis of its current size.

### *3.1.12 Key references (up to ten most recently published)*

- EC (2009) “EU Energy Security and Solidarity Action Plan: Second Strategic Energy Review”.
- World Energy Outlook 2009. OECD/IEA, 2009.
- Lasschuit, W and Thijssen, N. Shell, 2009. Supporting supply chain planning and scheduling decisions in the oil and chemical industry. Shell report..
- E. Tzimas, A. Georgakaki, C. Garcia Cortes and S.D. Peteves, December 2005. Enhanced Oil Recovery using Carbon Dioxide in the European Energy System. DG JRC Institute for Energy report
- EC, 2010. Facing the challenge of the safety of offshore oil and gas activities Communication from the Commission to the European Parliament and the Council. {sec(2010) 1193}
- Jernelöv, A, 2011. The Threats from Oil Spills: Now, Then, and in the Future. *AMBIO: A Journal of the Human Environment* 39, pp. 353-366.
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- DNV technology outlook, 2009
- OGP (2010) Oil & gas for Europe - it's about time and innovation
- OGP (2010) Environmental performance in the E&P industry - 2009 data

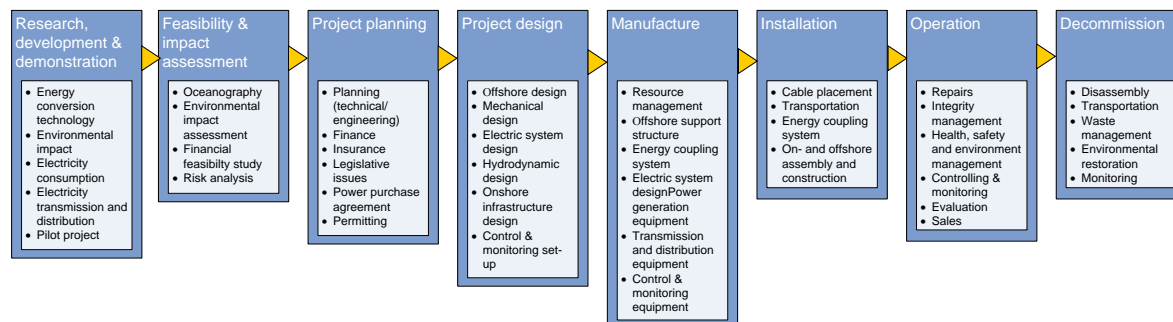
## 3.2 Offshore Wind energy

### 3.2.1 Definition and description

The sub-function Offshore wind energy is defined as all activities related to the development and construction of wind parks in marine waters, and the exploitation of wind energy by generating electricity offshore.

### 3.2.2 Value chain / economic sectors

The value chain for offshore wind energy can generally be visualised as follows:



### 3.2.3 Economic performance

Total wind power capacity in 2009 was 84 GW, of which 2.9 GW was installed offshore<sup>30 31</sup>. If we apply this ratio to the total employment figure of 203,100 FTE and a total turnover of 38,222 million euros in 2009<sup>32</sup>, there were around 7,000 jobs in the offshore wind energy industry in 2009, creating a turnover of around 1.3 billion euros.

This is reasonably in accordance with the estimation of EWEA, which assessed the offshore wind energy employment in Europe at 2800 fte in 2007.<sup>33</sup>

Offshore wind business clusters in Europe can be found in Denmark and Germany. Because the national governments of those Member States included (offshore) wind energy in their national renewable energy strategies, vast amounts of wind energy capacity were installed. This created a niche market for companies headquartered in Denmark and Germany (e.g. Vestas, Siemens Wind Power, Enercon and many smaller companies working in other parts of the value chain). Today, such clusters can be found, amongst others, in Esbjerg and Nakskov in Denmark, and Bremerhaven and Schleswig-Holstein in Germany. These clusters have a strong positive effect for the local economy.<sup>34</sup>

### 3.2.4 Environment

Offshore wind power contributes to the sustainability target of the EU, thereby reducing the emissions of CO<sub>2</sub> and air pollutants. In addition, wind power diversifies the electricity mix in Europe, contributing to increased energy security. Moreover, experts report that the installation of wind turbines and associated equipment improves the habitat for fish and benthic organisms. However, wind turbines can also have adverse effects<sup>35</sup>, such as:

<sup>30</sup> EWEA, 2010. <http://www.ewea.org/index.php?id=180>

<sup>31</sup> EWEA, 2010. Wind in power, *EWEA report*

<sup>32</sup> EurObserv'ER, 2010. The state of renewable energies in europe, *9th EurObserv'ER Report*.

<sup>33</sup> EWEA, 2009. Wind at Work, page 8.

<sup>34</sup> EWEA, 2009. Wind at Work.

<sup>35</sup> CEFAS, June 2004. Offshore wind farms - Guidance note for Environmental Impact Assessment In respect of FEPA and CPA requirements. Version 2

- Construction and installation can affect fish and sea mammals through sub-sea noise during pile-driving;
- There are collisions of birds with the rotor reported; and,
- There is a visual impact.

Conversely, extensive environmental monitoring programmes have been running for several years, mapping potential impacts of offshore wind parks on the marine environment. Examples can be found at Ormonde in the UK, Barrow in Ireland, Egmond aan Zee in the Netherlands and Nysted in Denmark. These effects will be discussed in more detail in work package 2, supplemented with interviews by relevant stakeholders.

### 3.2.5 Regulatory environment

The most important European regulations regarding offshore wind energy are listed below:

- Council Regulation (EU, Euratom) No 617/2010 of 24 June 2010 concerning the notification to the Commission of investment projects in energy infrastructure within the European Union and repealing Regulation (EC) No 736/96
- Regulation (EC) No 663/2009 of the European Parliament and of the Council of 13 July 2009 establishing a programme to aid economic recovery by granting Community financial assistance to projects in the field of energy
- Commission Regulation (EU) No 838/2010 of 23 September 2010 on laying down guidelines relating to the inter-transmission system operator compensation mechanism and a common regulatory approach to transmission charging
- Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC
- Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity repealing Regulation (EC) 1228/2003
- Directive 2005/89/EC of the European Parliament and of the Council of 18 January 2006 concerning measures to safeguard security of electricity supply and infrastructure investment
- Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC
- Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market.

Apart from this legislation, there are a view European funding schemes for wind energy<sup>36</sup>.

Source of funding	Programme	Finance instruments	Geographical scope	Type of projects
EBRD	Technical Cooperation Funds Programme (TCFP)	Grant co-financing	EBRD countries	Pre-development phase
EC	Intelligent Energy Europe (IEE)	Grant support	Member States, Norway, Iceland, Liechtenstein and Croatia	Capacity building
EC	European Regional Development Fund	NA	Member States	Installation investments

<sup>36</sup> Source: Ecofys (2011) Financing Renewable Energy in the European Energy Market. Report for the EC, DG ENER



Source of funding	Programme	Finance instruments	Geographical scope	Type of projects
	and Cohesion Fund			
EIB	NA	(Framework) loans	Member States	Installation investments
EC	European Local Energy Assistance (ELENA; part of IEE)	Grant support	Member States, Norway, Iceland, Liechtenstein and Croatia	Technical assistance and project development
EC	Seventh Framework Programme Energy (FP7)	Grant support	Member States	RD&D
EC	EU Recovery Programme	Grant support	Member States	Investments in installations
EBRD	Sustainable Energy Initiative (SEI)	Credit lines, long-term debt financing and equity investments	EBRD countries	Installation investments
EC	Entrepreneurship and Innovation Programme (EIP)	Venture capital and guarantees	Member States, Norway, Iceland, Liechtenstein and candidate countries for EU enlargement	Early and expansion stage companies

### 3.2.6 Key external drivers

In the list below, key potential external drivers that might affect the growth (or reduction) of the offshore wind sector are provided.

- Supply, demand and price development
- Legislative framework and political landscape
- Infrastructure and services
- Funding and financial markets
- Physical influences
- Marine spatial planning and competition for space
- Technological development

In principal, all drivers are likely to play a role in the development of the energy and raw materials sector. The drivers that are likely to play the largest role, though, are probably supply, demand and price development, legislative framework and political landscape, and the availability of funding and development of the financial markets. If these drivers actually do affect the sector, and how, will be verified and assessed during interviews in work package 2.

### 3.2.7 Crucial new technologies implemented

- Fewer moving parts in the gearbox, extending the lifespan of equipment<sup>37</sup>;
- Enhanced installation and construction techniques, enabling installation in deeper parts of the sea so that more parts of the marine environment can be exploited<sup>38</sup>;
- Floating wind turbine systems<sup>39</sup>;

<sup>37</sup> E.g.: <http://www.northernpower.com/community-wind/community-wind-theme-gearbox-problem.php>  
<sup>38</sup> Stancich, R, 29 November 2010. GeoSea: New technology drives down turbine foundation installation costs. *Wind EnergyUpdate*

- Multi-use offshore platforms<sup>40</sup>;
- Up-scaling of the wind turbines themselves, increasing the capacity of each turbine. There are examples of wind turbines with a capacity of up to 7 MW; and,
- The installation of a super grid in combination with a smart grid system.

### 3.2.8 Expected global competitive position

Globally, most offshore wind turbines are installed in Europe, primarily in Denmark, UK, the Netherlands and Sweden. Outside Europe, there are initiatives in the USA, Japan, China, India and Brazil. The largest offshore wind turbine manufacturers and developers are located in Europe, which represents a first mover advantage. It can be expected that Europe will be the strongest player globally in the field of offshore wind energy exploitation.

In a later stage (work package 2) the global context will be refined and where possible quantified. Impacts of entry of exit of new players on the global market and strong growth outside of the EU will be discussed in more detail.

### 3.2.9 Future potential

Overall score for future growth potential: ++

The European Wind Energy Association predicts a strongly growing home market of around 25% per year, contributing to an installed capacity of 40 GW<sup>41, 42</sup>. This shows that here is an enormous potential to be exploited over the coming years<sup>43</sup>.

Other infrastructures and logistics are necessary to facilitate growth of offshore wind as well. These include specialised vessels, offshore construction equipment, harbour and other onshore facilities and skilled personnel.

### 3.2.10 Links to other sub-functions

There is a link with the other renewable energy sources through sharing of the (offshore) power grid. This can have a negative impact through shortage of transmission capacity. However, a positive impact can be expected as well, since in the medium and long term offshore super grids might be realised in an earlier stage<sup>44</sup>. In addition, there is a potential link with the production of oil, gas and methane production through the multiuse of platforms and other offshore constructions. Finally, due to potential spatial competition and marine spatial planning, offshore wind is directly linked with all other sub-functions.

### 3.2.11 Concluding assessment

- The current size of the sub-function 'offshore wind energy' is estimated at € 1.3 bn added value and 7,000 jobs (EWEA, 2010; EuroObserver, 2010). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at 21.7% in terms of added value and employment growth (Eurostat database, 2011). This makes the sub-function to be ranked first in the top-7 in terms of recent growth.

<sup>39</sup> Lee, K.H. (2005) Floating wind turbines, special report for the 20th Workshop on Water Waves and Floating Bodies – Spitsbergen, Norway

<sup>40</sup> [http://cordis.europa.eu/fp7/energy/home\\_en.html](http://cordis.europa.eu/fp7/energy/home_en.html)

<sup>41</sup> The European offshore wind industry - Key trends and statistics: 1st half 2010. EWEA, August 2010

<sup>42</sup> A breath of fresh air - The European Wind Energy Association - Annual Report 2009. EWEA, April 2010

<sup>43</sup> EEA (2009), Europe's onshore and offshore wind energy potential. An assessment of environmental and economic constraints.

<sup>44</sup> Stancich, R., 19 March 2010. Vision for an offshore supergrid swims into focus. *Wind Energy Update*

- The future potential of this sub-function is scored qualitatively and the overall score is “+++ ++”. Therefore the sub-function is ranked first among the top-7 in terms of future potential, jointly with sub-functions 2.4 (high value marine resources) and 5.1 (protection against flooding and erosion).

Based on these scores, the sub-function is included in the selected set of 13 sub-functions that will be elaborated in WP2 on the basis of its future potential as well as its recent growth.

### *3.2.12 Key references (up to ten most recently published)*

- EEA (2009), Europe’s onshore and offshore wind energy potential. An assessment of environmental and economic constraints.
- The European offshore wind industry – Key trends and statistics: 1st half 2010, EWEA, August 2010
- A breath of fresh air - The European Wind Energy Association - Annual Report 2009. EWEA, April 2010
- Assessment of non-cost barriers to renewable energy growth in EU Member States – AEON. Ecorys, 2010
- Delivering Offshore Wind Power in Europe. Policy recommendations for large-scale deployment of offshore wind power in Europe by 2020 by the European wind energy association, 2007.
- Fact sheet EWEA: Operational offshore wind farms in Europe, end 2010. EWEA 2011
- EWEA, 2010. Wind in power, EWEA report
- EurObserv’ER, 2010. The state of renewable energies in Europe, 9th EurObserv’ER Report.

### 3.3 Ocean renewable energy resources

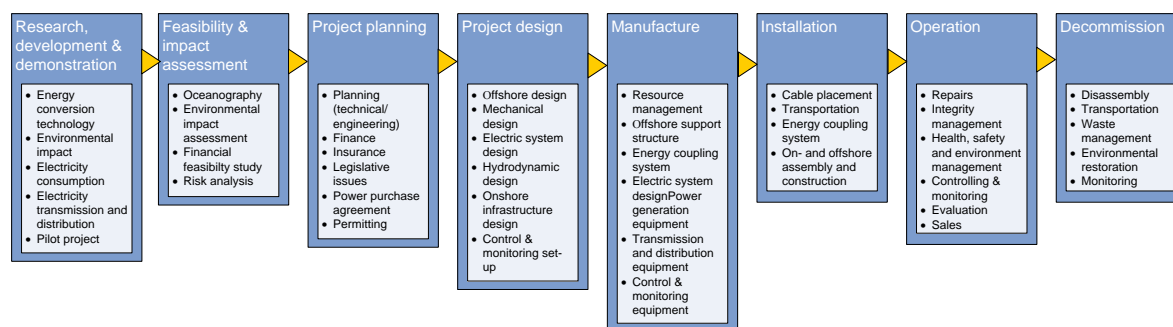
#### 3.3.1 Definition and description

The sub-function ‘Ocean renewable energy resources’ is defined as all economic activities associated to the exploration and production of offshore renewable energy other than wind energy and biofuel. In this functional profile all offshore renewable energy technologies other than wind energy (hereafter ocean energy) are defined, including:

- Wave energy, including attenuators, point absorbers, oscillation water column devices, overtopping techniques and oscillation wave surge collectors. Several demonstration projects are installed in the Netherlands, UK and Denmark;
- Tidal energy, including horizontal and vertical axis turbines, and oscillating hydrofoil equipment. Still in a premature state, although the first commercial turbine has been installed in Ireland;
- Ocean Thermal Energy Conversion (OTEC), which can be near-shore-based and shelf-based, or based on floating techniques using closed, open or hybrid loop systems. This can (currently) not be exploited in temperate Europe because of low differences in temperatures between water layers;
- Blue energy, driven by an osmotic potential between salt and fresh water, including reverse electro-dialysis and pressure retarded osmosis. Few demonstration projects in the UK, Norway, Netherlands, Ireland and Germany.

#### 3.3.2 Value chain / economic sectors

The value chain for ocean energy can generally be visualised as follows:



#### 3.3.3 Economic performance

According to the IEA, around 1 TWh or electricity was generated by tidal and wave energy technologies<sup>45</sup>. This is very small compared with a total generation of 3,325 TWh. Based on this small contribution to the total European power supply, it is assumable that most people active in this sector are working on R&D, such as technical university employees. We estimate the maximum turnover is 25 million euros, creating less than 500 fte in the ocean energy sector.

This rough estimation will be verified, or adapted if necessary in work package 2 by interviews.

#### 3.3.4 Environment

Renewable energy technologies contribute to the sustainability targets of EU by reducing CO<sub>2</sub> emissions and air pollutants. In addition, they diversify the electricity mix in Europe, contributing to increased energy security. However, there are also adverse effects<sup>52</sup>, such as:

<sup>45</sup> IEA (2011) World Energy Outlook 2010. IEA-OECD annual report.

- Construction and installation: Sub-sea noise potentially affects fish and marine mammals as well as scouring the sea bed due to altered sea currents. Installation itself can affect the integrity of the seabed;
- Operating equipment produces electro-magnetic fields that potentially impact electro-sensitive fish such as sharks and rays;
- In case of a tidal barrage, the local coastal ecosystem as a whole is affected; and,
- The visual impact.

Conversely, environmental monitoring programmes have been running for several years, mapping potential impacts of the different ocean energy technologies. These programmes will be discussed in more detail in work package 2, supplemented with interviews by relevant stakeholders. In general, though, the conclusion can be drawn that the current environmental impact is limited merely due to the small number of installations.

### 3.3.5 Regulatory environment

#### European objectives

In 2007, the European Council set out energy and climate change objectives for 2020.<sup>46</sup> The main goals and objectives are brought forward in the European Energy 2020 strategy and communicated via the European 2020 initiative. The main objectives of this initiative are to realise by 2020:

- A reduction of greenhouse gas emissions by 20%;
- An increase in the share of renewable energy to 20% of the energy mix; and
- An improvement of 20% in energy efficiency.

In order to achieve these goals, the EU has set out some priorities and action points for this strategy. The main five priorities of the strategy focus on:

1. ensure a well-functioning energy market
2. improve the interconnection of energy networks
3. enhance energy supply security
4. promote the use of renewable energy
5. increase energy efficiency

The development and deployment of ocean energy will mainly contribute in achieving priority three and four.

#### European legislation

A document is published on the website of DG ENER<sup>47</sup>, on which the European energy legislative framework is listed. The most relevant measures regarding ocean energy are:

- Regulation (EC) No 663/2009 of the European Parliament and of the Council of 13 July 2009 establishing a programme to aid economic recovery by granting Community financial assistance to projects in the field of energy.<sup>48</sup>
- Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC.<sup>49</sup>
- Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.<sup>50</sup>

<sup>46</sup> COM(2010) 639 final. Energy 2020 - A strategy for competitive, sustainable and secure energy.

<sup>47</sup> [http://ec.europa.eu/energy/doc/energy\\_legislation\\_by\\_policy\\_areas.pdf](http://ec.europa.eu/energy/doc/energy_legislation_by_policy_areas.pdf)

<sup>48</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:200:0031:0045:EN:PDF>

<sup>49</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0055:0093:EN:PDF>

<sup>50</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF>

## European funding

In the table below, the main European funding programmes for ocean energy are listed.

Table 0.1 Different European ocean energy funding programmes<sup>51</sup>.

Source of funding	Programme	Finance instruments	Geographical scope	Type of projects
EBRD	Technical Cooperation Funds Programme (TCFP)	Grant co-financing	EBRD countries	Pre-development phase
EC	Intelligent Energy Europe (IEE)	Grant support	Member States, Norway, Iceland, Liechtenstein and Croatia	Capacity building
EC	European Local Energy Assistance (ELENA; part of IEE)	Grant support	Member States, Norway, Iceland, Liechtenstein and Croatia	Technical assistance and project development
EC	Seventh Framework Programme Energy (FP7)	Grant support	Member States	RD&D
EC	EU Recovery Programme	Grant support	Member States	Investments in installations
EC	Entrepreneurship and Innovation Programme (EIP)	Venture capital and guarantees	Member States, Norway, Iceland, Liechtenstein and candidate countries for EU enlargement	Early and expansion stage companies

### 3.3.6 Key external drivers

In the list below, key potential external drivers that might affect the growth (or reduction) of the ocean energy sector are provided.

- Supply, demand and price development
- Legislative framework and political landscape
- Infrastructure and services
- Funding and financial markets
- Physical influences
- Marine spatial planning and competition for space
- Technological development

In principle, all drivers are likely to play a role in the development of the energy and raw materials sector. The drivers that are likely to play the largest role, though, are probably supply, demand and price development, legislative framework and political landscape, and the availability of funding and development of the financial markets. If these drivers actually do affect the sector, and how, will be verified and assessed during interviews in work package 2.

### 3.3.7 Crucial new technologies implemented

Basically all technologies need further research and demonstration in order to become commercially viable. All latest techniques have been summarised in sections above. In a report

<sup>51</sup> Source: Ecofys (2011) Financing Renewable Energy in the European Energy Market. Report for the EC, DG ENER

recently published by the IEA, there is an overview of these offshore renewable energy technologies, including key components and the latest developments.<sup>52</sup>

### 3.3.8 Expected global competitive position

Since all technologies are in a premature state, other than a few exceptions of installations that operate under very specific conditions such as La Rance Tidal Barrage in France, it is hard to predict what Europe's global competitive position will be. Conversely, since most R&D is conducted within its borders, Europe should be able to assume a leading position.

In a later stage (work package 2) the global context will be refined and where possible quantified. Impacts of entry of exit of new players on the global market and strong growth outside of the EU will be discussed in more detail.

### 3.3.9 Future potential

Overall score for future growth potential: +

The IEA predicts in its baseline scenario a total installed capacity in Europe of wave and tidal energy of 1 GW in 2020 and 3 GW in 2030. Although the contribution to the total electricity consumption will still be negligible at that time (<0.1%), there will be an annual increase of 10.5% over the coming two decades. This relatively strong growth is explained by the currently premature state of the technologies and will soon be developed rapidly according to the IEA. Blue energy, OTEC and offshore biomass are not mentioned by the IEA in the future European energy mix. Finally, in the renewable energy action plans of the Member States, these other offshore renewables are seldom mentioned as potential sources of energy by 2020, and should in total have an installed capacity of 2.1 GW.

In another report of the IEA, it is stated that: *“Proposed technologies use different types of ocean energy, like waves, tides, marine currents, thermal energy and salinity gradients. Some, like waves, have a wide applicability and large potential whilst for others such as tidal currents, the potential is limited by available sites. In the ACT scenarios, ocean energy technologies have only marginal importance in the period up to 2050.”*<sup>53</sup> From here we draw the conclusion that ocean energy has a marginal role to play. Essential, though, will be the (better) development of a policy framework regarding ocean energy technologies.

### 3.3.10 Links to other sub-functions

There is a link with offshore wind through sharing of the (offshore) power grid. This can have a negative impact through shortage of transmission capacity. However, a positive impact can be expected as well, since in the medium and long term offshore super grids might be realised in an earlier stage<sup>54</sup>. In addition, there is a potential link with the production of oil, gas and methane production through the multiuse of platforms and other offshore constructions. A further link can be found with short sea shipping, through transportation of equipment. Finally, due to potential spatial competition and marine spatial planning, ocean energy is directly linked with all other sub-functions.

### 3.3.11 Concluding assessment

- The current size of the sub-function 'ocean renewable energy resources' is estimated at less than € 250 mln added value and less than 500 jobs (Own estimate based on IEA, 2011). This makes the sub-function to be ranked outside the top-7 in terms of current size.

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<sup>52</sup> IEA-RETD, February 2011. Accelerating the deployment of offshore renewable energy technologies, *IEA-RETD report*

<sup>53</sup> IEA, 2006. Energy technology perspectives, *IEA\_RET report*, page 131

<sup>54</sup> Stancich, R., 19 March 2010. Vision for an offshore supergrid swims into focus. *Wind Energy Update*

- The recent growth of the sub-function is estimated at '+' in terms of added value and employment growth (own estimate based on literature). This makes the sub-function to be ranked outside of the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "+++++". Therefore the sub-function is ranked fourth in the top-7 in terms of future potential, jointly with sub-functions 6.1 (Traceability and security of goods supply chains) and 6.3 (environmental monitoring).

Based on these scores, the sub-function is included in the selected set of 13 sub-functions that will be elaborated in WP2, on the basis of its future potential.

### *3.3.12 Key references (up to ten most recently published)*

- IEA-RETD, February 2011. Accelerating the deployment of offshore renewable energy technologies, IEA-RETD report
- L.W.M. Beurskens and M. Hekkenberg, 1 February 2011. Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States Covering all 27 EU Member States. EEA and ECN report
- IEA, 2006. Energy technology perspectives, IEA\_RETD report
- Assessment of non-cost barriers to renewable energy growth in EU Member States – AEON. Ecorys, 2010
- Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources
- Stancich, R., 19 March 2010. Vision for an offshore supergrid swims into focus. Wind Energy Update
- ABS Energy Research, 2009. The Ocean Energy Report, fourth edition
- IEA 2011. World Energy Outlook 2010.



## 3.4 CCS

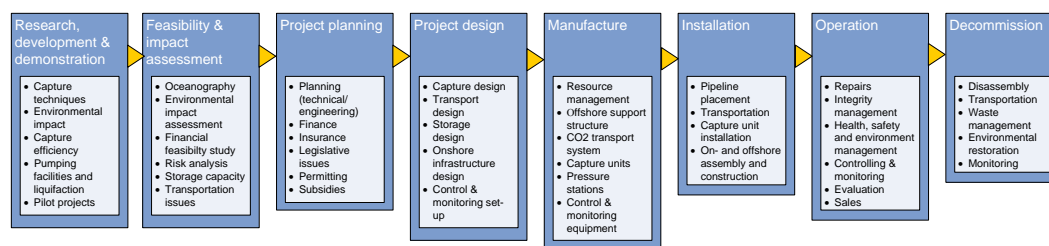
### 3.4.1 Definition and description

The sub-function of Carbon Capture and Storage (CCS) is defined as all activities associated to the storage of CO<sub>2</sub> in earth layers under the sea. CCS is a technique where CO<sub>2</sub> is captured at large CO<sub>2</sub> emitters (e.g. IGCC plants) and is transported to empty oil and gas fields and other favourable geological formations where it can be permanently stored. The option is being studied and demonstrated in several countries in Europe, both onshore and offshore. Although this technology is still in its infancy, CCS could contribute significantly to sustainability targets by reducing the CO<sub>2</sub> emissions. The CO<sub>2</sub> can be transported via pipelines, or specialised CO<sub>2</sub> shuttle vessels. Apart from storing CO<sub>2</sub>, CCS can be used for Enhanced Oil or Gas Recovery (EOR/EGR), enabling increased oil and gas production from the same field.

Currently, many uncertainties exist around CCS regarding its cost-effectiveness, environmental impact and future technological development. More research is needed to gain more insight in these fields.

### 3.4.2 Value chain / economic sectors

The value chain for CCS can generally be visualised as follows:



### 3.4.3 Economic performance

There are only a few demonstration projects in the EU. We therefore estimate value added to the European economy to be lower than €250 million annually, employing less than 500 people.

### 3.4.4 Environment

CCS enables a reduction of CO<sub>2</sub> emissions while continuing normal operations such as generating electricity from coal and gas, albeit not a truly sustainable solution because the fields will become full and the captured CO<sub>2</sub> must be stored elsewhere. Still, the EU has recognised the potential of CCS in helping to reach its sustainability target. However, there are also several adverse effects:

- Construction can affect fish and sea mammals through sub-sea noise;
- There is a potential heat flux from pipelines in the seabed, affecting local benthic communities; and,
- In case of leakage, there is a local increase of pH and pollution of heavy metals.

### 3.4.5 Regulatory environment

A new Directive for CO<sub>2</sub> storage was endorsed in 2008 by the European Parliament. In this Directive, a set of guiding principles are provided, including exploration and storage permits, liabilities and closure procedures for CO<sub>2</sub> storage sites. This Directive is part of an energy package which also includes the European emission trading scheme.

The emission trading scheme is simultaneously a funding source for CCS. 300 million emission allowances are reserved to finance 12 CCS projects, which equals to EUR 6-8 billion.

#### *3.4.6 Key external drivers*

In the list below, key potential external drivers that might affect the growth (or reduction) of the ocean energy sector are provided.

- Supply, demand and price development
- Legislative framework and political landscape
- Infrastructure and services
- Funding and financial markets
- Physical influences
- Marine spatial planning and competition for space
- Technological development

#### *3.4.7 Crucial new technologies implemented*

The main technological improvements can be found in capturing CO<sub>2</sub> from the exhaust fumes of CO<sub>2</sub> sources. The transport by pipelines and injection of CO<sub>2</sub> into the fields is a relatively easy operation. Yet how the CO<sub>2</sub> behaves in the empty fields precisely, and whether the storage is permanent, is still not understood fully. This links back to the potential strong environmental impacts, for which more research is needed.

#### *3.4.8 Expected global competitive position*

There is a strong link with the oil and gas industry, because it can be assumed that the companies able and willing to undertake CCS are the same companies that extract oil or gas from the fields. Building the offshore infrastructure such as specialised harbours (so called CO<sub>2</sub> hubs) and the CO<sub>2</sub> shuttle vessels is potentially an area where Europe could assume a leading global position, once CCS is applied on a larger, more commercial scale.

#### *3.4.9 Future potential*

Overall score for future growth potential: +

Although there are currently only a few demonstration projects, several are planned across Europe. What is more, the NER300, a financial instrument of the European Commission, European Investment Bank and several Member States, has released 300 million CO<sub>2</sub> emission allowances for CCS and renewable energy projects in Europe. How much exactly the grant will be depends on the price of the allowances, but it is very likely to be in the order of several billion of euros. This is an indication that CCS could, and very likely will, grow rapidly in the coming decade. Therefore, the future potential of CCS is estimated to be relatively high.

#### *3.4.10 Links to other sub-functions*

There is a direct link with the oil and gas industry as mentioned above. Moreover, due to potential spatial competition and marine spatial planning, ocean energy is directly linked with all other sub-functions.

#### *3.4.11 Concluding assessment*

- The current size of the sub-function 'CCS' is estimated at less than € 250 mln added value and less than 500 jobs (own estimate based on literature as presented above). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated qualitatively at '+' in terms of added value and employment growth. This makes the sub-function to be ranked outside of the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "+++". Therefore the sub-function is not ranked among the top-7 in terms of future potential

Based on these scores, the sub-function itself is NOT included in the selected set of 13 sub-functions that will be elaborated in WP2. However, synergies with other functions, notably with Oil, gas and methane hydrates production (3.1) will be actively sought.

#### *3.4.12 Key references (up to ten most recently published)*

- E. Tzimas, A. Georgakaki, C. Garcia Cortes and S.D. Peteves. Enhanced Oil Recovery using Carbon Dioxide in the European Energy System. DG JRC Institute for Energy. December 2005
- Directive 2009/31/Ec Of The European Parliament And Of The Council Of 23 April 2009, on the geological storage of carbon dioxide.
- European Commission report (2010) CO<sub>2</sub> Capture and Storage - Demonstration Projects Supported By The European Energy Programme for Recovery (EEPR)

## 3.5 Marine aggregate mining

### 3.5.1 Definition and description

The sub-function of marine aggregate mining is defined as all activities associated to the extraction of marine aggregates (sands and gravels) from the seabed. There are three main uses for marine aggregates: (i) construction, mainly for making concrete; (ii) land reclamation, infilling of docks, road bases, and other ground works (construction fill); and (iii) coastal protection, both recharge and coastal feeding. Small quantities of marine sand are used in agriculture to improve soil structure and as cover for oil and gas pipelines<sup>55</sup>.

According to the UEPG<sup>56</sup>, production of marine aggregates is only of importance in the North Sea basin. The Netherlands is the biggest producer, followed by the UK, Denmark, France, Belgium and Germany<sup>57</sup> (because by its very nature, dredging is a shallow water coastal activity). In other sea basins aggregate mining from the sea plays a much smaller role since much more is done on shore.

### 3.5.2 Value chain / economic sectors

The contribution of marine aggregates to the total production of aggregates in the EU is around 2% to 3%. However, within some Member States they form an important component of the overall need for aggregates (e.g. 20 % of the total demand for sand and gravel in the UK, and 46% in Wales<sup>58</sup>). In The Netherlands the marine aggregates have a share of around 42% in total aggregate production<sup>59</sup>.

### 3.5.3 Economic performance

Over the last decade, the total quantity of material extracted from the seabed has risen by approximately 30%<sup>60</sup>.

The marine aggregate dredging industry employs about 640 staff in the UK, 500 of which are ship crew and the rest provide shore support and administration<sup>61</sup>. Assuming that in other countries the same relation exists between the number of staff employed and the amount of production of marine aggregates, direct employment in marine aggregates can be estimated to be around 4,300. This is a minimum estimation since it is known that in Spain for example there are people working in the marine aggregates industry. The amounts of these aggregates are however relatively small and the aggregates may only be used for beach nourishment.

Total production value of aggregate mining in the EU amounts to € 27 bn (Eurostat). If the offshore part covers 2-3%, this would be appr. € 0.7 bn.

### 3.5.4 Environment

The extraction of sand and gravel from the seabed can have significant physical and biological effects on the marine and coastal environments. The significance and extent of the environmental effects will depend on a range of factors, including: the location of the extraction area; the nature of the surface and underlying sediment; coastal processes; the design, method, rate, amount, and intensity of extraction; and the sensitivity of habitats and assorted biodiversity, fisheries, and other users in the locality<sup>62</sup>.

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<sup>55</sup> Effects of extraction of marine sediments on the marine environment 1998-2004, ICES, Copenhagen, August 2009.

<sup>56</sup> European Aggregates Association (Union Europeenne des Producteurs de Granulats –UEPG)

<sup>57</sup> Production of aggregates in European Union, Wieslaw Koziol, Pawel Kawalec, Aleksander Kabzinska, 2008

<sup>58</sup> The strategic importance of the marine aggregate industry to the UK, British Geological survey, 2007

<sup>59</sup> Production of aggregates in European Union, Wieslaw Koziol, Pawel Kawalec, Aleksander Kabzinska, 2008.

<sup>60</sup> Summary assessment of sand and gravel extraction in the OSPAR maritime area, OSPAR Commission, 2009

<sup>61</sup> The strategic importance of the marine aggregate industry to the UK, British Geological survey, 2007

<sup>62</sup> Summary assessment of sand and gravel extraction in the OSPAR maritime area, OSPAR Commission, 2009

For EU Member States, the extraction of minerals from the seabed falls within Annex II of the EU Directive on the Assessment of the Effects of Certain Public and Private Projects on the Environment (85/337/EEC; also known as the EIA Directive). As an Annex II activity, an EIA is required if the Member State considers it necessary. It is at the discretion of the individual EU Member States to define the criteria and/or threshold values that need to be met to require an EIA. This Directive was amended in March 1997 by Directive 97/11/EC, which obliged Member States to transpose the requirements of the Directive into national legislation by March 1999.

### *3.5.5 Regulatory environment*

The exploitation of marine aggregates mainly takes place on shallow waters on the continental shelves and is thereby covered by the territorial waters and Economic Exclusive Zones (EEZs) of coastal states as established by the UN Convention on the Law of the Seas (UNCLOS). The territorial waters of a state stretches 12 nautical miles (nm) out from a baseline (normally low-water mark). The EEZ expands another 200 nm (about 370 km) further out. In territorial waters and EEZs, states have exclusive right to exploit marine resources, such as sand and gravel.

On a national level, legal frameworks for licensing exploitation differs. The framework includes laws on coastal protection, conservation, environmental protection, fisheries acts, water laws, etc.

### *3.5.6 Key external drivers*

Activity within the sector is driven by the demand for construction material and the availability of land-won aggregates in comparison with marine aggregates. Demand for construction material is in turn driven by large-scale infrastructure projects (which in turn are related to GDP growth).

For beach replenishment, marine materials are usually preferred from an amenity point of view, and are generally considered to be the most appropriate economically, technically, and environmentally. Therefore demand for marine sand and gravel is likely to increase in the future as a result of sea level rises<sup>63</sup>.

With regard to the availability of land-won aggregates, Belgium, France, the Netherlands, Denmark, and the UK have reported increasing difficulties in obtaining permission to extract land-based materials. On the other hand, countries such as Norway and Spain are looking to increase their output of crushed rock from coastal super-quarries, and this could be exported to countries with a shortfall in home-based production<sup>64</sup>.

### *3.5.7 Crucial new technologies implemented*

The identification and development of new resources located in deeper water (e.g. in the Eastern English Channel and the Outer Bristol Channel) are driving the development of marine aggregate technology. Whereas sand and gravel resources were previously dredged in maximum water depths of 35-40m, the new resource areas have water depths of 50-60 m. In order to exploit these new resources, many existing dredging vessels will need to be modified to operate effectively. Further resource mapping is expected to lead to the identification of substantial new resources<sup>65</sup>.

### *3.5.8 Expected global competitive position*

In most EU countries the production of aggregates (land-based, marine and recycled) is almost equal to their consumption. This can be explained by the local importance of those materials, and simultaneously the low importance of foreign trade in aggregates of some countries and the EU as

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<sup>63</sup> Effects of extraction of marine sediments on the marine environment 1998-2004, ICES, Copenhagen, August 2009

<sup>64</sup> Effects of extraction of marine sediments on the marine environment 1998-2004, ICES, Copenhagen, August 2009.

<sup>65</sup> Effects of extraction of marine sediments on the marine environment 1998-2004, ICES, Copenhagen, August 2009

a whole<sup>66</sup>. At a global level EU dredging operators are main players with regard to more complex marine contracting projects world wide.

### 3.5.9 Future potential

Overall score for future growth potential: 0.

Over the past ten years, there has been a significant increase in the use of secondary and recycled materials in an effort to reduce the pressures on primary aggregate resources, including marine resources. In this respect, The Netherlands, Germany, and the UK have led the field. However, there is a limit to the volumes of secondary and recycled materials available, for example in the UK. Although the contribution of secondary and recycled materials is about 23 % of total consumption, there is limited scope for further increases in the use of most alternatives to primary aggregates, unless significantly greater use can be made of other waste products, such as those from the production of china clay. On this basis, there is expected to be a continuing demand for primary-won aggregates to support construction, of which marine sources represent one component<sup>67</sup>.

Current knowledge of resources indicates that, although there are extensive supplies of some types of marine sand, there appear to be more limited resources of gravel suitable; for example to meet current concrete specifications and for beach nourishment.

### 3.5.10 Links to other sub-functions

Coastal protection.

### 3.5.11 Concluding assessment

- The current size of the sub-function 'marine aggregate mining' is estimated at € 0.7 bn added value and 4,300 jobs (Eurostat database, 2011, data 2007; British Geological Survey, 2007). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at 5.9% in terms of added value and -0.4% in terms of employment growth (Eurostat database, 2011). This makes the sub-function to be ranked outside of the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "0". Therefore the sub-function is not ranked among the top-7 in terms of future potential

Based on these scores, the sub-function is NOT included in the selected set of 13 sub-functions that will be elaborated in WP2.

### 3.5.12 Key references (up to ten most recently published)

- ICES (2009). Effects of extraction of marine sediments on the marine environment 1998-2004. Copenhagen, August 2009
- OSPAR (2009). Summary assessment of sand and gravel extraction in the OSPAR maritime area, OSPAR Commission, 2009
- Koziol, W., P. Kawalec, A. Kabzinska (2008) Production of aggregates in European Union
- British Geological survey (2007) The strategic importance of the marine aggregate industry to the UK.

<sup>66</sup> Production of aggregates in European Union, Wieslaw Koziol, Pawel Kawalec, Aleksander Kabzinska, 2008.

<sup>67</sup> Effects of extraction of marine sediments on the marine environment 1998-2004, ICES, Copenhagen, August 2009

## 3.6 Marine mineral resources

### 3.6.1 Definition and description

The sub-function 'Marine mineral resources' is defined as all economic activities associated to deep sea mining of raw materials other than aggregates. This includes iron ore, tin, copper, manganese, cobalt, beryllium, germanium, graphite, gold, sulphides, phosphorites, diamonds and lime. Some of these are labelled critical raw materials which have a risk of supply shortage with a higher economic impact than other raw materials.

This type of mining is still in an infant state; the notion that the seabed might contain large mineral deposits exists for decades but the exploration was yet too costly. The technology for deep sea mining was not mature enough and the market price of these raw materials was not at a level that could support costly deep sea exploration.

However, this is changing as in the past few years the market prices of most of these minerals have gone up significantly due to a combination of increased demand and increased supply risk. The increased demand is mainly driven by technological developments; many of these minerals are important raw materials in high tech applications. The supply risk depends on various factors, such as substitutability of the material, political stability of the producing country, the level of concentration of production and the level of recycling. In 2010, the EU has defined a list of 14 critical materials<sup>68</sup>, that have a relatively high economic importance combined with a supply risk. The supply risk comes from the fact that most of these materials come from China, Russia, DR Congo and Brazil; a very concentrated production combined with low substitutability and recycling levels.

It is expected that in the near and longer term future deep sea mining will become a quite important source of these critical raw materials; worldwide, but also for EU countries. It would reduce the dependency of the economies of the developed countries of the current suppliers of these materials. Technology for the exploration is still a challenge. Several companies and research institutes are currently active in research, development, design, construction and testing of equipment. Deep sea mining would still be expensive compared to landbased mining, but the economics of deep sea mining have changed due to the high commodity prices.

### 3.6.2 Value chain / economic sectors

Deep sea mining is at the very start of the value chain for the production of high tech applications, amongst others computers, mobile phones and batteries.

### 3.6.3 Economic performance

Deep sea mining is still at a very early stage of development, with first pilot projects being set up. As such, there is no data on the economic performance of the sector yet. We estimate the sub-function to be lower than €250 million, employing less than 500 people.

### 3.6.4 Environment

There are environmental issues involved with deep sea mining; it can potentially have significantly harmful effects on the marine eco-system, both temporary and permanent. The main effects to be expected are: disturbance of the sea bed which is the habitat of benthic organisms and blocking of light by plumes of sediment, which is harmful to plankton and therewith affecting the whole food

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<sup>68</sup> Critical raw materials for the EU, Ad-hoc Working Group on defining critical raw materials, version 30 July 2010, DG Enterprise & Industry

chain. The environmental effects of deep sea mining and mitigating measures still require a lot of research.

### *3.6.5 Key external drivers*

Key external drivers are:

- Increased dependence of high tech raw materials in developed economies.
- Increased supply risk of some of these raw materials due to a high concentration of production, political instability of the producing countries, low level of substitution and low level of recycling.
- Rapidly rising market prices for these raw materials due to the above drivers.
- Development of technologies used in deep sea mining.

### *3.6.6 Regulatory environment*

Mining is governed by the coastal states' Economic Exclusive Zones (EEZs) as defined under the UNCLOS II agreement from 1982. The EEZ stretches 200 nautical miles (about 370km) from the coast, or to the tip of the continental shelf, depending on what is the farthest. Within the EEZs, national states have full rights to exploit resources. The demarcation of EEZ border had led to several legal disputes throughout the years. Lately, several claims on the Arctic have become the centre of discussion.

Many of the potential mining deposits, however, are located outside the EEZs. These Areas Beyond National Jurisdiction (ABNJ) are governed under a patchwork of regulatory regimes depending on topics. Exploitation of mineral resources are regulated by the International Seabed Authority (ISA) governed by Part XI of the UN Convention on Law Of the Seas (UNCLOS II) from 1982 and article 2 of the 1994 Agreement on Implementation of Part XI of the UNCLOS . For parties to the Conventions and to the Agreements, all mining activity is banned without approval from the ISA. Activities are supposed to be carried out in the interest of all man-kind, recognizing that the international waters are a global common. Whenever an application is made, the applicant must select two areas of equal economic value, of which one goes to the commercial exploiter and one to the Enterprise of the Authority. In 2001/2002 the ISA entered into 15-year contracts with 8 contractors (of which one EU member, Germany<sup>69</sup>) each given a 150,000 sq km area to explore.<sup>70</sup>

### *3.6.7 Crucial new technologies implemented*

Several companies and research institutes are currently active in research, development, design, construction and testing of equipment for deep sea mining. IHC and DEME have announce plans to develop deep sea mining in a joint venture called Oceanflore.

### *3.6.8 Expected global competitive position*

It is difficult to predict the competitive position of the EU countries at this stage. The main pillars of this competitive position would be deep sea mining technology and availability of sufficient deep sea deposits of minerals within EU countries territories.

### *3.6.9 Future potential*

The overall score for future potential growth is: +.

(The scoring contains large uncertainties and gaps of knowledge in terms of deposits, technology, and environmental consequences.)

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<sup>69</sup> The Federal Institute for Geosciences and Natural Resources of the Federal Republic of Germany – approved during the 11th Session in 2005. The contract was signed on 19 July 2006.

<sup>70</sup> <http://www.isa.org.jm/en/scientific/exploration/contractors>



Deep sea mining is a relatively new area for exploitation of marine resources. Some geological surveys show rich deposits of several valuable minerals such as gold, cobalt and copper. There are no active mining sites available for analysis and the first project is expected to begin in 2013 off the coast of Papua New Guinea. There are also large uncertainties in environmental impact of marine mining.

Chinese and Russian applications for explorations in international waters indicate an increased international interest in deep-sea mining. On the short to medium term, the EU is well positioned to provide technology and know-how facilitating exploration and mining. European companies have well established expertise in remotely controlled underwater vehicles and drilling developed for the fossil fuel industry which could prove beneficial for the mining activities.

EU may also begin explorations on its own. Geological surveys are needed to map out the most promising sites within Community EEZs. In accordance with the precautionary principle, the environmental impacts must be studied carefully and considered in decision-making.

In conclusion, deep-sea mining is filled with uncertainties regarding size and position of deposits, and mining technology. There is large potential in innovation, building on existing knowledge, which could facilitate and enable future deep-sea mining. The price of raw material and results of surveying and first mining attempts will be key to determine the future growth potential of deep-sea mining,

#### *3.6.10. Links to other sub-functions*

Oil, gas and methane due to similarities of these offshore industries.

#### *3.6.11 Concluding assessment*

- The current size of the sub-function 'marine mineral resources' is estimated at less than € 250 mln added value and less than 500 jobs (own estimate based on literature as presented above). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at '0/+' in terms of added value and employment (score based on literature). This makes the sub-function to be ranked outside of the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "++++". Therefore the sub-function is ranked 7<sup>th</sup> in the top-7 in terms of future potential.

Based on these scores, the sub-function is included in the selected set of 13 sub-functions that will be elaborated in WP2 on the basis of its future potential.

#### *3.6.12 Key references (up to ten most recently published)*

- Critical raw materials for the EU, Ad-hoc Working Group on defining critical raw materials, version 30 July 2010, DG Enterprise & Industry.
- The dawn of deep sea mining, Moneyweek, Simon Wilson, 3 September 2010.
- Deep sea mining, Natural Resource, Stanley Slagmolen en Bart Hogeweg, 2008 Vol 2, pag 6-8.
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## 3.7 Securing fresh water supply (desalination)

### 3.7.1 Definition and description

This sub-function is defined as the economic activities related to the supply of fresh water (other than by regular fresh water supply, such as aquifers). The main economic activity under this function is desalination. Desalination refers to the process of removing salt and other minerals from salt (oceans) and brackish waters. Desalination is traditionally used on seagoing vessels and submarines, but most of the current interest is devoted to supplying fresh water to areas where water scarcity prevails. The most important other alternative is the redistribution of fresh water by, for example, shipping fresh water supplies by maritime transport.

Over the past thirty years, droughts (temporary water shortage) have dramatically increased in number and intensity in the EU. The number of areas and people affected by droughts went up by almost 20% between 1976 and 2006. At least 11% of the European population and 17% of its territory have been affected by water scarcity to date. Recent trends show a significant extension of water scarcity across Europe. According to the Intergovernmental Panel on Climate Change, climate change would bring water scarcity to between 1.1 and 3.2 billion people if temperatures rose by 2 to 3° C. (COM(2007) 414). Desalination can reduce the water scarcity, however also other measures or policies can contribute to the reduction of water scarcity which may reduce the need for desalination. For example the resource-efficiency initiative of the European Commission sets out a framework to help ensure that long-term strategies in for instance environment policy produce results on resource efficiency. The Initiative aims to help decouple economic growth from the use of resources. Furthermore a review of the EU Strategy for Water Scarcity and Droughts will be integrated into a planned "Blueprint to safeguard European waters". Other instruments to deal with water scarcity and drought such as water pricing, green public procurement, voluntary agreements, community funding, etc are taken into account while implementing the EU Water Framework Directive. (website European commission DG ENV)

Traditional desalination processes are vacuum distillation (boiling of water at low pressure). A major technique used in this respect is multi-stage flash (MSF) distillation. The principal competing technique at this moment is to use semi-permeable membranes and pressure to separate salts from water. Reverse osmosis plant membrane systems use less energy than thermal distillation, which has led to a reduction in desalination costs in the last decade. As of July 2004, the two leading methods were Reverse Osmosis (47%) and Multi Stage Flash (37%). However the majority of the new desalination plants that are currently installed use membrane technologies.

Currently over 21,000 industrial scale desalination units are operating worldwide. Half of them use seawater to produce fresh water whereas the rest used brackish water. The current installed capacity of desalination plants has been estimated at about 68 million m<sup>3</sup> per day globally. Key desalination markets are the Middle East (over 50%) followed by the US and China. In the Middle East dual purpose power plants and desalination plant are used on a large scale. In Europe the major countries using desalination techniques are Spain and Cyprus. The newly installed capacity saw a peak in 2007 (7.5 million m<sup>3</sup>/day newly installed capacity) followed by a slow down in recent years as result of the financial and economic crisis. In the coming years a further expansion is expected up to 13.2 million m<sup>3</sup>/day additional capacity in 2016 (GWI 2010).

### 3.7.2 Value chain / economic sectors

Desalination has a relatively limited value chain, as it mainly involves the manufacturing of fresh water out of marine resources. This has subsequently to be distributed through regular utility companies. Whereas shipping of fresh water is involved the traditional maritime shipping value chain is involved.

### 3.7.3 Economic performance

Notwithstanding a recent dip the desalination market has shown a continuous growth. Between 1990 and 2016 newly installed capacity per year per year is expected to have increased by more than a factor 10. Installed capacity is expected to double between 2009 and 2016 (GWI, 2010), reaching a total value of USD 30 billion in 2016. Other analyst reports claim that the worldwide desalinated water will triple by 2020, as a result of a.o. growing population volumes, showing a compound average annual growth rate of 8.5% over the next 10 years. (Lux Research, 2009)

Israel is now desalinating water at a cost of US\$0.53 per cubic meter. Singapore is reported to desalinate water for US\$0.49 per cubic meter. With new technologies costs are expected to decrease further. <http://en.wikipedia.org/wiki/Desalination>

### 3.7.4 Environment

One of the main environmental considerations of ocean water desalination plants is the impact of the open ocean water intakes when co-located with power plants. There are alternatives (e.g. beach wells) but they require more energy and higher costs while limiting output. Also energy consumption and related air pollution is an area of concern. Removing salt from seawater produces a concentrated sludge called brine, which is twice as salty as seawater and contains contaminants that can affect marine life when dumped back to the sea. If brine is disposed on land, it could seep through the soil, polluting water reserves underground.

### 3.7.5 Regulatory environment

**EU law and policy affects processes related to desalination.** The most relevant legislative frameworks for desalination are:

- EU Water Framework Directive (WFD): This policy includes both fresh water and coastal marine waters. The WFD states that all water bodies used for human drinking water must be identified, analysed for contaminants, and regularly monitored. Additionally they must comply with the EU Drinking Water Directive
- The Drinking Water Directive of 1998 created a set of minimum standards for human drinking water.

There is direct support for developing non-conventional water resources within the EU Water Initiative (EUWI), especially within the EUWI-Mediterranean and EUWI-WFD Joint Processes.

### 3.7.6 Key external drivers

Key external drivers are:

- The increased shortage of water due to increased population and population density;
- Increased water consumptions due to increased income levels;
- Increased water shortage due to climate change
- Subsidised water prices (disincentive to invest in desalination)

### 3.7.7 Crucial new technologies implemented

Three areas of new technology are likely to be the focus of commercialisation over the next four years. These are: improved membrane technology (both carbon nano-engineered and biomimetic), forward osmosis, and embrane distillation. These are expected to further reduce energy consumption and thus lower costs.

### 3.7.8 Expected global competitive position

As a whole, the desalination industry is unconsolidated, with a large number of small and medium sized players serving different niches. The strongest players can expect strong market growth as well as increases in market share.

A number of European players are active on the desalination market including Siemens AG, Tractebel, Veolia Environnement, Vivendi, Degremont (France), Suez Environnement, GE Infrastructure Water and Process Technologies, Koch Membrane Systems etc. In Europe the European Desalination Society exists which unites companies and research organisations interested in promoting desalination, water reuse and water technology. The majority of current economic actors are expected to be found in those countries where most desalination activities take place.

### *3.7.9 Future potential*

Overall score for future growth potential: +

As indicated the global growth potential in this market is high, although the majority of growth is expected to take place outside Europe. Especially the Middle East, USA, and Asian countries such as India and China are expected to increase their desalination capacity. In Europe most activity is expected in the Mediterranean.

### *3.7.10. Links to other sub-functions*

The most important links between this function is with living and working (and to some extent agricultural activities in the Mediterranean).

### *3.7.11 Concluding assessment*

- The current size of the sub-function 'securing fresh water supply' is estimated at € 0.7 bn added value and 7,000 jobs (Global Water Intelligence, 2010). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at 12.3% in terms of added value and employment (Global Water Intelligence, 2010). This makes the sub-function to be ranked third in the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is “++”. Therefore the sub-function is not ranked among the top-7 in terms of future potential

Based on these scores, the sub-function is included in the selected set of 13 sub-functions that will be elaborated in WP2, on the basis of its recent growth.

### *3.7.12 Key references (up to ten most recently published)*

- COM(2007) 414, Addressing the challenge of water scarcity and droughts in the European Union
- IPPC WGII Fourth Assessment Report, 6 April 2007.
- Global Water Intelligence (2004), Desalination markets 2005-2015
- Global Water Intelligence (2010), Desalination markets 2010
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- MSNBC, (2009), A Rising Tide for New Desalinated Water Technologies

#### 4. Leisure, Working and Living



## 4.1 Coastline tourism

### 4.1.1 Definition and description

The sub-function of coastline tourism is defined as coast related tourism. In general, tourism is one of the pillars of the economy of the coastal region. However, not all tourism can be categorised as coastal related tourism. Tourism and recreation activities are not always confined to the coastal environment. Also, it should be pointed out that not all tourism in coastal regions is sea related. For many recreational and tourist activities that take place in the coastal area proximity of the sea is not a condition. In this context a further distinction is made between the following sub-categories:

- Beach-based recreation and tourism: This encompasses all beach related (sea)water-based tourism activities in coastal regions (e.g. swimming, surfing, sun bathing).
- Non-beach related tourism in the coastal area: All other tourism and recreation activities that take place in the coastal area for which the proximity of the sea is a condition.

### 4.1.2 Value chain / economic sectors

Tourism is a broad industry as it contains attractions and transport, travel organisers and local tourist offices. Moreover, different target groups (e.g. business travellers, leisure tourists, etc.) are served. The tourism industry is also characterised by a geographically dispersed value chain:

- On the one hand, suppliers of tourism products and services – often SMEs – are mainly located in the tourist destination itself.
- On the other hand, the demand side consists of a very heterogeneous group of consumers.
- In between we find the intermediaries who bundle, pack and promote the tourism product and make it available to tourists. The intermediaries are located in the tourists' country of origin.

### 4.1.3 Economic performance

The coast is an important part of the tourism sector.

- Around 51% of bed capacity in hotels across Europe is concentrated in regions with a sea border.
- The density of tourism capacity is generally greater in the southern coastal regions, particularly around the Mediterranean Sea basin. Climate conditions are an important explanation for this pattern.
- Tourism remains a seasonal business, with peak-concentrations of visitors in the holiday season.
- About 2.35 mln people are employed in the coastal tourism sector, representing 1.1% total EU employment. Comparable data on GVA are not available. However if we estimate this to be having a similar share of the EU's GVA, the figure would approximately be € 121 bn (based on ECB). If we assume past growth to be relative to the number of tourists, an annual average increase of 2.8% is found. In terms of GVA this figure may be higher due to increased spending following from welfare rise.
- A substantial part of employment in coastal tourism is concentrated in the Mediterranean area, i.e. Spain, Italy, France and Greece and in countries near the Atlantic Ocean, i.e. the United Kingdom and Portugal.

### 4.1.4 Environment

- As tourists seek out beautiful places to spend their holidays, tourist activity poses a potential threat to precious landscapes and intra-coastal areas with high levels of biodiversity.
- In addition, negative environmental impacts can occur when the landscape is physically altered for new tourism infrastructure and developments.
- Furthermore, tourism can create great pressure on local scarce resources like water and energy.

- Due to the fact that tourism is a great user of energy, the industry contributes to CO<sub>2</sub> emissions.

#### 4.1.5 Regulatory environment

The most relevant European regulations regarding coastal tourism are listed below:

- Services directive (2006/123/EC) on services in the internal market;
- Working time directive (2003/88/EC) on the conditions of entry and residence of third-country nationals for the purposes of seasonal employment;
- EU Integrated Coastal Zone Management (ICZM) Recommendation which defines the principles sound coastal planning and management.
- Many marine and coastal areas are protected under Directive 92/43/EEC on the conservation of natural habitats and wild flora and fauna (habitat directive), as well as under Directive 2009/147/EC on the conservation of birds (birds directive).
- Water Framework Directive 2000/60/EC The directive establishes a framework for the protection of all surface waters and groundwater at EU level, with the aim of achieving a good ecological status and a good chemical status of waters by 2015.
- Bathing Water Directive (2006/7/EC updating 76/160/EEC) The directive covers coastal waters and inland waters and sets quality standards (limits for physical, chemical and microbiological parameters) for bathing water.
- Council Directive 91/271/EEC concerning urban waste water treatment.
- Marine Strategy Framework Directive (MSFD, 2008/56/EC) The framework establishes a framework for the protection and restoration of marine ecosystems: Member States must take the necessary measures to achieve or maintain a good environmental status (GES) in the marine environment by the year 2020. It applies to coastal areas for aspects not covered by the water framework: litter, noise, etc.
- Strategic Environmental Assessment directive (SEA) [Directive 2001/42/EC] and Environmental Impact Assessments (EIA) [Directive 85/337/EEC] on the assessment of the effects of certain public and private programmes and projects on the environment.
- In addition to European directives and national legislation the EU member states have signed International Conventions aiming to preserve the rich diversity of nature and limiting their effects on climate change: The Convention on Biological Diversity and the Kyoto Protocol.

#### 4.1.6 Key external drivers

- Globalisation has brought the whole world within reach, leading to new opportunities and stronger competition between tourism destinations and internationally oriented tourist companies.
- With population ageing, the demand for convenience, safety and luxury is growing. In 2020 around 20% of the EU's population will be older than 65.
- Consumers have easier access to information about products and prices due to technological progress.
- Quality and 'experience' are rapidly gaining more importance; the consumer becomes more critical.
- The continuous need to comply with new regulations on e.g. hygiene and food safety issues.
- Changes in natural environment and climate conditions will determine to a large extent the future viability and attractiveness of coastal regions as a tourist destination.

#### 4.1.7 Crucial new technologies implemented

No specific technologies identified.

#### 4.1.8 Expected global competitive position

- Large concentration of tourism in coastal regions.



- Employment in tourism industry is increasing.

The leisure sector is characterised by its small scale. Most of the leisure companies are to be found in SMEs and there are only a limited number of larger companies which are active in the leisure market. In addition, the market organisation is based on a system of a number of more or less independent linkages. An example is the case of airlines that bring tourists to the foreign destination, hotels that provide accommodation and various types of local entrepreneurs (e.g. taxis, souvenir shops) that benefit from the expenditure of tourists. Due to the predominantly small-scale and fragmented nature of the leisure sector, there are limited innovation and technological investments within leisure companies. On the other hand, however, a trend of further enlargement of the scale of business activities increases the strength and power of firms with a positive effect on innovations: Bigger companies are better able to free up financial resources and to invest in innovative and sustainable technologies and processes.

#### 4.1.9 Future potential

- Volume growth to continue with global economic growth.
- Rising income is the most powerful generator of tourism flows. Greater spending power, combined with population growth and available leisure time for certain groups will increase the number of potential travellers.

#### 4.1.10. Links to other sub-functions

Cruise tourism and yachting.

#### 4.1.11 Concluding assessment

- The current size of the sub-function 'coastline tourism' is estimated at € 121 bn added value (ECB, 2011) and 2.35 mln jobs (Eurostat database, 2011). This makes the sub-function to be the largest in terms of current size.
- The recent growth of the sub-function is estimated at 2.8% in terms of added value and employment (Eurostat database, 2011). This makes the sub-function to be ranked outside of the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is “++”. Therefore the sub-function is not ranked among the top-7 in terms of future potential.

Based on these scores, the sub-function is included in the selected set of 13 sub-functions that will be elaborated in WP2, on the basis of its current size.

#### 4.1.12 Key references (up to ten most recently published)

- Collet, I. (2010), *Portrait of EU Coastal regions*, Eurostat: Statistics in focus 38/2010, Luxembourg.
- Ecorys (2009), *Study on the Competitiveness of the EU tourism industry: - with specific focus on the accommodation and tour operator & travel agent industries*. Rotterdam/ Brussels.
- European Central Bank (2011), EU 27 (fixed composition) - Gross value added at basic prices - Current prices - ECU/euro - No adjustment. [www.ecb.europa.eu](http://www.ecb.europa.eu).
- European Commission (2006), *A renewed EU Tourism Policy: Towards a stronger partnership for European Tourism, Communication from the Commission*. Brussels.
- European Cruise Council (2010), *Contribution of Cruise Tourism to the Economies of Europe (2010 edition)*, Brussels.
- European Commission (2010), *Europe, the world's No 1 tourist destination – a new political framework for tourism in Europe (COM(2010) 352 final)*, Brussels.
- SRN, Ecorys, Euromapping (2007), *Classification of European recreational waterways; final report*, Driebergen/ Rotterdam.
- UNWTO (2009), *Tourism 2020 Vision, Tourism Highlights 2008*, Madrid.

## 4.2 Yachting including marinas

### 4.2.1 Definition and description

The sub-function of yachting and marinas covers all activities associated to the building, operating and hosting of sea going yachts. Yachting remains a popular activity for residents as well as visitors to several European countries. Over the past half century the industry has grown, and today a large number of marinas dot the European coastline. These provide supplies, easy access to the shore at major resorts and safe harbours, as well as often becoming local entertainment venues in themselves. Demand for professional marina services is growing, ushering in significant investment opportunities. Furthermore, due to the boost in demand the yacht building industry has developed into an economic sector of importance (see function profile maritime trade & transport on shipbuilding).

### 4.2.2 Value chain / economic sectors

Within yachting we can make a further distinction between:

- the production of yachts and related activities such as the production of motors, sailing equipment, boat maintenance and repair,
- and tourist activities and consumer spending related to the use of the yachts. Examples of companies that benefit from these spending are supermarkets, restaurants, cafes' and other tourist facilities.

An important connecting link between these two chains are the marinas. For example marinas often offer facilities for maintenance of yachts, mooring of yachts in combination with a bar, restaurant, other leisure facilities and shops.

### 4.2.3 Economic performance

Recreational water use is becoming more important in Europe. More people can afford a recreational boat, have more leisure time and are interested in travelling around Europe.

- More than 1 million motorised pleasure craft sail the inland waterways of the Member States of the European Union.
- The growth in the water sport sector is estimated at 5% per year (SRN/Ecorys/Euromapping 2007). Some of these boats are seaworthy and are located in one of the marinas along the coasts of the European waters. Comprehensive data on the number and location of marinas and available berth capacity and occupancy rates, however, are not available.
- The mega-yacht or luxury yacht industry has been a fast growing segment the last decade. From 1998 till 2008 the industry has grown with 228%. Europe is market leader in the luxury yacht industry, with a market share of more than 65% in 2008. Yacht builders in Europe are concentrated in Italy, the Netherlands, Germany, and the United Kingdom.

### 4.2.4 Environment

- Because marinas are located right along the water's edge, pollutants created by marina activities can be released directly into the water. This pollution from marinas can have an impact on local water quality.
- A source of pollution is also the entering of metals into the water during uncontrolled pressure washing, painting, or fueling activities. Metals such as lead or copper or tin and metal-containing compounds have many functions in boat operation, maintenance, and repair. Due to regulation this problem is now addressed.
- Other environmental issues are marine litter or the entering of oils and other petroleum products into the aquatic environment during refueling or fuel discharge from boats. For marine organisms oils are poisonous. The legislation in this area is also strengthened.

- Abandoned boats also pose environmental hazards. The goal of LIFE BOATCYCLE, a project of the European LIFE+ framework, is to reduce the environmental impact of the nautical industry providing recycling and valorisation methodologies through pilot experiences, raising environmental awareness, providing guidelines for the future implementation of the best practices adoption and regulatory action.

#### 4.2.5 Regulatory environment

The most relevant European regulations regarding yachting are listed below:

- Recreational craft directive 94/25/EC on the approximation of the laws, regulations and administrative provisions of the Member States relating to recreational craft: classifies recreational craft and lays down safety requirements for their design and construction, as well as environment requirements regarding their exhaust and noise emissions.
- Furthermore, EU Directive 2003/44/EG has come into force on 1 January 2005, supplementing EU Directive 94/25/EC. EU Directive 2003/44/EG defines exhaust fumes and sound limits for sport boat motors.
- Regulation (EC) No 725/2004 on enhancing ship and port facility security and Directive 2005/65/EC which complements the security measures introduced by Regulation (EC) No 725/2004.
- EU Integrated Coastal Zone Management (ICZM) Recommendation which defines the principles sound coastal planning and management.
- Many marine and coastal areas are protected under Directive 92/43/EEC on the conservation of natural habitats and wild flora and fauna (habitat directive), as well as under Directive 2009/147/EC on the conservation of birds (birds directive).
- Water Framework Directive 2000/60/EC The directive establishes a framework for the protection of all surface waters and groundwater at EU level, with the aim of achieving a good ecological status and a good chemical status of waters by 2015.
- Bathing Water Directive (2006/7/EC updating 76/160/EEC) The directive covers coastal waters and inland waters and sets quality standards (limits for physical, chemical and microbiological parameters) for bathing water.
- Marine Strategy Framework Directive (MSFD, 2008/56/EC) The framework establishes a framework for the protection and restoration of marine ecosystems: Member States must take the necessary measures to achieve or maintain a good environmental status (GES) in the marine environment by the year 2020. It applies to coastal areas for aspects not covered by the water framework: litter, noise, etc.
- Strategic Environmental Assessment directive (SEA) [Directive 2001/42/EC] and Environmental Impact Assessments (EIA) [Directive 85/337/EEC] on the assessment of the effects of certain public and private programmes and projects on the environment.

#### 4.2.6 Key external drivers

- An important driving force behind the development of yachting is welfare development. The purchase of a seaworthy boat is expensive and therefore not for everyone, within reach. Rise of the average income however are leading to new opportunities for the yacht building and related industry and for the marina's.
- With population ageing, the demand for convenience, safety, and luxury is increasing. This trend is expected to have a positive impact on the sector.

#### 4.2.7 Crucial new technologies implemented

- For the production of (mega-)yachts, knowledge, R&D and innovation are of strategic importance for the competitive position of the EU shipbuilding sector. The only way to remain competitive is to continuously innovate and do it fast, so as to stay ahead of the game. Overall,

R&D expenditures rose over the last years, reflecting the importance of innovation for the sector.

- In a broader sense are also all sorts of improvements in the environmental field relevant. Examples are new coatings with a lower environmental burden, the use of electro motors or the placement of port reception facilities with the aim of substantially reducing discharges of ship-generated waste and cargo residues into the sea.

#### 4.2.8 Expected global competitive position

- Europe remains an important market for yachting based on financing capacity. Some relative shifts in market share because of emerging new markets are expected. This specifically concerns the mega-yacht industry in Europe which sells world-wide to a distinct group of customers (as opposed to the recreational craft industry that produces for the local market).

#### 4.2.9 Future potential

Overall score for future growth potential: 0/+

- Volume growth to continue with global economic and trade growth.
- Employment in marinas remaining relative stable.
- Europe is leading in the building of (mega) yachts. However, increasing competition from emerging markets.

#### 4.2.10 Links to other sub-functions

Coastline tourism and shipbuilding.

#### 4.2.11 Concluding assessment

- The current size of the sub-function 'yachting including marinas' is estimated at € 23.4 bn added value and 253,000 jobs (Ecotec, 2006). This makes the sub-function to be ranked fifth in the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at 5.0% in terms of added value (SRN/Ecorys/Euromapping, 2007) and '+' in terms of employment (own estimate based on above literature). This makes the sub-function to be ranked fifth in the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "++++". Therefore the sub-function is not ranked among the top-7 in terms of future potential

Based on these scores, the sub-function is included in the selected set of 13 sub-functions that will be elaborated in WP2, on the basis of its recent growth as well as its current size. It is remarked however that the sub-function is not analysed independently, but is linked with sub-function 4.1 (coastline tourism).

#### 4.2.12 Key references (up to ten most recently published)

- Ecorys (2009), *Study on Competitiveness of the European Shipbuilding Industry*. Rotterdam/ Brussel.
- SRN, Ecorys, Euromapping (2007), *Classification of European recreational waterways; final report*, Driebergen/ Rotterdam.
- UNWTO (2009), *Tourism 2020 Vision, Tourism Highlights 2008*, Madrid.

## 4.3 Cruise including port cities

### 4.3.1 Definition and description

The sub-function of Cruise including port cities is defined as all activities associated to cruise holidays, including the ships used and the facilitations at destination ports. Cruise tourism is a form of tourism where people travel (cruise) on a ship. This can be to a sunny destination such as the Mediterranean and the Caribbean, but also to Norway, Alaska or Antarctica. It is a luxurious form of travel. Worldwide, as well as in Europe, in the last decade the cruise market has seen a rapid growth. The European shipbuilding industry is dominant in the construction of these types of ships.

### 4.3.2 Value chain / economic sectors

For the value chain of cruise tourism it is necessary to make a distinction between the demand side and the suppliers of products and services necessary for cruise tourism. This supply side of the cruise tourism consists of:

- Shipbuilding and marine equipment
- Operation of ships – shipping freight
- Port services and logistics – operating terminals, port management
- Other maritime services (bunkering, ship repair, pilotage, etc.)
- Maritime works – constructing ports, maintaining access channels

### 4.3.3 Economic performance

- The cruise industry in Europe generated direct expenditures of € 14.1 bn. and nearly 143,000 jobs (European Cruise Council (2010)). These were derived from four major sources:
  - The construction of new cruise ships and maintenance (€ 4.6 billion),
  - Cruise lines purchases in support of their cruise operations (€ 5.4 billion)
  - Spending of cruise passengers and crew (€ 2.9 billion)
  - Expenditures on wages and salaries (€ 1.2 billion)
- Total industry output (including indirect and induced impacts) rises to € 34.1 billion and 296,288 jobs
- Europe has been the world leader in the cruise building industry for 40 years. All the oceanic cruise ships currently under construction are built in European yards.

Trends are:

- Cruise passengers are increasingly experienced. They seek new experiences leading to the emergence of new destinations, among which is the EU.
- Cruise companies are increasingly segmenting the market. There is a vast trend towards more family booking. With the number of on-board leisure facilities increasing there is potential for growing the family market for cruising further (ECC, 2011).
- From 1999 to 2009 demand for cruising worldwide has doubled. The number of passengers embarking in Europe has increased (+ 4.8 m passengers in 2009).
- Total cruise industry output has grown by 79% in the period 2005-2009 (European Cruise Council (2010)), which equals a compound annual growth rate of 12.3%.

### 4.3.4 Environment

- Trend towards greener shipping.
- Operational impacts involving the use of energy, water and air quality pollution.
- On a worldwide level, regulations (e.g. on the use low-sulphur diesel fuels) are developed by the International Maritime Organisation (IMO).

### 4.3.5 Regulatory environment

The most relevant European regulations regarding cruises are listed below:

- Recreational craft directive 94/25/EC on the approximation of the laws, regulations and administrative provisions of the Member States relating to recreational craft: classifies recreational craft and lays down safety requirements for their design and construction, as well as environment requirements regarding their exhaust and noise emissions.
- EC Directive 2000/59 on port reception facilities, with the aim of substantially reducing discharges of ship-generated waste and cargo residues into the sea.
- The Council Directive 90/314/EEC on package travel, package holidays and package tours, designed to protect consumers who contract package travel in the EU.
- New EU legislation that came into effect on 1 January 2010 pertains to the EU Sulphur Directive 2005/33/EC, which defines limits on the sulphur content of marine fuels.
- Regulation (EC) No 725/2004 on enhancing ship and port facility security and Directive 2005/65/EC which complements the security measures introduced by Regulation (EC) No 725/2004.
- EU Integrated Coastal Zone Management (ICZM) Recommendation which defines the principles sound coastal planning and management.
- Many marine and coastal areas are protected under Directive 92/43/EEC on the conservation of natural habitats and wild flora and fauna (habitat directive), as well as under Directive 2009/147/EC on the conservation of birds (birds directive).
- Water Framework Directive 2000/60/EC The directive establishes a framework for the protection of all surface waters and groundwater at EU level, with the aim of achieving a good ecological status and a good chemical status of waters by 2015.
- Bathing Water Directive (2006/7/EC updating 76/160/EEC) The directive covers coastal waters and inland waters and sets quality standards (limits for physical, chemical and microbiological parameters) for bathing water.
- Marine Strategy Framework Directive (MSFD, 2008/56/EC) The framework establishes a framework for the protection and restoration of marine ecosystems: Member States must take the necessary measures to achieve or maintain a good environmental status (GES) in the marine environment by the year 2020. It applies to coastal areas for aspects not covered by the water framework: litter, noise, etc.
- Strategic Environmental Assessment directive (SEA) [Directive 2001/42/EC] and Environmental Impact Assessments (EIA) [Directive 85/337/EEC] on the assessment of the effects of certain public and private programmes and projects on the environment.

#### *4.3.6 Key external drivers*

- An important driving force behind the development of cruise tourism is welfare development: Today's cruise client is on average 45 years and has a high income. Rise of average incomes will further enlarge the market.
- Price competition drives ship size growth: The principle is that if the vessel size is increased, operational costs increase at a significantly lower rate than the carrying capacity, resulting in higher net revenue per unit.
- Environmental policies and consumer concerns about sustainable development increases causing pressure for greening ships (e.g. use of solar panels, wind turbines, eco-excursions).

#### *4.3.7 Crucial new technologies implemented*

- For the shipbuilding sector (cruise ships, mega-yachts), knowledge, R&D and innovation are of strategic importance for the competitive position of the EU shipbuilding sector. The only way to remain competitive is to continuously innovate and rapidly, so as to stay ahead of the game. Overall, R&D expenditures rose over recent years, reflecting the importance of innovation for the sector.

- New green, environment-friendly shipboard technologies are being utilized, such as solar power, advanced water treatment systems, Alternative Maritime Power (AMP), fuel conservation and innovative hull treatment.

#### 4.3.8 Expected global competitive position

- The worldwide cruise industry shows a strong growth trend in demand; total passengers carried worldwide is estimated to reach 29.7 million in 2020 (+61.4% from 2010)
- Europe as cruise destination will continuously increase its attractiveness (e.g. improved berthing situation)
- Future growth is biased towards Europe and Asia with at least consolidation of European cruise market expected.

#### 4.3.9 Future potential

Overall score for future potential: +

- Worldwide cruise demand growing with baby boomers and repeat cruisers expected to be the largest growth markets.
- European cruise industry is destination led; many EU ports regarded as 'must see'; good potential for developing cultural tourism.
- Tourist cruises have come to be regarded as "marine resorts" with an increasing number of leisure facilities on board in order to maximise on-board revenue. The increased size of ships being ordered has potentially positive impact for the EU-shipbuilding industry.
- Cruises in the EU are continuing to increase in popularity. This provides opportunities for extending the cruise season (e.g. Mediterranean).
- Further introduction of clean tech innovations.

#### 4.3.10. Links to other sub-functions

Yachting and marinas

#### 4.3.11 Concluding assessment

- The current size of the sub-function 'cruise including port cities' is estimated at € 14.1 bn added value and 143,000 jobs (European Cruise Council, 2010). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at 12.3% in terms of added value and employment (European Cruise Council, 2010). This makes the sub-function to be ranked second in the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "++++". Therefore the sub-function is not ranked among the top-7 in terms of future potential

Based on these scores, the sub-function is included in the selected set of 13 sub-functions that will be elaborated in WP2, on the basis of its recent growth. Relevant developments in the field of passenger ferry services (sub-function 1.3) affecting cruise tourism and/or building on similar trends and technologies, will be taken up within this sub-function as well.

#### 4.3.12 Key references (up to ten most recently published)

- Cruise Lines International Association (2008), *Cruise Market Profile Study*, Fort Lauderdale.
- Dowling, Ross K. (ed.) (2006), *Cruise Ship Tourism*, CAB International.
- Leakakou, N. (ed.) (2010), *The Economic Impact of Cruise to Local Economies: The case of an Island*, Presented at The 2011 Athens Tourism Symposium. Athens.
- Leakakou, N. (ed.) (2010), *Which Homeport in Europe: The cruise industry's selection criteria*. Tourismos.



- Ecorys (2009), *Study on Competitiveness of the European Shipbuilding Industry*. Rotterdam/ Brussels.
- European Cruise Council (2010), *The growing European Cruise Sector, Environmental Responsibility and Cultural Tourism (presentation)*, Brussels.
- European Cruise Council (2010), *The Cruise Industry (2010 edition)*, Brussels.
- European Cruise Council (2010), *Contribution of Cruise Tourism to the Economies of Europe (2010 edition)*, Brussels.
- The Naval Architect (February 2011), *New look to future cruising*, London.
- Policy Research Corporation (2009), *Tourist facilities in ports, The economic factor*, Antwerp/ Rotterdam.
- Policy Research Corporation (2009), *Tourist facilities in ports, The environment factor*, Antwerp/ Rotterdam.
- Peisley, T. (2008), *2020 Vision: New Focus for the Global Cruise Industry*. Seatrade. Colchester, UK.



## 4.4 Working

### 4.4.1 Definition and description

The sub-function 'Working' is defined as all employment geographically located in coastal regions. Coastal regions have a high employment concentration. In this study, however, the relevant factor is job creation in sectors related to the sea or using sea resources. This type of employment is already included as part of job estimates for the other functions and clusters and therefore it is not separately analysed here. To highlight the importance of coastal regions as areas with a high geographic concentration of economic activity (and population), some key information can be found in this factsheet.

### 4.4.2 Value chain / economic sectors

Within the sub-function 'Working' the value chain is similar to other industrial and service sectors.

### 4.4.3 Economic performance

The European coastal regions reflect a high concentration of economic activity:

- In 2007, 75.1 million people worked in the coastal regions of the EU-27 (NUTS-3 level).
- Besides tourism, coastal regions offer many other employment opportunities, particularly in the service sector.
- Total production value (GDP) and value added (GVA) in coastal regions is approximately 4.6 and 4.1 billion EUR (Eurostat, 2008 data), approx. 37% of EU-27 GDP and GVA.
- Employment levels in the coastal regions have increased in the last decade.
- The share of jobs in coastal regions in EU-27 employment, however, is near constant, meaning that growth has been comparable to that for the EU as a whole.

### 4.4.4 Environment

As a result of the high concentration of population in coastal regions, these areas potentially face many environmental challenges related to human-induced impacts. However, no specific information for this sub-function is available. For information on environmental issues, see the fact sheets of the other sub-functions.

### 4.4.5 Regulatory environment

The legislative framework that applies to employment generating maritime functions located in the coastal regions is already described in the concerning sub-function fact sheets.

### 4.4.6 Key external drivers

No specific information for this sub-function is available. Employment grows with the pace of economic growth. For information on key external drivers for economic sectors in the coastal region, see the fact sheets of the other sub-functions.

### 4.4.7 Crucial new technologies implemented

No specific information for this sub-function available. For information on technological progress, see the fact sheets of the other sub-functions.

### 4.4.8 Expected global competitive position

No specific information for this sub-function available. For more information, see the factsheets of the other sub-functions.

### 4.4.9 Future potential

No specific information for this sub-function available. For information on the future potential for working, see the fact sheets of the other sub-functions.

#### 4.4.10. Links to other sub-functions

All other sub-functions are relevant in respect of working in coastal regions.

#### 4.4.11 Concluding assessment

Due to the different nature of this sub-function compared to others, it is not assessed in terms of its current size, recent growth or future potential, and not considered for further elaboration in WP2 or beyond. Rather, it is seen as the reflection of activities taking place in other sub-functions generating these jobs.

#### 4.4.12 Key references (up to ten most recently published)

- Collet, I. (2010), *Portrait of EU Coastal regions*, Eurostat: Statistics in focus 38/2010, Luxembourg.
- Eurostat (2011), *Eurostat regional yearbook 2010*, Luxembourg.

## 4.5 Living

### 4.5.1 Definition and description

The sub-function of 'Living' is defined as all EU population living in coastal regions. The coastal region houses a very important part of the EU population. However, only a relatively small share of the coastal population is actually "sea-based". Consider for example retired and semi-retired people that are attracted to the coast because of the climate and the attractive living environment. But also for other target groups, the presence of the sea makes the coastal region an attractive place for living. Consider in this context mid-life and pre-retirement families with a second home in coastal regions. The motives for living in the coastal region are various. The actual "sea-based" population (defined as the population drawn to the coast due to the presence of the sea) is not known from regular statistics.

### 4.5.2 Value chain / economic sectors

The value chain of the sub-function "living" is mainly determined by the final consumption expenditure of residents. This has partly to do with expenditure on financing of the property (the effect of this precipitates in the financial sector), but more important is the construction sector that builds the houses. In addition, there are many other sectors that depend on consumer spending. For example, the retail trade, the energy sector or cafés and restaurants.

### 4.5.3 Economic performance

- In 2008, around 177 million people lived in EU regions with a sea border.
- These people represent 38% of the population of the 22 EU countries having a sea border and 35% of total EU-27 population.
- The economic importance of living in coastal regions follows from private sector consumer spending of inhabitants, e.g. electricity, gas and water supply (NACE 40), construction (NACE 45), retail trade (NACE 52), hotels and restaurants (NACE 55 and 56) and financial services (NACE 65).
- Comprehensive data on consumer spending, however, is not available.

### 4.5.4 Environment

As a result of the high concentration of people in coastal regions, these areas face potentially many environmental challenges related to human-induced impacts. The environmental impact of living is very similar to those discussed under the sub-function "coastline tourism" and not repeated here.

### 4.5.5 Regulatory environment

Some relevant European regulations regarding living are listed below:

- Services directive (2006/123/EC) on services in the internal market.
- The Energy Performance Building Directive EPBD (EU 2002/91/EG) and the Construction Products Directive (89/106/EEC).
- EU Integrated Coastal Zone Management (ICZM) Recommendation which defines the principles sound coastal planning and management.
- Many marine and coastal areas are protected under Directive 92/43/EEC on the conservation of natural habitats and wild flora and fauna (habitat directive), as well as under Directive 2009/147/EC on the conservation of birds (birds directive).
- Water Framework Directive 2000/60/EC The directive establishes a framework for the protection of all surface waters and groundwater at EU level, with the aim of achieving a good ecological status and a good chemical status of waters by 2015.
- Bathing Water Directive (2006/7/EC updating 76/160/EEC) The directive covers coastal waters and inland waters and sets quality standards (limits for physical, chemical and microbiological parameters) for bathing water.

- Council Directive 91/271/EEC concerning urban waste water treatment.
- Strategic Environmental Assessment directive (SEA) [Directive 2001/42/EC] and Environmental Impact Assessments (EIA) [Directive 85/337/EEC] on the assessment of the effects of certain public and private programmes and projects on the environment.

#### *4.5.6 Key external drivers*

- GDP growth driving coastal spatial development.
- Ageing population with share of senior citizen living in coastal regions growing.
- Environmental policies causing pressure for environmentally sustainable living.

#### *4.5.7 Crucial new technologies implemented*

No crucial new technologies have been implemented. Technological development will consist of further development and improvement of existing construction technologies.

#### *4.5.8 Expected global competitive position*

- Competition may occur on a (sub-) regional level only. On a global scale, there is no competition.

#### *4.5.9 Future potential*

Overall score for future potential: +

- Population living in coastal regions is growing with the pace of economic growth.
- Potential varying with growth of other sub-functions.

#### *4.5.10. Links to other sub-functions*

Transport, Fisheries, Energy and Raw materials, Tourism, Coastal protection, Maritime security

#### *4.5.11 Concluding assessment*

Due to the different nature of this sub-function compared to others, it is not assessed in terms of its current size, recent growth or future potential, and not considered for further elaboration in WP2 or beyond. Rather, it is seen as the reflection of activities taking place in other sub-functions generating these jobs.

#### *4.5.12 Key references (up to ten most recently published)*

- Collet, I. (2010), *Portrait of EU Coastal regions*, Eurostat: Statistics in focus 38/2010, Luxembourg.
- Eurostat (2011), *Eurostat regional yearbook 2010*, Luxembourg.

## 5. Coastal Protection



## 5.1 Coastal protection against flooding and erosion

### 5.1.1 Definition and description

The sub-function 'Coastal protection against flooding and erosion' is defined as all economic activities associated to the protection of EU land areas against flooding or erosion from the sea.

Three elements are identified:

- Flooding can result in loss of life and damage to societal and economic assets. Therefore protection measures are taken. These measures themselves result in turnover and employment for enterprises.
- Erosion results in the loss of land and consequently damage to societal and economic assets, amongst others the loss of ecosystems and freshwater supply. Furthermore, erosion usually increases the risk of flooding. To protect threatened areas against erosion measures are taken as well.
- Relative sea-level rise can lead to sediment deposition (sink) in tidal basins. The nearby coast can act as a sediment source leading to increased coastal erosion (and protection of erosion). In case of insufficient sediment trapping in the tidal basin, relative sea-level rise can result in loss of valuable eco-systems (submerging). To protect the eco-systems measures are taken.

As coastal protection measures generally influence all aspects (flooding – erosion – ecosystems – salinity intrusion) and the immediate course of protection can often not be distinguished, for this function the sub-functions are not analysed separately.

### 5.1.2 Value chain / economic sectors

Monitoring – design – construction – maintenance.

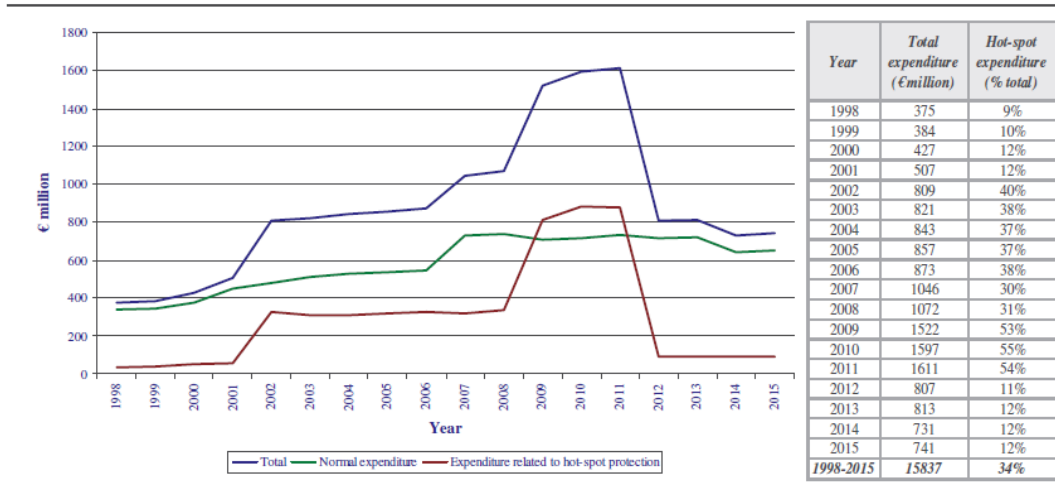
### 5.1.3 Economic performance

The overview of the actual protection practices and related investments for Europe is limited. In the EuroErosion study commissioned by DG Environment, the following figures were presented (European Commission, 2004): Public expenditure on protection of erosion has reached an estimate of 3,200 million euros in 2002 compared to 2,500 million in 1986 (an increase of almost 30%, on average 4% per year). This expenditure only reflects the need to protect assets at imminent risk; it does not reflect the hidden costs in the long term. Studies for the UN-IPCC estimate costs of 5,400 million euro per year between 1990 and 2020.

In 2009 an overview of coastal adaptation expenditure was made and the figures represent expenditure by public and private actors to maintain and adapt their coastal zones (European Commission, 2009). Over the period 1998-2015 Europe's total expenses to coastal protection is estimated to amount to 15.8 billion euros (on average 0.88 billion euros per year), see Figure 5.3 below.

Employment data on this sub-function were not found, but we estimate these to be in the order of 10,000 to 50,000 FTE.

**Figure 0.1 Normal versus hot-spot (exceptional cities or single eco-systems) coastal protection expenditure in coastal member states**



Source: Policy Research Corporation

Source: European Commission (2009)

The expenditure to counteract freshwater shortage steadily increased between 1998 and 2015 (European Commission, 2009), primarily for the Mediterranean marine basins. The difficulty with this expenditure is that it is not one-to-one related to coastal areas.

A quick scan of six large dredging companies from which annual financial reports were publicly available has been carried out (Ecorys, personal communication). Their total turnover in 2009 rises to over € 22 billion which indicates that the available figures may not only cover civil engineering but also other divisions, and thus the economic performance of the maritime function profile cannot be based on the available figures.

#### 5.1.4 Environment

As eco-systems (habitats) are threatened by both submerging and erosion, several measures protect eco-systems. The environmental impact of coastal protection measures depend on the type of measurement (protections strategy) and specific location. Hard protective measures tend to cause a coastal squeeze (trapping eco-systems between the sea and coastal construction).

EIA procedures are not systematically applied to small and medium sized projects. In addition there is barely focus on cumulative effects (EuroSION study, European Commission, 2004). The protection measures are recently more focussed on the concept of *Building with nature*. The trend that sand nourishment is preferred to hard structure is an example. In the Netherlands the studies on environmental impact of coastal protection measures have recently been intensified, aimed at the ecological optimization of sand nourishments.

#### 5.1.5 Regulatory environment

In this section a brief overview of the most relevant EU Directives are given (<http://ec.europa.eu>).

The *EU ICZM Recommendation* (2002) calls for a strategic approach to coastal zone planning and management in order to achieve sustainable development. A more coherent and integrated approach to coastal planning and management should provide a better context to benefit from synergies, to level out inconsistencies, and ultimately to better and more effectively achieve sustainable development. To support the implementation of the ICZM Recommendation, an EU working group on indicators and data was formed and several projects were started (amongst others EUROSION, SAFECOAST CONSCIENCE, OURCOAST).

To inform the evaluation of ICZM in Europe, the EEA produced a 'State-of-the-coast assessment'. The EU ICZM Recommendation requested the EC to present an evaluation report to the Council and the European Parliament. The external assessment was done in 2006.

In the framework of the *Barcelona Convention* a Protocol on ICZM is being developed and signed in January 2008. It will allow the Mediterranean countries to better manage and protect their coastal zones, as well as to deal with the emerging coastal environmental challenges, such as the climate change.

The development of a new initiative must be accompanied by an Impact Assessment. The scoping of the impact assessment was discussed with the EU ICZM expert group in 2009. Given the need for coherent planning of coastal and maritime areas, the impact assessment for a follow-up to the EU ICZM Recommendation is conducted in conjunction with the assessment of possible future action on maritime spatial planning. The key inputs and next steps in the impact assessment process are:

- Member State reports on progress in ICZM implementation
- An on-line public consultation started 23 March 2011
- A public hearing will take place the 30th of May 2011
- Studies by DG Environment to underpin the impact assessment (1st half 2011)
- An impact assessment report will sum up the results of the reports, studies and consultations (mid-2011).

In 2010 the European Commission adopted the *Communication 'Maritime Spatial Planning in the EU - Achievements and future development'*. To determine the best way forward, the Commission has therefore launched an impact assessment to explore a range of options to promote and develop MSP and ICZM. The outcome of this work will be presented in 2011.

The *EU Floods Directive (2007)* requires Member States to assess the watersheds and coastal areas that are at risk from flooding (by 2011); to map the flood extent and assets and humans at risk in these areas (by 2013); and to take adequate and coordinated measures to reduce this flood risk (by 2015). The outcomes of project Safecoast may serve as a (coastal flood risk) reference framework for the implementation of the directive (Safecoast, 2008).

Sustainable development aims at the continuous improvement of the quality of life and well-being on Earth for present and future generations. To that end it promotes a dynamic economy with full employment and a high level of education, health protection, social and territorial cohesion and environmental protection in a peaceful and secure world, respecting cultural diversity. In 2006 the European Council adopted a renewed *Sustainable Development Strategy (SDS)* that sets out a single, coherent plan on how the EU will more effectively live up to these principles and the overarching objective of sustainable development enshrined in the Treaty.

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For the regulatory framework relating to ecosystem protection the reader is referred to subfunction 5.3 Coastal Protection of Habitats.

#### *5.1.6 Key external drivers*

The coastal protection function has always been driven by:

1. The exposure of coastal areas to flooding and erosion
2. High value assets in the coastal region (i.e. people, houses, industry, ecosystems, freshwater supply).

Coastal erosion and flooding has always existed and these processes have contributed to the shaping of the present coastlines. Coastal flooding is strongly related to storm conditions with high water levels due to tides and sea waves. The exposure to flooding is therefore mainly related to Tidal range and Storm set-up. Coastal erosion results in the loss of valuable areas and or/and increase in the exposure to flooding for other areas. Coastal erosion strongly depends on: Type of coast, Wave climate, Surge levels, Sediment composition, and Beach slope.

Global warming (about two to four degrees Celsius in this century according to IPCC (2007)) may lead to the increase of rainfall in winter periods (larger river flows), storm intensity and sea-level rise *leading to increased flooding and erosion*. Global warming is a global driver, though the effect on flooding and erosion is different for each of the European coastal basins (depending on tidal range, storm set-up, coastal type etc.).

The value of assets in coastal regions is strongly influenced by socio-economic development.

#### *5.1.7 Crucial new technologies implemented*

The available options of shoreline management to deal with erosion and flooding problems are:

- to accept retreat in areas where beaches and dunes are wide and high;
- to maintain the coastline at a fixed position by of hard structures and/or by soft nourishments;
- to bring the coastline to a more seaward position by reclaiming land from the sea.

In the EUROSION project (European Commission, 2004) it is recommended to maintain the coastline by restoring the overall sediment balance on the scale of coastal cells. To compensate sea-level rise effects and human-induced erosional effects, nourishments can be carried out to lead to an overall favourable sediment status.

In the CONSCIENCE project (Marchand, 2010) the coastal cell concept to deal with coastal erosion has been further explored. The effectiveness of soft and hard remedial measures for sandy beaches is assessed based on laboratory, field and modelling experiences.

The trend (new technology) that restoring sediment balances by soft measures (if applicable) is preferred to hard measures is likely to continue.

#### *5.1.8 Expected global competitive position*

*No information (literature sources) available at present except the following general information:*

The need for coastal protection is a global need. Europe has a long tradition in coastal protection, both within Europe but also as an export product.

#### *5.1.9 Future potential*

In the DINAS-COAST project a new global database, a set of consistent climatic and socio-economic scenarios and an integrated simulation model (DIVA model for coastal systems) are developed. In the PESETA (projection of economic impacts of climate change in sectors of the European Union based on bottom-up analysis) the DIVA model was applied (Ciscar, 2009). The impacts (damage) of the various scenario's on sea flood costs, salinity intrusion costs and migration due to land loss costs were derived for two cases: without and with adaptation of coastal protection. In the applied model, adaptation consists of dike building and nourishment and the decision on adaptation is based on a cost-benefit analysis. The damage costs without adaptation are estimated to be between 5.0 and 6.6 billion euros per year in 2020 and between 10.3 and 44.6 billion euros per year in 2080 (depending on the scenario). The adaptation costs are estimated between 0.3 and 1.0 billion euros per year in 2020 and between 0.3 and 2.6 billion euros per year in 2080. The net

benefits of adaptation are estimated between 3.5 and 3.9 billion euros per year in 2020 and between 9.2 and 39.8 billion euros per year in 2100.

In a more recent study (Hinkel et al., 2010) better, higher resolution of elevation data has been used. In case of no adaptation the damage costs are estimated around 3.1 billion euros per year in 2010 and 16.9 billion (0.04% of GDP) euros per year in 2100. Main contribution by sea floods (>70%) and damage costs are highest in the Netherlands (0.3% of GDP; for all other countries less than 0.1%). With adaptation in 2100 damage costs are roughly a factor of eight to nine lower<sup>71</sup>. Adaptation costs are estimated between 2.6 (0.005% of GDP) and 3.5 billion euros per year (0.009% of GDP). Differences between the applied scenarios only become significant after 2050. This is caused by the slow response of the ocean to global warming. Therefore in the first half of the century coastal impacts are predominantly driven by socio-economic factors.

Amongst others the lack of accurate data, current scientific results on future scenarios and the limitations of the global coastal model DIVA (Ciscar, 2009 and Hinkel et al., 2010) are not supportive enough to accurately predict the future potential of coastal protection. Yet the presented figures are a sound base to indicate the growth potential and compare this with the potential of other maritime functions.

#### *5.1.10 Links to other sub-functions*

The damage costs depend on future scenarios of people living and working in the coastal zone and therefore this function is in particular linked to the maritime function Living, Working and Leisure. Whether or not coastal protection measures (adaptations) are carried out depend on a cost-benefit analyse (relation between damage costs and adaptation costs). In addition, the size of adaptation depends on the economic welfare (increasing adaptation costs with economic welfare).

#### *5.1.11 Concluding assessment*

- The current size of the sub-function 'protection against flooding and erosion' is estimated at € 1.0-5.4 bn added value (EuroSION, 2004; IPCC, 2009; EC, 2004; Hinkel, 2010) and 10,000-50,000 jobs (own estimate). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at 4.0% in terms of added value (EuroSION, 2004) and '+' in terms of employment (own estimate). This makes the sub-function to be ranked seventh in the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "+++ +++". Therefore the sub-function is ranked first among the top-7 in terms of future potential, jointly with sub-functions 2.4 (high value marine resources) and 3.2 (offshore wind energy).

Based on these scores, the sub-function is included in the selected set of 13 sub-functions that will be elaborated in WP2, on the basis of its future potential.

#### *5.1.12 Key references (up to ten most recently published)*

- European commission, 2004. Results from the EuroSION Study.
- European commission, 2009 The economics of climate change adaptation in EU coastal areas – Summary report.
- Ciscar, J.C. (editor), 2009. Climate change impact in Europe. Final report of the PESETA research project.
- Hinkel, J, Nicholls, R. J. , Vafeidis, A. T., Tol, R. S. J., Avagianou, T, 2010. Assessing risk of and adaptation to sea-level rise in the European Union: an application of DIVA
- Marchand, M (Editor), 2010. Concepts and Science for Coastal Erosion Management. Concise report for policy makers.

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<sup>71</sup> Salinity contributes to about 90% since engineering options against salinity intrusion are not considered

- Van Rijn, L.C., 2011. Coastal erosion control based on the concept of sediment cells, Report Conscience. [www.conscience-eu.net](http://www.conscience-eu.net)
- Van Rijn, L.C., 2011. Coastal erosion and control, accepted by Journal for Ocean and Coastal Management

## 5.2 Preventing saltwater intrusion

### 5.2.1 Definition and description

The sub-function of 'Preventing saltwater intrusion' is defined as all activities associated to the prevention of saltwater intrusion in (coastal) land areas. With the withdrawal of groundwater sources for agriculture, industry, energy, but also living and tourism in coastal areas the pressure on coastal aquifers has increased. This has further been aggravated by decreases in water run-off, increased evaporation and sea level rises attributed to global warming. In Europe, where many groundwater resources in coastal areas are located in shallow aquifers, this leads to water stress and saltwater intrusion (WssTP 2010).

Over the past thirty years, droughts (temporary water shortage) have dramatically increased in number and intensity in the EU. The number of areas and people affected by droughts went up by almost 20% between 1976 and 2006. At least 11% of the European population and 17% of its territory have been affected by water scarcity to date. Recent trends show a significant extension of water scarcity across Europe. According to the Intergovernmental Panel on Climate Change, climate change would bring water scarcity to between 1.1 and 3.2 billion people if temperatures rose by 2 to 3° C. (COM(2007) 414). This will further increase pressure on these coastal aquifers and thus increase changes on salt water intrusion.

Once saltwater intrusion has occurred it is almost impossible to reverse. Mitigation strategies that are designed to slow or halt the rate of saltwater intrusion can be expensive. Apart from reducing the overpumping of the coastal aquifers various technologies exist to mitigate or halt salt water intrusion, including:

- Recharging aquifers with fresh water (treated waste water)
- Replacing ground water with treated effluent for agricultural purposes
- Coastal barriers where salinisation is caused by storm surges;
- Technological adjustments to locks which separate salt water from fresh water

### 5.2.2 Value chain / economic sectors

The value chain for salt water intrusion is strongly linked to coastal protection especially where physical protection measures are undertaken.

### 5.2.3 Economic performance

Economic activities related to mitigation of salt water intrusion are hard to get. WssTP indicates that saltwater intrusion mitigation, e.g. through water injection to restore aquifers inter seasonal water storage enhancement or saltwater intrusion barriers, is still limited (WssTP 2010).

### 5.2.4 Environment

Salt water intrusion can have a significant impact on the environment as it directly influences the eco-systems (both animal and plant life) that depend on fresh water resources (primary but also secondary loss by specific species proliferation, non-endemic species invasions, fisheries productivity or habitat related losses). Not only natural resources but also human life and economic activities depending on freshwater (notably agriculture) are obviously affected.

### 5.2.5 Regulatory environment

For relevant regulatory framework the reader is referred to subfunction 5.1 Coastal Protection against Flooding and Erosion and 5.3 Coastal Protection of habitats.

### 5.2.6 Key external drivers

- Sea level rise
- Increased extraction of fresh water from coastal aquifers:

- Increased economic activity in coastal areas
- Increased population pressure in coastal areas
- Increased tourism in coastal areas

#### *5.2.7 Crucial new technologies implemented*

Apart from hydrological measures (recharging fresh water into aquifers, construction of fresh water wells that serve as a salt water intrusion barrier) several technical solutions exist to prevent salt water intrusion. Also work on advanced salt water intrusion modelling is required to be better able to manage fresh water resources. Apart from technological measures obviously demand management, and appropriate pricing and legislation form important elements in an effective salt water intrusion management strategy.

#### *5.2.8 Expected global competitive position*

As mentioned earlier, active salt water intrusion mitigation measures are still relatively limited. Nevertheless water management in general is an area which is expected to receive an increase interest where Europe might succeed in building an international competitive position (also towards other countries).

#### *5.2.9 Future potential*

Overall score for future growth potential: 0

Whereas an increasing pressure on coastal regions and fresh water use in coastal areas may increase the need for salt water intrusion mitigation measures it is not expected these will increase very strongly.

#### *5.2.10 Links to other sub-functions*

- Fresh water supply through desalination (3.7)
- Living and working in coastal areas (4.4, 4.5)
- Coastal tourism (4.1)
- Agriculture on saline soils (2.5)

#### *5.2.11 Concluding assessment*

- The current size of the sub-function 'preventing salt water intrusion' is estimated at less than € 250 mln added value and less than 500 jobs (own estimates based on literature mentioned above). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at '+' in terms of added value and of employment (own estimate). This makes the sub-function to be ranked outside the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "++". Therefore the sub-function is not among the top-7 in terms of future potential.

Based on these scores, the sub-function is NOT included in the selected set of 13 sub-functions that will be elaborated in WP2.

#### *5.2.12 Key references (up to ten most recently published)*

- WssTP – The European Water Platform (2010), Mitigation of Water Stress in coastal zones
- COM(2007) 414, Addressing the challenge of water scarcity and droughts in the European Union
- Sagala, J., Smith, Z., (2008). Comparative groundwater management: findings from an exploratory global survey. Water International, Vol 33, Issue 2, June 2008, pp 258 – 267.
- Steyer G. (2007), Potential consequences of saltwater intrusion associated with hurricanes Katrina and Rita

## 5.3 Protection of habitats

### 5.3.1 Definition and description

The sub-function 'Protection of habitats' is defined as all activities associated to protecting habitat areas in coastal regions as well as in the marine environment. The coastal areas are important from a habitat perspective. It is the area with the greatest variety of water bodies: river estuaries & deltas, coastal lakes and lagoons, wetlands – including temporary water bodies – that play an important role in the water cycle and in the ecosystems (major nursery systems) as well as in the mitigation of climate change impacts. More than half of Europe's wetlands have disappeared in recent years according to RAMSAR. Wetlands are disappearing (for instance, due to drainage and conversion to farmland) or are being polluted at an alarming rate and are among Europe's most threatened ecosystems. Data show that most wetlands are concentrated in Northern Europe with the highest relative losses on the Mediterranean and Baltic coasts (EEA 2009). In addition, habitat protection refers to marine habitats. Habitats in general are used to mean both the physical and environmental conditions that support a particular biological community, together with the community itself.

The EC Habitats Directive sets out a framework of protected sites within Europe that is called Natura 2000. Annex I of the EC Habitats Directive lists marine habitats whose conservation requires the designation of Special Areas of Conservation (SACs). Special Areas of Conservation (SACs) are designated for habitats and species listed on the Habitats Directive. SACs with marine components are defined as those that contain qualifying marine habitats or species.

In recognition of their importance wetlands were one of the very first nature conservation issues ever put forward for European and international policy consideration under the 1971 Ramsar Convention on the conservation and wise use of wetlands and their resources. In May 2006, the European Commission adopted a communication on biodiversity and an action plan which defines priority actions to meet this target. Many of the objectives, targets and actions are directly relevant to the conservation and wise use of wetlands. The action plan also emphasises the links to other relevant environmental legislation, including the Water Framework Directive (WFD). The Habitats and Birds directives and the WFD are the main pieces of legislation ensuring the protection of Europe's wetlands. The Natura 2000 network of protected sites and the integration of wetlands into future river basin management planning (under the WFD) are helping to guarantee their future conservation and sustainable use.

Other regulatory frameworks addressing marine habitats are The Convention on Biological Diversity which was adopted at the Earth Summit in Rio de Janeiro, Brazil in June 1992, and entered into force in December 1993. As the first global treaty to provide a legal framework for biodiversity conservation. Marine habitats are also protected under the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention).

As eco-systems (habitats) are threatened by both submerging and erosion, several measures protect eco-systems. The environmental impact of coastal protection measures depend on the type of measurement (protections strategy) and specific location. Hard protective measures tend to cause a coastal squeeze (trapping eco-systems between the sea and coastal construction).

### 5.3.2 Value chain / economic sectors

Monitoring – design – construction – maintenance.

### 5.3.3 Economic performance

The economic activity related to protection of habitats is hard to establish. Nevertheless these habitats are important from an economic perspective mainly from their specific function to other activities. For example wetland ecosystems hold an important part of Europe's biodiversity. They provide ideal conditions for a vast diversity of habitats and species. They are important for birds, as well as for other fauna species. Specialist plants depend on wetlands. Wetlands also perform a function as fish and molluscs nurseries.

In addition, wetlands support a wide range of public goods and services, such as providing fresh water and recreational and tourism opportunities. Finally, they act as carbon 'sinks' and perform hydrogeological functions in maintaining water tables, attenuate floods or serve as water reservoirs.

Various studies have been performed to estimate the value of wetlands. Values range from 120 USD per hectare to 374 USD/ha, but could even increase to almost 500 USD/hectare for especially valuable wetlands that perform a combination of specific functions. Based on these estimates the total value of European wetlands has been estimated at approximately 300 million USD per year (WWF 2004). Not all of these wetlands are located in coastal areas, but this figure illustrates the potential value of these areas.

### 5.3.4 Environment

As indicated above marine habitats and wetlands perform important environmental functions including the interaction between biota and ecological processes and water quality, the relation with respect to fresh water storage and the capacity to maintain restore or enhance water and sediment quality affected by, for example, pollution, eutrophication, toxic blooms, or invasive species. The role of coastal wetlands and resilient coastal ecosystems is also being acknowledged in the mitigation of climate change impacts (EEA 2009)

### 5.3.5 Regulatory environment

In this paragraph a brief overview of the EU Directives most relevant for habitats (and more general ecosystems) are given (<http://ec.europa.eu>).

The *EU Birds Directive* (the EU's oldest piece of nature legislation, adopted in 1979) places great emphasis on the protection of habitats for endangered as well as migratory species, especially through the establishment of a coherent network of Special Protection Areas (SPAs) comprising all the most suitable territories for these species. Since 1994 all SPAs form an integral part of the NATURA 2000 ecological network.

The *EU Habitats Directive* (together with the Birds Directive) is built around two pillars: the Natura 2000 network of protected sites and the strict system of species protection.

The aim of the *EU Water Framework Directive* (2000) is to obtain a 'good status' for all European waters in 2015 and a sustainable approach throughout Europe. All countries have to implement the directive.

The *EU EIA Directive (Environmental Impact Assessment)* is in force since 1985 and applies to a wide range of defined public and private projects, Environmental assessment can be undertaken for individual projects on the basis of the EU EIA Directive or for public plans or programmes on the basis of the *EU SEA Directive (Strategic Environmental Assessment)*.

The aim of the *EU Marine Strategy Framework Directive* (adopted in June 2008) is to protect more effectively the marine environment across Europe. It aims to achieve good environmental status of



the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend.

The *Pan-European Ecological Network (PEEN)* is one of the most important implementation tools of the Pan-European Biological and Landscape Diversity Strategy (PEBLDS).

Other relevant directives can be found in subfunction 5.1 Coastal Protection against Flooding and Erosion.

#### *5.3.6 Key external drivers*

Key external drivers are:

- The increased pressure on multi-functional use of marine areas;
- Increased population pressures in coastal areas;
- The increased recognition of the potential value of eco-systems and habitats and the resulting incorporation in environmental protection measures;

#### *5.3.7 Crucial new technologies implemented*

No real crucial technologies are developed in this area. The major important development is the recognition of its value and the integration of environmental protection and mitigation measures (including compensation measures) as part of other initiatives.

#### *5.3.8 Expected global competitive position*

The economic performance of this sub-function mainly takes place at a regional, European level. As such it is not really a market that is operated in a global competitive environment.

#### *5.3.9 Future potential*

Overall future potential: 0

Although the value of this sub-function is increasingly recognized in terms of sustainable development it is also put under pressure by use for by other marine functions. Nevertheless, increasingly sustainability including the preservation of natural habitats is taken into consideration. A good example of this is formed by new coastal protection measures that are characterized as “building with nature”.

#### *5.3.10. Links to other sub-functions*

The protection of habitats in this sub-function relates to a number of other sub-functions, including coastal protection (5.1) and salt water intrusion (5.2), tourism (4.1), growing aquatic product (2.3) fish catching (4.1 and 4.2) and agriculture on saline soils (2.5). The most important links between this function is with living and working (and to some extent agricultural activities in the Mediterranean).

#### *5.3.11 Concluding assessment*

- The current size of the sub-function ‘protection of habitats’ is estimated at less than € 250 mln added value and less than 500 jobs (own estimates based on literature mentioned above). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at ‘+’ in terms of added value and of employment (own estimate). This makes the sub-function to be ranked outside the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is “++”. Therefore the sub-function is not among the top-7 in terms of future potential.

Based on these scores, the sub-function is NOT included in the selected set of 13 sub-functions that will be elaborated in WP2.

#### *5.3.12 Key references (up to ten most recently published)*

- EMODnet, JNCC, Ifremer, ISPRA, DHI, Natur Vards Verket, Danish Ministry of Environment (2010), "Preparatory Action for development and assessment of a European broad-scale seabed habitat map- EU SEAMAP" (Final report)
- OSPAR Commission (2003), Initial OSPAR List of Threatened and/or Declining Species and Habitats
- Turner, R. K., Georgiou, S., Brouwer, R., Bateman, I. J. and Langford, I. J. (2003), Towards an integrated environmental assessment for wetland and catchment management. *Geographical Journal*, 169: 99–116. doi: 10.1111/1475-4959.04953
- WssTP – The European Water Platform (2010), Mitigation of Water Stress in coastal zones
- EC (2007) LIFE and Europe's wetlands, restoring a vital ecosystem.
- RAMSAR, <http://www.ramsar.org/>
- EEA (2009), EEA report "6/2006 the changing faces of Europe's coastal areas; EEA 'Report on good practice measures for climate change adaptation in river basin management plans'
- Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora
- WWF (2004), The Economic Values of the World's Wetlands

## 6. Maritime Monitoring and Surveillance



## 6.1 Traceability and security of goods supply chain

### 6.1.1 Definition and description

The sub-function of 'Traceability and security of goods supply chain' is defined as all activities associated with ensuring the security of services in the maritime transport supply chain. It involves notably shipping and customs control, including such critical issues as infrastructure, process management and the exchange and protection of data. Statistics provided by customs authorities also contribute to a wide range of economic policy making functions. The equipment used for security purposes by customs authorities aims in particular to avoid the utilisation of the international supply chain as mode of transport of any type of illegal goods, radiological materials, or any other substances or objects that might represent a risk to the world trade community and its member states. On the other hand, equipment used for security purposes in the field of maritime transportation covers a wide variety of products and its objective is to prevent threats and attacks that harm the natural flow of goods throughout the global supply chain that might cause economic and/or human losses.

### 6.1.2 Value chain / economic sectors

The value chain consists of suppliers of equipment related to customs control (e.g. container scanning), design and construction of ships as well as satellite manufacturing, launching and operating services.

### 6.1.3 Economic performance

The economic performance of the related sectors to this sub-function is difficult to precise through desk research alone and primary data collection as part of the next Work package will shed new light on its economic value. This is mainly because the value of the sub-function lies as much in the indirect benefits as the direct value in terms of GDP and employment. For example, if the maritime environment becomes more secure, this will increase trade and consequently economic growth. Moreover, the question is not only related to the value created but also to the costs that are saved, illustrated below in relation to the substantial and increasing costs of piracy. Thus, it may not be possible to come up with a global monetary figure for the economic performance of the sub-function. At this stage we can only estimate the value in terms of demand for security equipment in particular sectors. For example, we estimate the demand in the shipping sector to be worth roughly €0.6 - €1 billion<sup>72</sup>. However, the indirect benefits of the sub-function will be explored further during the expert and industry interviews, notably from a qualitative perspective.

### 6.1.4 Environment

Security of goods supply chains mainly concerns providing specific security equipment on board of the vessels and taking additional security measures. Also specific measures are needed to secure the loading and unloading of the goods in the ports area and for customs control. In most cases this additional equipment and measures only have a limited effect on the emissions of the vessels which are used or on the environmental impacts in the port areas where the goods are loaded and unloaded.

### 6.1.5 Key external drivers

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<sup>72</sup> This valuation was based on data from a European Commission study on financing of maritime security, and calculated as follows: The fleet under flags of the EU Member States account for about 9,000 vessels and operators have to bear an average investment cost in security equipment of around €100,000 per vessel and a further €25,000 running costs per year (Investments are mainly in equipment and compliance certification, whereas more than 50% of the running costs represent the cost of specialised personnel). If each vessel and its equipment has an economic lifetime of ten years then the average annual depreciation would be €10,000. Combined with the running costs of €25,000 and multiplied by the overall EU fleet, a figure of about €0.3 billion can be estimated. This figure would double or triple if onshore facilities are accounted for, thus arriving at the estimate of €0.6 - €1 billion. The level of employment is in turn estimated at 5,000 to 10,000 FTE.

One of the trends in the transportation of goods by sea which has caused an increase in security risks is the growing importance of container transportation<sup>73</sup>. As the container transport chain is relatively fragmented and includes activity by various operators, ensuring security is a complex and difficult task. One option is to physically open and inspect containers but the process is both expensive and time consuming, and therefore only accounts for 1-2% of all containers. An alternative which enables more inspection is **container scanning**. This involves the use of large x-rays that enable the checking of container contents without opening them. Approximately 5% of containers entering the EU via maritime transport are subject to scanning. Yet ports are reluctant to undertake security measures that slow down container handling. In particular, with the increase of container traffic in the international transport of goods, an efficient handling process is becoming more and more important. Technological improvements aimed at increasing the effectiveness and efficiency of container screening have therefore gained much importance. In addition, revisions to the Community Customs Code aims to make borders both safer and open to trade of trusted goods. Since January 2011, it has become obligatory for operators to provide information on security to customs authorities before entering port, which allows a safety and risk analysis prior to arrival, thus facilitating quicker clearance of goods. In addition, certified 'Authorised Economic Operators' benefit from simpler rules, including those related to security. Sharing of data has also been improved through the introduction of an EU wide computer database.

International shipping has been highly affected by **increased piracy activity** in recent years. Piracy has contributed to an increase in shipping costs and impeded the delivery of food aid shipments. Their activities have intensified in recent years,<sup>74</sup> especially off the coast of Somalia<sup>75</sup>. **Pirates' income from ransom** has been estimated to be \$58 million in 2009 and in 2010 it was four times more, that is \$238 million (One Earth Future Foundation 2010). Furthermore, the **indirect costs of piracy** are thought to be much higher<sup>76</sup>. There are efforts to combat piracy in the region, an example being the **military operation Atlanta**<sup>77</sup>. It is planned that Community development aid instruments will be used through the 'Instrument for Stability' (IfS). It provides for a programme on 'critical maritime routes' for 2009-2011 covering the Strait of Malacca and the Gulf of Aden in particular, to seek a more long-term resolution of the phenomenon of maritime piracy and armed robberies at sea<sup>78</sup>.

#### 6.1.6 Crucial new technologies implemented

The following European projects are relevant in the area of traceability and security of goods supply chain:

- MERCURY (Anti-piracy in the HoA, web-based info sharing established/managed by Atalanta force)
- SafeSeaNet (EMSA, DG MOVE)
- Thetis (Port state control) (EMSA, DG MOVE)
- Blue Belt pilot project (EMSA, DG MOVE)
- Electronic customs projects introduced through revisions to the customs code (e.g. automated import and export systems and the New Computerised Transit System).
- TRACES for import and export of live animals (DG SANCO)

#### 6.1.7 Expected global competitive position

<sup>73</sup> RAND Europe (2003), Security: Improving the Security of the Global Sea-Container Shipping

<sup>74</sup> At the end of 2010, around 500 seafarers from more than eighteen countries were being held hostage by pirates. This includes vessels as well as people from the EU (One Earth Future Foundation 2010)

<sup>75</sup> In the period 2004-2009, only 15% of global piracy attacks occurred off the coast of Somalia. But in 2009 Somali pirates were already responsible for 53% of reported attacks around the world which included 47 hijacked vessels and 867 seafarers held hostage (One Earth Future Foundation 2010)

<sup>76</sup> The indirect costs of piracy are estimated at \$7 to \$12 bn including insurance, naval support, legal proceedings, re-routing of slower ships, and individual protective steps taken by ship-owners (One Earth Future Foundation 2010)

<sup>77</sup> European Commission (2009), Maritime security: protecting maritime transport from piracy, IP/09/83, Brussels

<sup>78</sup> European Commission (2009), Maritime security: protecting maritime transport from piracy, IP/09/83, Brussels

The EU has been using various tracking and tracing systems using RFID and GPS technologies. Many companies have developed both with respect to design and equipment production as well as services in this area. In the global market fierce competition can especially be expected from the US. The US, on the other hand, is developing the Advanced Container Security Device (ACSD) Project, the Advanced Screening and Targeting (ASAT) Project, the Supply Chain Security Architecture (SCSA) Project, the Marine Asset Tag Tracking System (MATTS) Project, the Hybrid Composite Container Project, the Secure Carton Project, and the Secure Wrap Project.

#### 6.2.8 Legal framework

The legal framework for customs in the EU is based on the Community Customs Code that was first established in 1992 and that has been subsequently revised on many occasions and in 2008 a consolidated Modernised Customs Code was introduced. The Code includes provisions on import and export duties, the introduction of goods into the customs area and their subsequent treatment or use. The code is implemented via Regulation 2454/93 which sets down rules for the classification of goods, the application of the Community customs tariff, and the responsibilities and powers of customs officials. In 2005 amendments were made to tighten security for the movement of goods across international borders. This followed a growing concern about security threats in international trade, reflecting in the Commission Communication on the role of customs in the integrated management of external borders<sup>79</sup>. The communication argued that the controls in place were not adequate to protect Member State against threats from terrorism and criminality, health and safety risks to consumers, and environmental risks. One of the main weaknesses was the lack of harmonisation of controls among Member States based on varying procedures, equipment and resource allocation. The 2005 amendments aimed to tackle these challenges by requiring economic operators to provide customs authorities with details of goods before they are imported into the EU or exported from it, through 'one stop shops'. In addition, common methods for risk-assessment analysis were introduced based on computerised systems. In 2008 a modernised customs code was agreed<sup>80</sup>, to follow recent technological developments in the field of customs control. However, the new code can only be implemented once the implementing rules become applicable and it has taken a long time to develop computer systems in line with the rules. The main changes foreseen in the new code are

- Rationalisation of the legal framework and the definition of custom rules and procedures (including fewer procedures)
- Greater standardisation of customs rules and their implementation through IT systems to manage decisions, simplifications and guarantees related to the rights and obligations of economic operators
- Simplification of customs procedures and the creation of a centralised customs clearance system (EU level management)
- IT system for declaration and data exchange
- Interoperability of national customs systems.

With regard to security of maritime transport, the legal framework consists of the Regulation on ship and port facility security<sup>81</sup> and the Directive on port security<sup>82</sup>, which together aim to secure the entire chain of maritime transport logistics.

- The Regulation on ship and port facility security provides a basis for the harmonised interpretation and implementation as well as Community monitoring of the special measures to enhance maritime security adopted by the IMO in 2002 which amended the 1974 SOLAS

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<sup>79</sup> [COM\(2003\) 452](#) final - Official Journal C 96 of 21.4.2004

<sup>80</sup> The new code was introduced via Council Regulation 450/2008

<sup>81</sup> Regulation (EC) No [725/2004](#) of 31 March 2004 on enhancing ship and port facility security.

<sup>82</sup> Directive [2005/65/EC](#) of 26 October 2005 on enhancing port security.

Convention and established the ISPS code. Two of the main provisions of the Regulation require security assessments of port facilities by Member States and their maritime security authorities to demand from each vessel entering port information about its international ship security certificate and other security measures. The Commission carries out security inspections of port facilities and shipping companies in the Member States. These inspections are prepared with assistance from the European Maritime Safety Agency and are conducted by inspectors from the Member States.

- The Directive on port security aims to enhance the security of port infrastructure from risks such as terrorist attacks. It introduces a security system in all port areas that guarantees a high and comparable level of security in all European ports. Designated national port authorities are responsible for taking the necessary security measures and drawing up port security plans. A sequence of security levels are established depending on the perceived risk (normal, heightened or imminent threat).

#### *6.1.9 Future potential*

It is, however, expected that the international trade and **transport of goods via containers will grow** in the coming years. The projections show various figures, but almost all of them indicate the growing importance of container traffic. This will put more pressure on various operators involved in container handling, especially within various ports. The scarce space at port sites and more and more stringent security regulations will impact their functioning. It is expected that in time more and more containers will have to be scanned. Due to the large quantities of containers handled and the relatively large costs of container screening, it is not expected that in the coming years 100% of containers will be scanned. It is, however, expected that the present figure of approximately five percent of containers screened will gradually grow.

The recent increased activity of the Somali pirates shows a concerning trend in this area. The illegal activity of the pirates in this region has been growing rapidly in recent years while the international response lacked pronounced decisions. National governments have often paid ransoms and as a result the Somali pirates' incomes increased four times between 2009 and 2010. This means that the indirect costs of piracy have grown as well. It is expected that **piracy activities will continue**: Unless the international community finds a rapid solution to the current increasingly concerning situation, they are likely to continue to grow and negatively affect international maritime transport security.

There is a clear link between the projected increase in container transport growth and economic development. As it is expected that the container industry throughout northern Europe will double in the coming decade<sup>83</sup>, this will have the effect of doubling the number of containers that have to be scanned, go through a risk assessment and have to be handled at ports. This will involve major increases in demand for container scanners and related security equipment, and depending on the level of automation, lead to a growth in security jobs at ports.

Piracy activities are negatively affecting the European companies involved in production and shipping of goods that are subject to piracy. On the other hand, additional resources have to be allocated to combat piracy.

#### *6.1.10. Links to other sub-functions*

This sub-function is clearly linked to the prevention and protection against illegal movement of goods and people. Additionally, it impacts on the maritime transport and shipbuilding sub-function.

#### *6.1.11 Concluding assessment*

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<sup>83</sup> Ocean Shipping Consultants Ltd. (2009), Press release on the "North European Container Markets to 2020", UK.



- The current size of the sub-function 'Traceability and security of goods supply chains' is estimated at € 0.6-1.0 bn added value and 5,000-10,000 jobs (own estimates based on EC, 2006). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at '+' in terms of added value and of employment (own estimate). This makes the sub-function to be ranked outside the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "+++++". Therefore the sub-function is ranked fourth among the top-7 in terms of future potential, jointly with sub-functions 3.3 (ocean energy) and 6.3 (environmental monitoring).

Based on these scores, the sub-function is included in the selected set of 13 sub-functions that will be elaborated in WP2, on the basis of its future potential. In WP2, it will be linked with sub-function 6.2 (Prevent and protect against illegal movement of goods and people) and both sub-functions will be assessed jointly as one sub-function.

#### *6.1.12. Key references (up to ten most recently published)*

- ESRIF WG3 on Border Security
- EMSA (2006), SafeSeaNet Change Management Framework Issue 1 Rev 0 11 March, 2006
- European Commission (2010), "Draft Roadmap towards establishing the Common Information Sharing Environment for the EU maritime domain", Communication COM(2010) 584 final
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- PRC (2009), The impact of 100% scanning of U.S.-bound containers on maritime transport Final report
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## 6.2 Prevent and protect against illegal movement of goods and people

### 6.2.1 Definition and description

The sub-function of 'Prevent and protect against illegal movement of goods and people' can be defined as all activities associated with ensuring prevention and protection of illegal movements on EU seas. It closely relates to maritime border surveillance, which has many different user communities, calling for Integrated Maritime Surveillance (European Commission 2009). Europe has about 90 000 km of coastline along two oceans and four seas. This long coastline is monitored by various Member States with different resources, technologies, focus areas, etc. In addition, due to the Schengen area and the EU Customs Union, people and goods that enter the external borders of the Union gain access to many countries.

### 6.2.2 Value chain / economic sectors

The value chain includes the suppliers of equipment for maritime surveillance (including satellites), as well as for port security and customs control.

### 6.2.3 Economic performance

The economic performance of the fragmented security market is difficult to precise and will need primary data collection in WP11. Like sub-function 6.1 about the security of the supply chain, which overlaps with the prevention and protection against illegal movement of goods and people (the two sub-functions will be merged in WP11), the most important benefits of better maritime surveillance will be indirect and more qualitative in nature. At this stage only specific demand for equipment in different sectors can be quantified. For example, the money spent by ports related to security can be estimated at €1.1 billion<sup>84</sup>.

### 6.2.4 Environment

Maritime border control mainly concerns activities at sea needed to secure the external borders of the Member States of the EU. Compared to the worldwide merchant and fishery fleet the number of border control vessels is much smaller. The environmental impacts are therefore also much lower. Other maritime border control activities are carried out in port areas. These port areas are relatively small, compared to the land area of the whole country. The security facilities and equipment concern a small part of the port area, which has only a limited environmental impact. However, there are also indirect environmental benefits of improved maritime surveillance because of information sharing across sectors (encouraged through the CISE initiative). Surveillance to prevent illegal movement of goods and people can also provide information to prevent environmental disasters, which is linked to sub-function 6.3.

### 6.2.5 Key external drivers

One of the drivers observed in the past years has been so-called '**irregular immigration**'. According to the ESRAB study<sup>85</sup>, organised crime generates an income of approximately EUR 3 billion per year from activities linked to irregular immigration. Following EUROPOL, approximately 500 000 people enter the European Union illegally every year. According to Frontex<sup>86</sup> the top ten nationalities detected for irregular border crossings at the EU external land and sea borders in 2008 were Albanian, Afghan, Moroccan, Somali, Iraqi, Tunisian, Nigerian, Eritrean, Palestinian and

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<sup>84</sup> This valuation was based on data from a European Commission study on financing of maritime security<sup>84</sup>, and calculated as follows: The European Union has more than 1200 seaports and about 4,000 port facilities. The average cost of security is 464,000 euros for investment costs and 234,000 euros for annual running costs<sup>84</sup>. Assuming investment costs of port facilities to be depreciated in 10 years, total turnover for all 4,000 ports together would amount to € 1.1 bn. The level of employment is in turn estimated at 10,000 FTE.

<sup>85</sup> European Security Research Advisory Board (2006), Meeting the challenge: The European Security Research Agenda

<sup>86</sup> Frontex statistics (2008), following EUROPOL

Algerian. According to EUROPOL<sup>87</sup> the majority of irregular immigrants from Africa arrive at the Italian shores (i.e. islands of Lampedusa, Sicily and Sardinia). This has intensified in recent months due to the unstable political situation in selected countries of Maghreb and Mashreq. Although smaller, the pressure of maritime irregular immigration from Africa on mainland Spain and the Canary Islands still exists. Greek coasts have recently been targeted by irregular immigrants from the Middle East and South Asia. Greece is also a first destination for irregular immigrants, mainly from Turkey and Albania. According to the report<sup>88</sup> the Western Balkans remain the origin for irregular immigrants into the EU, but the region is also a transit region for irregular immigrants from other parts of the world. The role of Eastern Europe outside the EU relates to irregular immigration as well as serves as a transit region for mixed migration flows. This affects the whole of the EU and not just those Member States situated in East and South-East Europe. Therefore, appropriate solutions are needed to be put in place.

#### 6.2.6 Crucial new technologies implemented

- The rise of terrorism together with increased immigration from South America and North Africa has impelled EU Member States and the European Commission to invest in hi-tech systems to safeguard external borders. Government spending on border control and surveillance is expected to increase, creating new opportunities for information technology (IT) and security system manufacturers.
- Biometric systems that are evolving as the standard technology for border control will continue to drive this market. Multimodal biometrics, which ensures flexibility and authenticity, is in the developmental stage but will likely come to dominate the market in the future. However, companies and biometric associations should address the fear of data misuse and centralise information to gain end-user confidence.
- Implementation of hi-tech projects like the Visa Information System (VIS)<sup>89</sup>, bio development (BIODEV) and Schengen information system II (SIS-II) which have been developed by the Commission, as well as other projects initiated by some of the Member States, will further initiate growth in this market.

The following European projects are relevant in the area of prevention and protection against illegal movement of goods and people:

- COASTNET (network for Baltic Sea Region Border Control Cooperation/BSRBCC)
- SEAHORSE (network between border control authorities in Spain, Portugal and six African countries, Spanish surveillance system between third countries)
- Black Sea Border Coordination and Information Centre (BBCIC; established in the framework of the Black Sea Littoral States Border/Coast Guard Cooperation Forum – BSCF)
- MAREX (Mediterranean AIS regional server), Helcom (Baltic AIS), North sea AIS, VRMTC (Virtual AIS Center in Med, BS and South America), GOFREP (Gulf of Finland reporting system for maritime traffic)
- LRIT EU-DC(EMSA, DG MOVE)
- SIS/VIS/Entry-Exit (Schengen) (DG HOME)
- Common Information Sharing Environment (DG MARE)
- EPN (JORA network on ICONET) (FRONTEX)
- SIENA (Europol)
- e-Customs/ ECS/ ICS/ NCTS (DG TAXUD)
- VMS exchange among FMCs / E-log books (DG MARE – B2, A4)
- EUROSUR: European border surveillance system (DG HOME)
- SAT-AIS (DG MOVE, ENTR, MARE)

<sup>87</sup> EUROPOL (2009), Facilitated Illegal Immigration into the European Union

<sup>88</sup> EUROPOL (2009), Facilitated Illegal Immigration into the European Union

<sup>89</sup> VIS is being rolled out on a regional basis, with the first round currently being implemented in North Africa and the Middle East.

- BlueMassMed (Lead partner: France, SG Mer)
- Marsuno (Lead partner: Swedish Coast Guard)
- FP7 projects on maritime border surveillance (e.g. PERSEUS, I2C, SEABILLA)
- Coastal radar images exchange through SafeSeaNet (EMSA)

#### 6.2.7 Expected global competitive position

A significant number of projects have been implemented and are still being developed in Europe. There are many companies active in the development of the new comprehensive surveillance systems. US companies as well as the department of Homeland Security are very active in this area. Several projects have been developed by the US in this field, including: the Automatic Target Recognition (ATR) Project, the Border Detection Grid (BDG) Project, the Border Net Project, the BorderTech Project, the CanScan Project, the Secure Border Initiative (SBI), the Systems Engineering and Modeling and Simulation Project, the Systems of Systems Engineering (SoSE) Capability Development Project, the Sensors/Data Fusion and Decision-Aids Project, the Sensors and Surveillance Project, and the Situational Awareness and Information Management Project.

However, recovery from the current economic slump will not happen overnight because of budgetary constraints. Resultant delays in commissioning new civil security projects negatively affect the duration of the sales cycle. The financial crisis and intensifying competition add to the pricing pressure on suppliers. Although prices have declined considerably, cost continues to be a challenge for vendors.

#### 6.2.8 Legal framework

The legal framework for this sub-function partly overlaps with 6.1 in relation to customs and so will not be repeated here. However, with regard to maritime surveillance the Integrated Maritime Surveillance (IMS) initiative of the European Commission aims to ensure exchange of information across different sectors. So far the initiative consists of a Communication setting out a Roadmap for IMS as well as several pilot projects. The Roadmap follows a previous Communication that established principles for the establishment of a Common Information Sharing Environment in the maritime domain (CISE). The diversity of legal frameworks in the Member States means that a flexible system is to be established that has been described as “a cost effective decentralised interconnection of different information layers that increases efficiency of maritime surveillance systems by filling existing information gaps across Europe while avoiding data duplication”. The Roadmap towards IMS established six steps that are to be followed in the coming years:

Step 1 - Identifying all User Communities

Step 2 - Mapping of data sets and gap analysis for data exchange

Step 3 - Common data classification levels

Step 4 - Developing the supporting framework for the CISE

Step 5 - Establishing access rights

Step 6 – Ensuring respect of legal provisions

The ‘User Communities’ will be established on functions rather than different types of national authorities since the latter are very diverse.

#### 6.2.9 Future potential

According to EUROPOL<sup>90</sup> the abuse of legal migration systems is likely to increase in the future, especially in the area of visa and residence permits. Additionally, the intra-EU freedom of movement can be abused by Organized Crime (OC) groups. Document counterfeiting and the abuse of the transport sector, mainly low cost airlines, are major facilitating factors of criminal activity. It is difficult to estimate whether **irregular immigration** will change much in the coming

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<sup>90</sup> EUROPOL (2009), European Organised Crime Threat Assessment (OCTA)

years. Nevertheless, it is expected that it **will continue** to some extent. Irregular immigration leads to an increase in the black market which negatively affects the European economy.

#### *6.2.10. Links to other sub-functions*

This sub-function is clearly linked to the 'Traceability and security of goods supply' sub-function 6.1. In particular, the CISE initiative aimed at Integrated Maritime Surveillance is relevant for both sub-functions 6.1 and 6.2 and this will be shown in detail when the sub-functions are merged in WP II. In addition, it is linked to the 'Maritime transport and shipbuilding' function as well as the 'Leisure, working and living' function.

#### *6.2.11 Concluding assessment*

- The current size of the sub-function 'Prevent and protect against illegal movement of people and goods' is estimated at € 1.1 bn added value and 10,000 jobs (own estimates based on EC, 2006). This is only a small part of the real economic value of this function which is characterized by strong indirect benefits (surveillance as a facilitating function). Nevertheless the direct size leads to a ranking of the sub-function outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at '+' in terms of added value and of employment (own estimate). This makes the sub-function to be ranked outside the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "+++". Therefore the sub-function is not ranked among the top-7 in terms of future potential.

Based on these scores, the sub-function is included jointly with sub-function 6.1 in the selected set of 13 sub-functions that will be elaborated in WP2.

#### *6.2.12 Key references (up to ten most recently published)*

- European Commission (2009) , Maritime security: protecting maritime transport from piracy, IP/09/83, Brussels
- European Security Research Advisory Board (2006), Meeting the challenge: The European Security Research Agenda
- EUROPOL (2009), European Organised Crime Threat Assessment (OCTA)
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## 6.3. Environmental monitoring

### 6.3.1 Definition and description

The sub-function of 'environmental monitoring' is defined as all activities associated to the monitoring of the seas with regard to their environmental state and their development. It is noted however that *marine* environmental monitoring is not a clear-cut function. Although referred to here as a "sub-function", it is essentially a tool to ensure a safe and sustainable well-being and economic usage of marine resources. Monitoring is needed in order to support the protection of the marine environment and therefore the economic value chain. Marine environmental monitoring services include multidisciplinary data on marine physics (temperature, salinity), chemistry (water quality), biology (ecosystems and fisheries). Such data forms the basis of our understanding of the underlying processes determining ocean functioning, allows for the identification of natural variability and long-term trends in the context of climate change and for the assessment of the drivers and impacts of natural and man-made disasters.

### 6.3.2 Value chain / economic sectors

The economic sectors providing environmental monitoring services are wide ranging, including either commercial entities but, to a large extent, public organisations. Monitoring is generally conducted 1) by private companies driven by more efficient exploitation of resources, 2) by scientists in quest for knowledge and 3) within the scope of policy compliance and surveillance. Technical means that are used for marine environmental monitoring are amongst others: ferry boxes, buoys, drifters, radar, gliders, sensors, satellite images, vessels and a combination thereof. These means are provided by a plethora of suppliers. In addition, many of the information services that are provided are research projects. The demand side of the function is consisting of national, euro-regional, European and international policy organisations.

### 6.3.3 Economic performance

As a result of the difficulty of identifying sectors within the marine environmental monitoring sub-function the definition its economic performance is not straight-forward. An indication would be the expenditures on environmental monitoring by public organisations. Already An indication would be the expenditures on environmental monitoring by public organisations. The estimated current annual spending in Europe on sea and ocean data gathering and monitoring is more than €1 billion for public bodies and about € 3 billion for private ones. Eurostat is still in the pilot phase to assess the environmental monitoring expenditures, not including yet marine environmental monitoring expenditures. Nevertheless, initiatives by EU, such EMODNET and SEIS as a tool to optimize and bring coherence to the current fragmented monitoring activities, and CISE (Common Information Sharing Environment) that allows for the exchange of maritime surveillance data and other information across sectors under the "Integrated Maritime Surveillance" are aimed at optimizing and increasing the cost effectiveness of the marine environmental monitoring programmes and services that use this data. For example, pollution preparedness and response is one of the identified user communities to share/receive information on the need-to-know and a need-and-responsibility-to-share basis.

### 6.3.4 Environment

This sub-function is entirely about the environment and environmental policy. See below.

### 6.3.5 Regulatory framework

The main European Directives that are, to various extent, related to 'Environmental Monitoring' include:

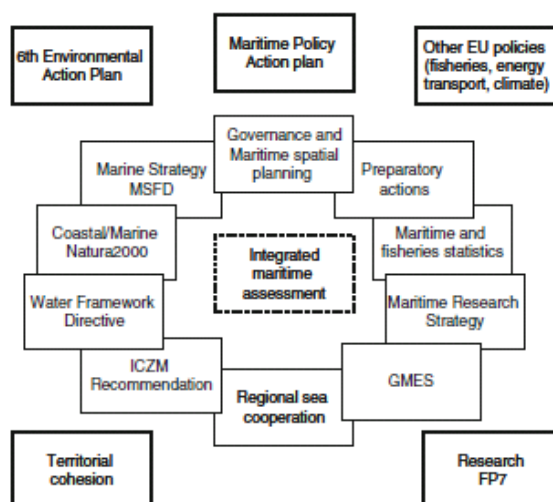
- a) Marine Strategy Framework Directive (MSFD, aiming at reaching or maintaining a Good Environmental Status by 2020 through the monitoring of environmental indicators grouped under 11 descriptors)
- b) Integrated Coastal Zone Management Directive (defines the principles of sound coastal planning and management)
- c) Bathing Water Quality Directive
- d) Urban Waste water directive
- e) Habitats Directive
- f) Regional Conventions between Member States and the EC – OSPAR/ HELCOM/ Barcelona/ Bucharest Conventions
- g) 6th Environmental Action Plan; in particular its Climate Change and Marine Environmental Strategy components
- h) The Sustainable Development imperative which is written into the Rome Treaty and is now being developed through the Green Paper on Maritime Policy
- i) Relevant existing EU Directives, such as the Water Framework Directive (WFD) in its application to coastal waters
- j) INSPIRE Directive (Infrastructure for Spatial Information in Europe)
- k) Environmental Information Directive (on public access to environmental information)
- l) MARPOL (International convention for the prevention of pollution from ships)

### 6.3.6 Key external drivers

The main drivers for marine environmental monitoring are:

- (marine) environmental policy and the need for data to monitor these policies
- the societal attention for the environment and the affection to preserving our seas (especially after large accidents such as Erica tanker and subsequent oil spill)
- Industrial policy: driving the technical means to deliver advanced environmental monitoring services (see below on GMES).

An indication for the first driver is provided in the figure below, depicting the wide range of (maritime) policy initiatives and their need for environmental data.



### 6.3.7 Crucial new technologies implemented

The major new initiative that drives environmental monitoring in Europe is the GMES initiative of the European Commission. GMES (Global Monitoring for Environment and Security) is the European



Programme for the establishment of a European capacity for Earth Observation. The Marine Environment Monitoring Service is one of the Core Services of the GMES initiative. The service is to produce generic services based upon the common –denominator ocean state variables that are required to help meet the needs for information of those responsible for environmental and civil security policy making, assessment and implementation. The marine service consists of the following activities:

- Acquisition efforts of data from the ground segment of the space based observing systems and in situ networks;
- Acquisition efforts of atmospheric forcing data (atmospheric winds, temperatures, fluxes) from National Meteorological Services and ECMWF;
- Compilation of these data into quality controlled thematic datasets suitable for the generation of more extensive data sets for subsequent use, analytical products and assimilation by ocean models. Thematic Assembly Centres are in charge of compiling this task for the following data sets: sea surface temperature, ocean colour, sea level, sea ice, surface winds and fluxes wind, and in situ data;
- Running of numerical ocean models in near real time to assimilate the thematic data and generate analyses and forecasts from them to an agreed and generally perpetually repeating cycle. The centres also need to operate offline to produce reanalyses /hindcasts. Monitoring and Forecasting Centres are operating regional and global models: global, Arctic, Baltic, North West shelf, Irish -Bay of Biscay and Iberian Coast, Mediterranean sea and Black Sea.

As can be derived above, the GMES Marine service combines traditional in-situ measurements (e.g. by vessels, buoys, ferry boxes etc) and satellite imagery data. The European Commission aims to ensure that GMES is fully operational by 2014.

Remarkable technological and implementation progress has taken place in the state-of-the-art and operation of “in situ” ocean-observing systems. Traditionally “in situ” observations have been carried out by oceanographic ships, moorings, and floats. More novel technologies include robotic floats, gliders, automated sensors that provide real-time data. Although these observing platforms can carry out multidisciplinary measurements, combining different technologies (ships, moorings, floats, gliders and satellites) will enhance our capacity for ocean observation by filling spatio-temporal gaps left by individual observing systems. The critical technological developments are driven by “Integrated Monitoring” that presents a sustainable operation of marine observations systems through the integration of FerryBox (for ground truth values for remote sensing data), remote sensing (expansion of transect to spatial view) and numerical models (filling data gaps, providing extended spatio/temporal coverage and forecasting capability e.g. algal blooms). This synergistic concept underpins the “Operational Oceanography Approach” as also defined in FP-7 funded research project MyOcean.

EMSA is also operating the CleanSeaNet System, a satellite-based aperture radar imagery as a monitoring system for marine oil spill detection and surveillance in European waters. The service to Member States provides a range of detailed information to track marine pollution and the polluter.

#### *6.3.8 Expected global competitive position*

The global competitive position is potentially large, as when these services are developed (i.e. moved from research phase to full operational phase) these can be applied worldwide (although would always need regional in-situ input). It must be noted that the demand for these services worldwide will be institutional. Major competitor is the US, advancing its own Earth Observation programmes, a/o for marine environmental monitoring.



### 6.3.9 Future potential

There is potential. There is an increasing demand for (marine) environmental policy and thus for data to monitor the policy. Europe is advanced in this respect compared to other regions of the world and is now shaping one of its space flagship technology initiatives a/o towards marine environmental monitoring, while GMES is now still in pre-operational phase. This offers growth potential to exploit further in Europe and other regions of the world. The key future potential developments will be discussed in more detail in WP2.

### 6.3.10. Links to other sub-functions

Environmental monitoring links directly to other subfunctions, such as growing aquatic products, ecosystem health, maritime shipping and renewable energy. There is also relation to clusters of subfunctions related to maritime surveillance, as addressed by the Integrated Maritime Surveillance (IMS) initiative. The establishment of the Common Information Sharing Environment (CISE) for the surveillance of the EU maritime domain demands for the sharing data from different functions such as maritime safety, fisheries control and marine environment. CISE will be discussed in more detail in WP2 under the *Surveillance* subfunction.

### 6.3.11 Concluding assessment

- The current size of the sub-function 'Environmental monitoring' is estimated at € 0.1-0.2 bn added value and 1,000-1,500 jobs (Ecorys, 2010). This makes the sub-function to be ranked outside the top-7 in terms of current size.
- The recent growth of the sub-function is estimated at '+' in terms of added value and of employment (own estimate). This makes the sub-function to be ranked outside the top-7 in terms of recent growth.
- The future potential of this sub-function is scored qualitatively and the overall score is "+++++". Therefore the sub-function is ranked fourth among the top-7 in terms of future potential, jointly with sub-functions 3.3 (ocean energy) and 6.1 (traceability and security of goods supply chains). Based on these scores, the sub-function is included in the selected set of 13 sub-functions that will be elaborated in WP2, on the basis of its future potential.

### 6.3.12 Key references (up to ten most recently published)

- ECORYS, 2008, Competitiveness of the GMES downstream sector
- European Commission, REGULATION (EU) No 911/2010 on the European Earth monitoring programme (GMES) and its initial operations (2011 to 2013), 22 September 2010
- European Commission, Building a European marine knowledge infrastructure: Roadmap for a European Marine Observation and Data Network, SEC(2009) 499, 7 April 2009
- European Commission, European Marine Observation and Data Network Impact Assessment, COM(2010) 461, SEC(2010) 999, 8 September 2010
- European Commission, Marine Knowledge 2020 marine data and observation from smart and sustainable growth, SEC(2010) 461, 8 September 2010
- European Commission, Draft Roadmap towards establishing the Common Information Sharing Environment for the surveillance of the EU maritime domain, COM(2010) 584, 20 October 2010
- European Commission, Towards a space strategy for the European Union that benefits its citizens, COM (2011)152, 4 April 2011.
- Eurostat, 2007, Environmental expenditure statistics, General Government and Specialised Producers data collection handbook
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- National Research Council, 1990, Managing Troubled Waters: The Role of Marine Environmental Monitoring

## Annex 4 Explanatory notes on sub-functions data and selection

The selection of sub-functions on the basis of current size and recent trends is based on statistical data and other sources, as explained in chapter 3 of the main report. This annex presents the underlying data and explains calculations made for each sub-function. Subsequently, results of sensitivity tests are described, which is used for assessing the robustness of the resulting selection of sub-functions.

As was made clear in the main report as well as in annex 3, for the more mature sub-functions statistical data is available from generic sources like Eurostat allowing EU wide data assessment and time series analysis. For smaller sub-functions that are still in their early phase of development this is not the case, and estimates are often based on specific sector reports, lacking harmonised approach (f.i. no NACE statical codes defined yet), and no time series available. For those, in several cases qualitative scores were applied as shown in chapter 3 of the main report.

### 1. Maritime transport and shipbuilding

#### 1.1. Deep sea shipping, 1.2. Shortsea shipping (incl. RoRo) and 1.3. Passenger ferry services

For these sub-functions, data on value added and employment is available for the shipping function as a whole, e.g. covering the sub-functions of deep sea shipping (1.1), shortsea shipping (1.2) and passenger ferry services (1.3). Assumptions have therefore been made to allocate the overall data to these sub-functions. These are explained below.

The following table presents the total value added in current prices for water transport (NACE (Rev 1.1) 61.10 Sea and coastal water transport), shipbuilding (NACE (Rev 1.1) 35.1 Building and repairing of ships and boats) and port services (NACE (Rev 1.1) 63.11, 63.11 Cargo handling and NACE (Rev 1.1) 61.20 Inland water transport). Data is only available up to 2007.

**Table 0.1 Value added maritime transport and shipbuilding (bn EUR, current prices)**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Water transport	13	15	14	16	21	19	20	21	n/a	n/a
Shipbuilding	9	10	9	9	10	10	11	13	n/a	n/a
Port Services	85	97	102	107	123	130	142	154	n/a	n/a
<b>Total</b>	<b>107</b>	<b>122</b>	<b>125</b>	<b>132</b>	<b>154</b>	<b>159</b>	<b>173</b>	<b>188</b>	n/a	n/a

Source: Eurostat database (2011)

On this time series, the compound annual growth rate (CAGR) has been calculated taking the latest 5 years for which data is available, e.g. 2002 to 2007. The resulting figure is 8.5% on the above time series (growth from 125 to 188 bn EUR GVA).

For employment data, the same level of data is available, as presented in the next table.

**Table 0.2 Employment maritime transport and shipbuilding (FTE \* 1000)**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Shipping	133	120	115	133	134	132	146	143	n/a	n/a
Shipbuilding	203	189	227	236	224	228	239	246	n/a	n/a
Port	1.433	1.586	1.693	1.727	1.845	1.944	2.001	2.086	n/a	n/a

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Services										
<b>Total</b>	<b>1.769</b>	<b>1.895</b>	<b>2.035</b>	<b>2.095</b>	<b>2.204</b>	<b>2.304</b>	<b>2.386</b>	<b>2.475</b>	n/a	n/a

Sources: Source: Eurostat database (2011) (Port services: number of employees)

On this time series, the compound annual growth rate (CAGR) has been calculated taking the latest 5 years for which data is available, e.g. 2002 to 2007. The resulting figure is 4.0% on the above time series (growth from 2,035 to 2,475 mln).

Subsequently, it was necessary to decompose data to estimate the size and growth of the underlying sub-functions. As this was not possible on the basis of employment and value added statistics from Eurostat, additional data was collected.

First, an estimate was made of the employment in the passenger ferries segment (sub-function 1.3). as no sectoral data throughout Europe could be obtained, data was gathered from a number of large operators active in Europe (Stenalines, Hellenic Seaways, Grimaldi) using data published in their latest annual reports. These revealed the total number of passengers transported by these companies, along with their staff numbers and fleet sizes. Using these data, a proxy was calculated on the number of passengers served on average per staff member (including office and other shore staff of these companies). This proxy was in the order of 5,700 pax/staff/year.

From Eurostat, data on the total number of passengers transported is available.

**Table 0.3 Number of passengers shipped in Europe (\*mln)**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Shipping	n/a	n/a	416	414	407	395	407	414	412	403

Source: Eurostat database (2011)

The figures indicate a stable number of passengers over time with a CAGR for the last five years of -0.2%.

Using the proxy derived from operators' annual reports, employment in this sector would be in the order of 150,000 FTE. However as stated in the factsheet in passenger ferry services in annex 3, data are based on larger sized companies and therefore the figure is considered an underestimation. Employment is taken to be in the range of 200-300,000 FTE.

This implies that the sub-functions 1.1 deepsea shipping and 1.2 shortsea shipping will have a joint employment of  $(2,475 \text{ minus } 250) = 2,225,000$  jobs (we take the middle value of the range estimated for passenger ferry services for calculating figures).

Subsequently, this figure is allocated between 1.1 deepsea shipping and 1.2 shortsea shipping on the basis of freight volumes handled, as explained in annex 3 in the factsheets of these sub-functions. As explained there this may be an overestimation for deepsea shipping compared to shortsea shipping as larger vessels require less crew relative to the cargo carried. On the other hand for port services and other components of the sub-function this will be much less the case. Furthermore it is noted that the share of employment of shipping itself is less than 10 percent of the total employment in the maritime function (see table x.x above).

Eurostat data do not distinguish between deepsea and shortsea but between intra-EU and extra-EU. These are taken as a proxy for shortsea and deepsea, respectively.

**Table 0.4 Freight volumes in the EU-27 (mln tons)**

	2008	2009
Total transport	3,107	2,715
National	10%	11%
International Intra-EU	25%	25%
Extra-EU	63%	62%
Unknown	2%	2%

Source: Eurostat database (2011)

Based on these data the deepsea share is taken to be 63% and the shortsea share 37% (including national transport in the shortsea segment).

Employment for these sub-functions is then calculated by splitting the total employment of 2,225 thousand into 63% (1,402) for 1.1 deepsea shipping and 37% (823) for 1.2 shortsea shipping.

Value added is allocated using the same ratios as employment, on the assumption that average value added per FTE will not differentiate. This may not be fully true for the shipping sectors itself but when combining these with port services and other components the differences will likely have averaged out. This results in a GVA of 106 bn EUR for deepsea shipping, 63 bn EUR for shortsea shipping and 19 bn EUR for passenger ferry services.

For calculating recent growth, for the deepsea sub function (1.1) the above presented Eurostat data is applied. For shortsea shipping (1.2) growth is taken to be relative to volume trends in intra-European shipping.

#### 1.4. Inland shipping (sea-borne cargoes)

For inland shipping, separate sources were consulted as some data could be obtained on the specific economic importance of this sub-function. In 2007 the sector accounted for 6.1 bn EUR of turnover (Eurostat, published in EU energy and transport in figures, Statistical Pocketbook 2010). Employment amounts to 43.4 thousand FTE (Eurostat, published in EU energy and transport in figures, Statistical Pocketbook 2010).

Time series for both value added and employment could not be used due to incompleteness. As indicated in the sub-function factsheet stable trends are assumed.

## 2. Food, nutrition health and ecosystem services

### 2.1. Fish for human consumption

Statistics do not distinguish between fishing for human consumption and fishing for animal feeding. Available data do distinguish between fishing and fish processing, and these data are added to obtain total figures for the sub-functions. Below table gives the figures for value added.

**Table 0.5 GVA (mln EUR) of fishing and fish processing**

Added value	2003	2004	2005	2006	2007
Fishing	3,043	3,247	3,652	3,860	3,606
Fish processing	3,735	3,782	3,977	3,955	4,330
Total	6,778	7,029	7,629	7,815	7,936

Source: Eurostat database (2011), Anderson and Guillen (2009). See notes in annex 3 on the coverage of countries in these data.

CAGR over this period amounts to 4.0%.

Employment data also distinguishes between fishing and processing, and is as follows.

**Table 0.6 Employment (in FTE) in fishing and fish processing.**

	2003	2004	2005	2006	2007
Fishing sector	159,405	131,832	140,877	135,401	119,760
Fish processing	118,479	116,437	117,296	116,876	116,314
Total	277,884	248,269	258,173	252,277	236,074

Source: Eurostat database (2011). See notes in annex 3 on the coverage of countries.

CAGR over this period amounts to -4.0%.

### 2.2. Fish for animal feeding

Estimations exist on the share of fish catch aimed for animal feeding. Below table gives these figures. We assume this share to be also valid for value added and employment of this sub-function.

Fishing Sector	2003	2004	2005	2006	2007
Share of the industrial catch in total production	2.27%	1.85%	1.91%	2.03%	2.58%

Source: based on Eurostat database (2011)

Applying this share results in a value added of 0.2 bn EUR and employment of 5.7 thousand.

### 2.3. Growing aquatic products

For this sub-function, data on the production value is available, but not on the added value.

**Table 0.7 Production value aquaculture (in mln EUR)**

	2003	2004	2005	2006	2007
Aquaculture	2,733	2,569	2,843	3,037	3,272

Source: Eurostat database (2011)

CAGR over this period amounts to 4.6%.

Estimated employment in this sub-function is 63,700 FTE in 2006 (Framian, 2009). No time series data was found on employment in this sub-function. As indicated in the sub-function factsheet in annex 3, this number is expected to have grown over the past 5 years.

### 2.4. High value use of marine resources (health, cosmetics, well-being, etc.)

As stated in the sub-function factsheet in annex 3, economic size is limited and data scarcely available. A ballpark figure is estimated based on the assumption that one third of global activity is taking place in Europe. No employment data was found but given the size of value added it is estimated below 500 jobs.

### 2.5. Agriculture on saline soils

Data on economic importance of this sub-function is not available in generic statistical sources. Therefore consultants have assumed a modest figure of 0.25 bn EUR GVA and less than 500 jobs.

## 3. Energy and raw materials

### 3.1. Oil, gas and methane hydrates

Eurostat database value added data on oil and gas activities is incomplete. Therefore for estimating the economic size data on production output has been applied. Totals for the EU27 are given in annex 3 and are only published for 2008 (Eurostat database, 2011). Data cover both onshore and offshore activities.

The value of offshore oil and gas production is calculated using the assumption that 80-90% of oil production is taking place offshore, and 45-46% of gas production. See the factsheet on this sub-function in annex 3 for further explanations. These assumptions result in a production value of 107-123 bn EUR.

The growth of oil and gas added value and employment is based on the production volumes. Below table gives the figures applied.

**Table 0.8 Production volumes of oil and gas (in 1000 tons of oil equivalent)**

		2001	2002	2003	2004	2005	2006	2007	2008
Oil production	170,305	158,903	161,829	151,937	140,909	128,465	116,797	115,333	107,350
Gas production	207,840	208,497	204,240	199,811	203,242	188,673	179,412	167,224	168,117
Total	378,145	367,400	366,069	351,748	344,151	317,138	269,209	282,557	275,467

Source: Eurostat database (2011)

CAGR amounts to -4.8% over the last 5 years (2003-2008).

### 3.2. Offshore wind

Current added value and employment is estimated based on the installed capacity and capacity/turnover and capacity/employment ratios of the sector. See the factsheet on this sub-function in annex 3.

The growth of offshore wind added value and employment is based on the production volumes. Below table gives the figures applied.

**Table 0.9 Electricity production from wind energy (onshore and offshore) (in 1000 tonnes of oil equivalent)**

		2001	2002	2003	2004	2005	2006	2007	2008
Production	1.911	2.318	3.071	3.813	5.055	6.063	7.077	8.971	10.164

Source: Eurostat database (2011)

CAGR amounts to -21.7% over the last 5 years (2003-2008).

### 3.3. Ocean energy (wave, tidal, OTEC, thermal, biofuels, etc.)

No separate statistics on the value added and employment for this sub-function was found. On the basis of installed capacity in comparison to other electricity sectors, consultant has estimated this sub-function to have a value added of less than 0.25 bn EUR and an employment of less than 500 FTE. No time series are available. Therefore CAGR could not be calculated.

### 3.4. CCS

No separate statistics on the value added and employment for this sub-function was found. As there are only a few demonstration projects in the EU, consultant has estimated this sub-function to

have a value added of less than 0.25 bn EUR and an employment of less than 500 FTE. No time series are available. Therefore CAGR could not be calculated.

### 3.5. Aggregate mining (sand, gravel, etc.)

Value added data on this sub-function is incomplete in Eurostat statistical tables. Turnover and production value data indicate an overall size (onshore and offshore) of € 27 bn EUR. See table x.x below. The share of offshore is estimated at 2-3% based on specific data for several countries (see the sub-function factsheet in annex 3).

**Table 0.10 Aggregate mining economic size (in mln EUR and number of persons)**

		2001	2002	2003	2004	2005	2006	2007	2008
Turnover	19.692	20.998	20.479	21.384	23.802	25.873	28.147	27.047	
Production value	18.911	20.428	19.994	20.923	23.178	25.803	27.276	26.356	
Employment	121.373	128.981	137.028	139.071	138.186	138.224	141.564	134.375	1.

Source: Eurostat database (2011)

The growth of offshore aggregate mining is based on the production value (onshore and offshore). This results in a CAGR (2003-2007) of 5.9% for value added and -0.4% for employment.

### 3.6. Other raw materials

No separate statistics on the value added and employment for this sub-function was found. As first pilots are currently being set up, consultant has estimated this sub-function to have a value added of less than 0.25 bn EUR and an employment of less than 500 FTE. No time series are available. Therefore CAGR could not be calculated.

### 3.7. Securing fresh water supply (desalination)

No generic statistics on this sub-function were found, but sector reports indicate growth figures. See the factsheet on this sub-function in annex 3.

## 4. Leisure, working and living

### 4.1. Coastline tourism

Employment in leisure in coastal regions is not published separately by Eurostat in its database. Use was made of a coastal tourism specific publication in which 2006 data was presented (Policy Research Corporation, 2008). This source presented employment in coastal tourism to amount to 2,359,625 jobs. No time series could be constructed on the size.

The employment figure resembles 1.1% of total EU employment (Eurostat database, 2011). As comparable data on GVA for coastal tourism was not found, this percentage was assumed to be valid for GVA as well, resulting in a total GVA of 121 bn EUR (based on ECB 2011 data for EU GVA).

Growth of the sub-function is based on the increase in number of tourists (mln hotel nights)

**Table 0.11 Number of hotel nights in EU countries (\* mln)**

		2001	2002	2003	2004	2005	2006	2007	2008
Hotel nights	1,750	1,760	1,740	1,730	1,740	1,830	1,875	1,935	1,925

CAGR (2003-2008) amounts to 2.8%. this figure is taken for both value added and employment growth.

#### *4.2. Yachting including marinas*

No time series was found for this sub-function. Figures on employment and added value were taken from Ecotec (2006). Figures on the annual growth were taken from SRN/Ecorys/Euromapping (2007).

#### *4.3. Cruise including port cities*

No time series was found for this sub-function. Figures on added value were taken from European Cruise Council (2010). Figures on employment were taken from Policy Research Corporation (2008). Figures on the annual growth were taken from European Cruise Council (2010).

#### *4.4. Working*

As mentioned in Ch.3 this sub-function is not considered for the selection. Therefore this sub-function is not included in the sensitivity analysis.

#### *4.5. Living*

As mentioned in Ch.3 this sub-function is not considered for the selection. Therefore this sub-function is not included in the sensitivity analysis.

### **5. Coastal protection**

#### *5.1. Protection against flooding and erosion*

As coastal protection activities are not distinguished in separate NACE codes, no statistical data on this sub-function could be obtained from generic sources like Eurostat. However data on public expenditures for coastal protection is published by the European Commission (2009) as well as future spending needs. See the data presented in the sub-function factsheet of annex 3. Based on these data a value added range of 1.0-5.4 bn EUR was estimated. Consultant has assumed an average GVA per FTE of € 100,000 to arrive at an employment range of 10-50,000 FTE.

Time series data on public expenditure is used to calculate a CAGR of 4% (see again the sub-function factsheet in annex 3).

#### *5.2. Preventing salt water intrusion and water quality protection*

No generic statistics on this sub-function were found, but sector reports indicate growth figures. See the factsheet on this sub-function in annex 3.

#### *5.3. Protection of habitats*

No generic statistics on this sub-function were found, but sector reports indicate growth figures. See the factsheet on this sub-function in annex 3.

### **6. Maritime monitoring and surveillance**

#### *6.1. Traceability and security of goods supply chains*

No generic statistics on this sub-function were found, but sector reports indicate growth figures. See the factsheet on this sub-function in annex 3.

#### *6.2. Prevent and protect against illegal movement of people and goods*

No generic statistics on this sub-function were found, but sector reports indicate growth figures. See the factsheet on this sub-function in annex 3.

#### *6.3. Environmental monitoring*

No generic statistics on this sub-function were found, but sector reports indicate growth figures. See the factsheet on this sub-function in annex 3.



### Sensitivity tests on data applied

The selection of sub-functions is based on current size and recent growth of employment and added value and therefore depends on the data available. To test robustness of the selection on current size, sensitivity is tested for using data of other years (one or two years earlier than the latest year for which data is available). The robustness of the selection on the basis of recent growth is based on sensitivity tests for 5-year CAGR figures for the latest-but-one year and back and for the latest-but-two years and back. The resulting figures are presented in the below tables.

**Table 0.12 Sensitivity results – current size**

Function	Sub-function	GVA (bn EUR)			Employment (* 1000 jobs)		
		Latest year	One-but latest year	Two but latest year	Latest year	One-but latest year	Two but latest year
1. Maritime transport and shipbuilding	1.1 Deepsea shipping	106	98	89	1.402	1.346	1.294
	1.2 Shortsea shipping (incl. RoRo)	63	57	52	823	790	760
	1.3 Passenger ferry services	20	18	17	200-300	n/a	n/a
	1.4 Inland waterway transport.	6.1	5.5	5.4	43.4	43.5	41.7
2. Food, nutrition, health and eco-system services	2.1 Catching fish for human consumption	7.9	7.8	7.6	236	252	258
	2.2 Catching fish for animal feeding	0.2	0.2	0.2	5.7	6.6	6.7
	2.3 Growing aquatic products	3.3	3.0	2.8	63.7	n/a	n/a
	2.4 High value use of marine resources (health, cosmetics, well-being, etc.)	0.6	n/a	n/a	<0.5	n/a	n/a
	2.5 Agriculture on saline soils	<0.25	n/a	n/a	<0.5	n/a	n/a
3. Energy and raw materials	3.1 Oil, gas and methane hydrates	107-133	n/a	n/a	25-50	n/a	n/a
	3.2 Offshore wind energy	1.3	n/a	n/a	7	n/a	n/a
	3.3 Other renewables (wave, tidal, OTEC, thermal, biofuels, etc.)	<0.25	n/a	n/a	<0.5	n/a	n/a
	3.4 Carbon capture and storage	<0.25	n/a	n/a	<0.5	n/a	n/a
	3.5 Aggregates mining (sand, gravel, etc.)	0.7	0.7	0.6	4.3	4.5	4.4
	3.6 Other raw materials	<0.25	n/a	n/a	<0.5	n/a	n/a
	3.7 Securing fresh water supply (desalination)	0.7	n/a	n/a	7	n/a	n/a
4. Leisure, working and living	4.1 Coastline tourism	121	n/a	n/a	2,350	n/a	n/a
	4.2 Yachting and marinas	23.4	n/a	n/a	253	n/a	n/a
	4.3 Cruise including port cities	14.1	n/a	n/a	143	n/a	n/a
	4.4 Working	4.108	3.886	3.678	75.1 mln	73.7 mln	72.0 mln
	4.5 Living	n/a	n/a	n/a	177 mln	PM	PM

Function	Sub-function	GVA (bn EUR)			Employment (* 1000 jobs)		
		Latest year	One-but latest year	Two but latest year	Latest year	One-but latest year	Two but latest year
5. Coastal protection	5.1 Protection against flooding and erosion	1.0-5.4	n/a	n/a	10-50	n/a	n/a
	5.2 Preventing salt water intrusion	<0.25	n/a	n/a	<0.5	n/a	n/a
	5.3 Protection of habitats	<0.25	n/a	n/a	<0.5	n/a	n/a
6. Maritime monitoring and surveillance	6.1 Traceability and security of goods supply chains	0.6-1	n/a	n/a	5-10	n/a	n/a
	6.2 Prevent and protect against illegal movement of people and goods	1.1	n/a	n/a	10	n/a	n/a
	6.3 Environmental monitoring	0.1-0.2	n/a	n/a	1-1.5	n/a	n/a

As explained in section 3.3.1 the ranking is based on a combined indicator constructed of GVA and employment data, resulting in a top-7 sub-functions in terms of current size. The same has now been done for the other data years using above figures.

The result of this is that if ranking and selection of the 7 largest sub-functions was based on other year data, exactly the same ranking on current size would result. It must be noted that for some sectors no data on other years was available, but given the differences in size consultant is confident that although within the top-7 list some changes might be needed, the overall list is not expected to change.

Similar analysis is done on recent growth, looking at the latest 5 year time series available (base case) compared to the afore lying 5-year series, if data was available for these years.

**Table 0.13 Sensitivity results – recent growth (five year series)**

Function	Sub-function	GVA (bn EUR)			Employment (* mln jobs)		
		Latest year	One-but latest year	Two but latest year	Latest year	One-but latest year	Two but latest year
1. Maritime transport and shipbuilding	1.1 Deepsea shipping	8.5%	7.2%	7.2%	4.0%	4.7%	5.4%
	1.2 Shortsea shipping (incl. RoRo)	6.1%	??	??	6.1%	??	??
	1.3 Passenger ferry services	0/+	n/a	n/a	-0.2%	-0.1%	-0.1%
	1.4 Inland waterway transport.	0	n/a	n/a	0/-	n/a	n/a
2. Food, nutrition, health and eco-system services	2.1 Catching fish for human consumption	4.0%	n/a	n/a	-4.0%	n/a	n/a
	2.2 Catching fish for animal feeding	-5.8%	n/a	n/a	-	n/a	n/a
	2.3 Growing aquatic products	4.6%	n/a	n/a	+	n/a	n/a
	2.4 High value use of	+	n/a	n/a	+	n/a	n/a

Function	Sub-function	GVA (bn EUR)			Employment (* mln jobs)		
		Latest year	One-but latest year	Two but latest year	Latest year	One-but latest year	Two but latest year
	marine resources (health, cosmetics, well-being, etc.)						
	2.5 Agriculture on saline soils	+	n/a	n/a	+	n/a	n/a
3. Energy and raw materials	3.1 Oil, gas and methane hydrates	-4.8%	-5.0%	-4.2%	-4.8%	-5.0%	-4.2%
	3.2 Offshore wind energy	21.7%	23.9%	25.0%	21.7%	23.9%	25.0%
	3.3 Other renewables (wave, tidal, OTEC, thermal, biofuels, etc.)	+	n/a	n/a	+	n/a	n/a
	3.4 Carbon capture and storage	+	n/a	n/a	+	n/a	n/a
	3.5 Aggregates mining (sand, gravel, etc.)	5.9%	8.1%	6.0%	-0.4%	1.9%	2.6%
	3.6 Other raw materials	0/+	n/a	n/a	0/+	n/a	n/a
	3.7 Securing fresh water supply (desalination)	12.3%	n/a	n/a	12.3%	n/a	n/a
4. Leisure, working and living	4.1 Coastline tourism	2.8%	1.9%	1.0%	2.8%	1.9%	1.0%
	4.2 Yachting and marinas	5.0%	n/a	n/a	+	n/a	n/a
	4.3 Cruise including port cities	12.3%	n/a	n/a	12.3%	n/a	n/a
	4.4 Working	4.5%	4.3%	4.4%	4.5%	4.3%	4.4%
	4.5 Living	0.1%	n/a	n/a	0.1%	n/a	n/a
5. Coastal protection	5.1 Protection against flooding and erosion	4%	n/a	n/a	+	n/a	n/a
	5.2 Preventing salt water intrusion	+	n/a	n/a	+	n/a	n/a
	5.3 Protection of habitats	+	n/a	n/a	+	n/a	n/a
6. Maritime monitoring and surveillance	6.1 Traceability and security of goods supply chains	+	n/a	n/a	+	n/a	n/a
	6.2 Prevent and protect against illegal movement of people and goods	+	n/a	n/a	+	n/a	n/a
	6.3 Environmental monitoring	+	n/a	n/a	+	n/a	n/a

As explained in section 3.3.2 the ranking is based on the average of the growth percentage of GVA and employment, resulting in a top-7 sub-functions in terms of recent growth. The same has now been done for the other data years using above figures. If no data was available for other years ("n/a" in the table), the same figure as in the latest (only) available year is applied.

The result of this is that if ranking and selection of the 7 fastest growing sub-functions was based on other years data, no other ranking would result. Partly this is because for a number of sub-functions, no time series data is available and no quantitative recent growth estimate could be established for other years. Still it is clear that for sub-functions where data exists, growth figures

for other years are in the same order of magnitude. Consultant therefore considers the selection on the basis of recent growth to be robust.

## Annex 5: Initial findings on horizontal research programmes

This annex contains the specific findings on horizontal research programmes, as described in chapter 2 of this report. The following sections are included:

- Overview of FP6/7 projects
- Overview of MEDA (Union for the Mediterranean (UM)) projects
- Overview of Interreg projects
- Overview of Motorways of the Seas projects

FP6/FP7 projects

Relevance of Projects for Maritime Functions			1	2	3	4	5	6
Source	Acronym	Title	Maritime transport and shipbuilding	Food, nutrition and health, ecosystems	Energy and raw materials	Leisure, working and living	Coastal protection	Maritime monitoring and surveillance
FP6	AQUAMONEY	Development and Testing of Practical Guidelines for the Assessment of Environmental and Resource Costs and Benefits in the WFD	√	√	√	√	√	√
FP6	BASIN	Basin-scale Analysis, Synthesis, and Integration: Resolving the impact of climatic processes on ecosystems of the North Atlantic Basin and shelf seas		√			√	
FP6	CONSCIENCE	Basin-scale Analysis, Synthesis, and integration: Resolving the impact of climatic processes on ecosystems of the North Atlantic Basin and shelf seas					√	
FP6	CONSCIENCE	Concepts and Science for Coastal Erosion Management					√	
FP6	ECOOP	European Coastal-shelf sea Operational observing and forecasting system	√		√		√	√
FP6	ELME	European Lifestyles and Marine Ecosystems		√		√	√	
FP6	ENCORA	European Network for Coastal Research and Extension	√	√	√	√	√	√
FP6	ESONET	European Seas Observatory Network	√	√	√	√	√	√
FP6	ESONIM	European Seafloor Observatory Network Implementation Model		√	√		√	
FP6	EUR-OCEANS	European network of excellence for Ocean Ecosystems Analysis		√			√	

Relevance of Projects for Maritime Functions			1	2	3	4	5	6
Source	Acronym	Title	Maritime transport and shipbuilding	Food, nutrition and health, ecosystems	Energy and raw materials	Leisure, working and living	Coastal protection	Maritime monitoring and surveillance
FP6	HERMES	Hotspot Ecosystem Research on the Margins of European Seas and Extension		√			√	
FP6	IASON	International Action for Sustainability of the Mediterranean and Black Sea Environment	√	√	√	√	√	√
FP6	MARBEF	Marine Biodiversity and Ecosystem Functioning	√	√	√	√	√	√
FP6	Modelkey	Models for Assessing and Forecasting the Impact of Environmental Key Pollutants on Marine and Freshwater Ecosystems and Biodiversity	√	√	√	√	√	√
FP6	SEED	Life history transformations among HAB species, and the environmental and physiological factors that regulate them						
FP6	Sesame	Southern European Seas: Assessing and Modelling Ecosystem changes		√			√	
FP6	SIMORC	Proposal to Establish a System of Industry Metocean data for the Offshore and Research Communities	√		√			√
FP6	SPICOSA	Science and Policy Integration for Coastal System Assessment		√			√	
FP7	CoralFish	Assessment of the interaction between corals, fish and fisheries, in order to develop monitoring and predictive modelling tools for ecosystem based management in the deep waters of Europe and beyond		√				
FP7	DS <sup>3</sup> F	The Deep Sea & Sub-Seafloor Frontier	√	√	√	√	√	√

Relevance of Projects for Maritime Functions			1	2	3	4	5	6
Source	Acronym	Title	Maritime transport and shipbuilding	Food, nutrition and health, ecosystems	Energy and raw materials	Leisure, working and living	Coastal protection	Maritime monitoring and surveillance
FP7	ECO2	Sub-seabed CO2 Storage: Impact on Marine Ecosystems			√			
FP7	EUROBASIN	Basin-scale Analysis, Synthesis and Integration	√	√	√	√	√	√
FP7	EUROMARINE	Integration of European Marine Research Networks of Excellence	√	√	√	√	√	√
FP7	EUROSITES	Integration and enhancement of key existing European deep-ocean observatories	√	√	√			
FP7	HERMIONE	Hotspot Ecosystem Research and Man's Impact on European seas	√	√	√	√	√	√
FP7	KNOWSEAS	Knowledge-based Sustainable Management for Europe's Seas	√	√	√	√	√	√
FP7	MARCOM+	Towards an Integrated Marine and Maritime Science Community	√	√	√	√	√	√
FP7	Marine TT	European Marine Research Knowledge Transfer and Uptake of Results	√	√	√		√	
FP7	MEECE	Marine Ecosystem Evolution in a Changing Environment		√			√	
FP7	MESMA	Monitoring and evaluation of spatially managed marine areas		√		√	√	
FP7	ODEMM	Options for Ecosystem-based Marine Management	√	√	√	√	√	√
FP7	PEGASO	People for Ecosystem Based Governance in Assessing Sustainable Development of Ocean and Coasts	√	√	√	√	√	√
FP7	SECOA	Solutions for Environmental Contrasts in Coastal Areas		√		√	√	



Relevance of Projects for Maritime Functions								
Source	Acronym	Title	1 Maritime transport and shipbuilding	2 Food, nutrition and health, ecosystems	3 Energy and raw materials	4 Leisure, working and living	5 Coastal protection	6 Maritime monitoring and surveillance
FP7	VECTORS	Vectors of Change in Oceans and Seas Marine Life, Impact on Economic Sectors	√	√	√	√	√	√
FP7	CLEAR	Climate change, Environmental contaminants and Reproductive health		√		√		
FP7	ERA-ENVHEALTH	Coordination of National Environment and Health Research Programmes - Environment and Health ERA-NET						

### Interreg projects

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
1	<a href="#">ScaldWIN</a>	ScaldWIN Scheldt Transnational Water management aimed at Improving and Integrating Innovative measures for groundwater, sediments and surface water in the International Scheldt River Basin District.	<p>The general aim of the project is to contribute to a better quality of surface and groundwater bodies in the Scheldt International River Basin District (IRBD). This will be done by developing and implementing a set of cost-effective, innovative and transnational actions aimed at attaining a good status of surface and groundwater bodies. By monitoring the transnational effect of these actions, the foundation for the development of a transnational surveillance system for the Water Framework Directive (WFD) programmes of measures for the Scheldt IRBD will be laid.</p> <p>With this project aim, the Scaldwin-project capitalises on the results of the Interreg IIIB NWE Scaldit-project. The pressure on the water system differs between regions. Most of the investigated transboundary or similar surface waters and groundwater layers are at risk of not achieving a good status as asked by the WFD. All competent authorities of the Scheldt IRBD will have to take extra measures. This project aims at finding the best available meas</p>	2, 5	North Sea Region
2	<a href="#">IMCORE</a>	Innovative Management for Europe's Changing Coastal Resource	<p>Aim: To promote a transnational, innovative and sustainable approach to reducing the Ecological Social and Economic impacts of climate change on the coastal resources of NWE.</p> <p>To achieve: A demonstration of how the innovative expert couplet approach (i.e. collaboration between coastal practitioners and scientists using the principles of sustainability science), can help with the effective implementation of adaptive management strategies for coastal resources.</p> <p>The identification of impacts of a range of specified climate change scenarios on coastal sectors and the development of a response in the form of strategies for adaptive management.</p>	2, 5	North Sea Region

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
3	<a href="#">InTraDE</a>	Intelligent Transportation for Dynamic Environment	<p>The world seaborne trade has been developed in the last decade, mainly due to globalization and development of emerging countries. This world growth has an influence on the development of ports and maritime terminals. Within North West Europe (NWE), few ports are able to keep pace with this growth, despite the importance of this coastal area (stretching from Ireland to the Netherlands (see Figures 6, 7, 8 in Annex)).</p> <p>The main problem of the development in the ports and terminals of the NWE area depends on the internal traffic management and space optimisation inside a confined space. A solution was proposed for a selection of major ports such as Rotterdam, Düsseldorf and Hamburg, to automate the handling of goods using automatic guided vehicles (AGV). This solution has resolved some relative internal traffic issues, although it has highlighted several limitations:</p> <ul style="list-style-type: none"> <li>• The port infrastructure would need to be adapted to use AVG's, making it difficult to generalise about how this would work within other ports of</li> </ul>	1	North Sea Region
4	<a href="#">AUXNAVALIA</a>	Enhancement of innovation capacity and competitiveness of the (auxiliary) maritime sector industry	The general objective of the AUX-NAVALIA project is to improve competitiveness of the marine shipbuilding ancillary services industry, by implementing resources and activities that improve their innovation capacity. The project is therefore envisaged within a framework oriented towards reinforcing competitiveness and innovation in excellence niches of the Atlantic Area maritime economy, such as the naval sector and more specifically in the ancillary industry.	1	Atlantic Area
5	<a href="#">ENERMAT.a</a>	A transnational cluster in the field of materials for energy	<p>Energy is a very burning political issue at all governance levels (regional, national and European) in the context of global warming, sustainable development, the end of the fossil fuel era and its rising cost for the last years.</p> <p>At the scientific level, the energy challenge is widely connected with</p>	3	Atlantic Area

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			the elaboration of new materials dedicated to the production, transport, conversion, storage and savings of energy. It concerns the use of breaking technologies in order to develop methods of elaboration and shaping of materials for the energy, namely magnetic and superconducting materials, composite materials in particular biomaterials, dielectric materials, materials for the photovoltaic cells as well as materials for the hearts of fuel cells and biofuels. An increasing part of innovation is today based on new combinations of existing technologies from different backgrounds. Thus, Cross-disciplinary research should be promoted to go beyond the current technological hurdles in material sciences in energy. In addi		
6	<a href="#">KIMERAA</a>	Knowledge transfer to Improve Marine Economy in Regions from the Atlantic Area	The project Knowledge transfer to Improve Marine Economy in Regions from the Atlantic Area (KIMERAA) aims to develop excellence economic niches through the creation of bridges between the scientific knowledge and firms related with the sea. To this goal is necessary to articulate channels for knowledge transfer in the Atlantic area regions, linking the different institutional actors that can intervene in the Marine Economy. It is strongly related with the objectives of European territorial cooperation programmes by focusing the Innovation theme. It is interested in creating and consolidating scientific and technological networks that contribute to the enhancement of innovation capabilities in the economic sectors, specifically the Atlantic area programme by understanding the centrality of marine resources to the cohesive, sustainable and balanced territorial development of its regions like stated in 2007-13 programme goals. The acronym of the project Knowledge transfer to Improve Marine Economy in Regions fro	1	Atlantic Area
7	<a href="#">NEA2</a>	NAUTISME ESPACE ATLANTIQUE 2	The European project NEA2 aims to co-ordinate and sustainably develop the marine leisure sector in each of the regions along the Atlantic Area (including training organisations, boating marinas, manufacturing, retail and activity providers), through the strengthening	4	Atlantic Area

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			of co-operation on three themed strands: economic development, environmental sustainability, and social cohesion.		
8	<a href="#">NETALGAE</a>	Inter-regional network to promote sustainable development in the marine algal industry	By creating a diverse network of relevant stakeholders in the marine macro-algal sector it is expected that significant progress can be made towards developing industrial, commercial and scientific links and fostering a culture of trade and co-operation between the membership. At present there is a lack of communication vehicles, varying language capabilities, of functional contact points and limited knowledge amongst industry players of the resources and expertise that are dispersed outside of their own specific regions. A series of business tools will be developed: web-based communication portal, trade directory, training and development manuals. The project seeks to establish technology transfer initiatives and to support the formation of a European representative body for entities trading in macro-algae resources and products. The first European macro-algae congress that is focused on the bringing together industry, policy makers, environmentalists and regulators with a view to developing a sustainable vi	3	Atlantic Area
9	<a href="#">SHIPWELD</a>	Automatic Welding Process for the Shipbuilding Industry	SHIPWELD project will focus on a metal welding process applied to the ship building industry. The objective is to design a monitoring technique aiming to perform a good quality welding joint on a typical application in the ship building industry with a fully automatic welding system unit. Up to now the different section plates of ships are welded manually which causes inaccuracies due to the poor repeatability of the process. As a consequence of the working environment where the welding process takes place the welding staff risks their lives. The R&D activities focus the attention on monitoring the welding process of hulls. The project will yield new knowledge and understanding about different welding processes and the research activities to be performed will allow the online control and	1	Atlantic Area

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			adjustment of the parameters and the welding path to ensure a good welded seam.		
10	<a href="#">ANCORIM</a>	Atlantic Network for Coastal Risk Management	<p>The project intends to contribute to strengthening the ability to action for coastal actors from the Atlantic regions in terms of the management and prevention of coastal risks, notably taking into account the worsening factor of climate change. It is therefore aimed at coastal managers and decision-makers as well as the scientific community. The project intervenes in terms of networking, the pooling of resources, communication and entertainment, to help mobilise and raise awareness among actors and to supply them with operational tools for decision-making in terms of preventing and fighting against coastal risks.</p> <p>ANCORIM enables the creation of a network of knowledge, tools and skills between different European regions in the Atlantic area and thus enables resources to be pooled. As the problem of coastal risks is common in integrated coastal management of the Atlantic area, as well as having diverse effects, it becomes useful to promote the exchange of experiences, to circulate information and to contribute</p>	5	Atlantic Area
11	<a href="#">ARCOPOL</a>	ATLANTIC REGIONS' COASTAL POLLUTION, RESPONSE AND PREPAREDNESS	<p>ARCOPOL aims to improve prevention, response and mitigation capabilities against oil, HNS and inert spills and to establish the basis for a sustainable Atlantic network of experts supported by adequate information, data exchange and management tools.</p> <p>The project will be developed by a consortium involving partners from 5 countries of the Atlantic Area, where regional and local competent agencies and authorities as well as research organizations are well represented. It will be supported by an Advisory Body comprised of key authorities, experts and industry delegates and will look for the involvement of relevant stakeholders and organizations during the</p>	6	Atlantic Area

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>lifetime of ARCOPOL. This will create the basis for a sustainable network of experts on spill and HNS response of the Atlantic Area supported by adequate information and data exchange and management tools.</p> <p>In order to meet the project aims, seven activities, including coordination and project management have been developed:</p> <p>Activity 1: Coordination a</p>		
12	<a href="#">ATLANTOX</a>	Advanced Tests about New Toxins appeared in Atlantic Area	<p>The main objective of this project is to support and accelerate the development and introduction of a proper and efficient method of fast alternative controlling based on antibodies and functional tests for biotoxins.</p> <p>The main idea of this project directly responds to the priorities and objectives of the Operational Programme of Atlantic Area. It establishes the need to protect coastal areas and its environmental quality, counteracting those factors that threaten the integrity of this marine environment within the same Operational Programme; in coincidence with the measures of this proposal for developing the following action (collected directly in this project):Design exemplary solutions and test methods among transnational partners to avoid coastline changing.</p> <p>The preservation of coastal areas and protection of their ecosystems is a primary purpose for the Atlantic Area Operational Programme , whose approach is taken by this project through carrying out research tasks that are promoted not only to the</p>	2, 4, 5	Atlantic Area

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
13	<a href="#">BIOTECMAR</a>	BIOTEchnological exploitation of MARine products and by-products	<p>The Biotecmar project supports the development of a chain for the production of valuable ingredients using underexploited marine products derived from fishing, aquaculture, seaweed and food industry.</p> <p>Biotecmar, it is...</p> <ul style="list-style-type: none"> <li>- Analyzing the current blocking points for by-products use and studying the possible exploitation by value chains (by species, and by-product).</li> <li>- Establishing an Atlantic network with connections between scientists, marine resources providers, manufacturers and users.</li> <li>- Disseminating information among SMEs on the marine resource potential, processing methods, biological activities, traceability, regulation and market trends via the organization of seminars, workshops, training sessions, conferences, individual meetings, etc.</li> <li>- Supporting the industries/SMEs from Atlantic area to develop these biotechnologies.</li> </ul>	2	Atlantic Area
14	<a href="#">FAME</a>	The Future of the Atlantic Marine Environment	<p>The project objectives are:</p> <ul style="list-style-type: none"> <li>To establish a transnational evidence base to inform decisions on the Atlantic marine environment.</li> <li>To make specific recommendations on designating and managing Marine Protected Areas (MPAs).</li> <li>To communicate effectively with decision makers, scientists, NGOs, marine professionals and the public about the importance of the Atlantic marine environment and role they can play in protecting it.</li> </ul> <p>The need for these objectives to be delivered has been identified by the project partners in the course of their work over the last few years. As the project partners have been communicating with other organisations, including governments, it has become very clear that this information, detailed recommendations and effective communications are required for all concerned to make the correct</p>	2, 4, 5	Atlantic Area



Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>decisions about the Future of the Atlantic Marine Environment.</p> <p>The FAME partnership includes partners from all Member States in the programme area. This will allow the experiences of marine protection in each me</p>		
15	<a href="#">MAIA</a>	Marine protected Areas In the Atlantic Arc	<p>The project aims to:</p> <p>Share experience on how to draw up management plans for activities which take place in existing marine protected areas (MPAs) and thus fulfil the nature conservation objectives that justified their designation;</p> <p>Define and implement joint methodology to identify the marine areas, both inshore and offshore, whose habitats and/or species justify special protection or management.</p> <p>Work will be carried out in close collaboration with professional fishermen who are particularly concerned by these issues, both geographically and economically.</p>	5	Atlantic Area
16	<a href="#">PORTONOV O</a>	Water Quality in Harbours	<p>In accordance with the WFD, the specific uses with high economic and social value carried out by ports are specifically recognized, this way their water bodies are also recognized as heavily modified water bodies (HMWB). This recognition justifies the reduction of its environmental objectives to fulfil the named good ecological potential, and demands a specific management system. In this context, this project intends to develop great quality searching results to strengthen the present situation in accordance with the European legal framework about water quality in harbours. Definitively, PORTONOVO intends to standardize a methodology for the water quality management in port areas all over along the Atlantic Area.</p>	5	Atlantic Area
17	<a href="#">PRESPO</a>	Sustainable Development of the Artisanal fisheries in the Atlantic Area	<p>The Project PRESPO is integrated in the Priority 2 of the Programme “Protect, secure and enhance the marine and coastal environment sustainability”, specifically in the Objective 2.2 “Sustainable</p>	1,2,5	Atlantic Area

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>management and protection of the resources of marine spaces”, taking into account that the aim is to guarantee the long-term sustainability of the fishing activity, considering environmental, economical and social aspects. Moreover, because marine areas are used daily by numerous fishing boats, the project also coincides with the Objective 2.1 of the Priority 2 “Improve maritime safety”, since it will be obtained information on the fishing activity, essential to promote the integrated management of the marine areas.</p> <p>PRESPO is clearly trans-national as in the areas included in the project (Portugal, Spain and France) in particular, and in the Atlantic Area in general, the artisanal fishery has great social and economical importance, namely in the areas that highly dependent on this activity, which is a tradition and</p>		
18	<a href="#">SEAFARE</a>	Sustainable and Environmentally friendly Aquaculture For the Atlantic Region of Europe	SEAFARE brings together applied R&D centres, aquaculture industry organisations and environmental agencies across the Atlantic maritime region, to promote sustainable expansion of European aquaculture. SEAFARE will develop solutions to specific constraints on industry development for Europe's fish and shellfish farmers, through species diversification and development of low-intensity aquaculture systems that are compatible with sensitive coastal habitats. Thus it will provide models for profitable expansion of the aquaculture sector that can be integrated with sustainable management of coastal ecosystems. The partnership of technology transfer and dissemination specialists with R&D providers, industry organisations and public agencies will bridge the knowledge gap to facilitate rapid and effective capitalisation of project results as tangible and sustainable examples of good practice to inform sustainable industrial expansion, environmental management and policy development.	1, 2	Atlantic Area

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
19	<a href="#">PROPOSSE</a>	Promote Ports, SSS & SME Cooperation	<p>The general aim of this project is to promote short sea shipping as a real alternative to other means of goods transportation, basically the exclusive transportation by road between the SME´s of the hinterlands of the ports of Aveiro, Gijón, Le Havre, Poole and Cork.</p> <p>Identifying the main obstacles and potential opportunities as regards the modal switching of SME freight to Short Sea shipping and Motorways of the Sea, and more important, making both SME´s, as well as transport operators aware of the potential and advantages of a modal switchover will be our main objectives.</p> <p>In order to meet these goals,</p> <ul style="list-style-type: none"> <li>- SSS Services available will be studied and analysed.</li> <li>- Current and prospective SME freight that is open to being transferred to the SSS mode will be identified.</li> <li>- Opportunities of SSS Routes will be drawn.</li> <li>- Programs to integrate road haulage to create an efficient intermodal network will be offered.</li> <li>- And, even more important, a Plan of Promotion of SSS and MOS will be designed and put into action.</li> </ul>	1	Atlantic Area
20	<a href="#">START</a>	Seamless Travel across the Atlantic area Regions using sustainable Transport	<p>The START project will directly address some of the weaknesses related to travelling around Europe that has led to:</p> <p>poor accessibility of many regions; insufficient interconnection of networks; and poor access to regional airports/ports/rail interchanges.</p> <p>The main objectives of START are:</p> <ol style="list-style-type: none"> <li>1. To improve the accessibility of regions and the interconnection of passenger transport networks; and</li> </ol>	1	Atlantic Area

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>2. To establish a transnational network of regional and local authorities and other actors to promote enhanced accessibility.</p> <p>The specific objectives of START are:</p> <p>1. To make it easy for people to travel to, from and around Europe using a combination of local public transport and inter-regional transport services;</p> <p>2. To design and develop high-quality information services for travellers that are accessible for all;</p> <p>3. To design and develop easy to use advanced ticketing systems;</p> <p>4. To design and develop high quality, easy to use and convenient public transport services; and</p> <p>5.</p>		
21	<a href="#">DORNA</a>	Organized and Sustainable Development in the Atlantic Northwest	<p>the DORNA project is centred on development of the Atlantic regions included in it from a perspective of sustainable economic growth and cultural diversity, achieved by encouraging and diversifying traditional naval carpentry. This line of action will make the following objectives achievable:</p> <ul style="list-style-type: none"> <li>- Promote use of traditional vessels as a low pollution, more environmentally friendly model.</li> <li>- Development of the tourist sector by launching new products</li> </ul>	1, 4	Atlantic Area

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>(traditional, nautical) linked to Atlantic culture into the market.</p> <p>- Identification of a common model to the Atlantic area, and enriching regional differences of this model</p> <p>The Project DORNA acts on 3 lines of action directly related to the objectives. These are economic development, environmental and socio-cultural. For each of the main priorities are designed to enable strategic lines to achieve the objectives. These strategic lines are: Competitiveness &amp; Business, Research, , Innovation, Diversification, and a Communications Plan. Under this strategic lines t</p>		
22	<a href="#">APICE</a>	Common Mediterranean strategy and local practical Actions for the mitigation of Port, Industries and Cities Emissions	APICE proposes a decision-making approach and related set of mitigation measures that assume the impact of air pollution sources as driver for the coast management in port-cities. This model is based on a stronger coordination of environmental and spatial planning policies, leading to curb emissions and preserving economic potentialities of port-cities. Results will be owned by some of the main MED port-cities to move towards the attainments of the key objectives of EU Integrated Maritime Policy.	5	Mediterranean area
23	<a href="#">BACKGRONDS</a>	IMPROVING PRODUCTIVE CLUSTERS ACCESSIBILITY TO GLOBAL MARKET	BACKGROUNDS project faces developmental disparities in southern regions of Europe. The main arrival and departure hubs of European maritime traffic axis are based in the large ports of Northern Europe (Rotterdam, Hamburg) and only to a lesser extent in the Mediterranean basin. Two main flows start from these axes: the Europe-America axis and the Europe-Far East axis. The Med area is above all interested and competitive by the Europe-Asia line, characterised by ships coming in through the Suez channel and leaving through Gibraltar (and vice-versa). On the short-term, the present situation may hold down production structures, services, social contexts and development opportunities reducing the competitiveness and increasing production and distribution costs.	1	Mediterranean area

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			Thus, the project aims at improving the capacities and intervention strategies of regional authorities in charge of managing maritime transports from an integration point of view so as to improve the local productive systems. In particular, an inter-modal n		
24	<a href="#">CLIMEPORT</a>	Mediterranean Ports' Contribution to Climate Change Mitigation	CLIMEPORT proposes the assessment of different methodologies in order to combat the global climate change. The project takes place in several countries of the Mediterranean area involving a group of the largest ports committed to tackling climate change. Thus, the cooperation among Mediterranean ports becomes a vital key of the logistic chain which is essential for reducing greenhouse gas emissions. The project aims to develop and implement solutions in order to improve the general climate conditions by means of actions in maritime and inland transport, energy saving and efficiency, implementing the world port climate declarations, designing an environmental indicators system as footprint according to CO2 levels, ...,etc. For these reasons, CLIMEPORT set several actions and initiatives to develop a diagnosis of the port influence in the climate change and the actions plans for reducing the port activities' impact in the environment.	5	Mediterranean area
25	<a href="#">COASTANCE</a>	Regional Common Action Strategy Against Coastal Erosion and climate change effects for a sustainable coastal planning in the Mediterranean basin	The increasing erosion phenomena and marine flooding risks arising on the mid-long term related to the effects of climate changes (sea level rising, extreme storm events, increasing frequency & intensity etc.) pushes Public Administrations towards strategic approach for the Integrated Coastal Zone Management (ICZM) with a particular emphasis on coastal protection. The loss of rivers solid transport (due to hydraulic works, bridges, crossbars, dams, on rivers), the presence of hard protection works and harbours along the coasts (that intercept the natural distribution of sediments) and the effects of climate changes increased the vulnerability of coastal stretches, today affected by diffuse erosive processes and marine flooding hazard. In this frame it is evident the need of a strategic and	5	Mediterranean area

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			sustainable management of coastal sediments, paying attention to the new environmental aspects involved in the related activities.		
26	<a href="#">DEVELOP-MED</a>	DEVELOP-MED	The DEVELOPMED Project aims at promoting the strategic integration of Mediterranean ports. The main aim of DEVELOPMED Project is to evaluate, define and agree upon a common development strategy for improving competitiveness of the MED maritime system, developing the connections between the main regional ports and the Trans-European Network of Transport (TEN-T). For the development of the analysis all Partners can be supported by important university and private research centres, which have dealt with various aspects of maritime transport, local and global trends in foreign trade, and the conditions for a competitive positioning of Mediterranean ports within such scenarios and trends. The direct target groups of the project include ministries, regional administrations, municipal institutions, port authorities, terminal operators, forwarders, shipping companies, haulage contractors, etc., which will cooperate in the implementation of the priority scenarios identified for improving the transport and logistics of	1	Mediterranean area
27	<a href="#">InnoNauTICs</a>	Innovation for Nautical Development Sector in the Mediterranean Area	The main goal of InnoNauTICs is to reinforce the innovation ability of the SMEs of the nautical sector through the diffusion of innovative solutions and the creation of transnational initiatives of cooperation that allow the modernization of a key sector for the insular economy in the Mediterranean. A new technological platform will increase the knowledge degree of internal competitiveness and strengthen the start-up of pilot actions of the Mediterranean nautical sector enterprises	1	Mediterranean area
28	<a href="#">LOSAMEDC HEM</a>	How could the logistics and the safety of the transports of chemicals be improved in the	The project originates from the development of the traffic of chemicals in the Mediterranean and aims to reach these main objectives: promote cooperation among chemical districts and between them and the main harbours, improve integration between	5, 6	Mediterranean area

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
		Mediterranean area	harbours/hinterlands, sustain intermodality, reinforce the railways/waterways transportation for chemical products, promote a transfer of know-how and safety technologies, harmonize regulations and policies		
29	<a href="#">MAREMED</a>	MARitime REgions cooperation for MEDiterranea	The project aims to improve the coordination of regional maritime policies, between themselves and with National, European and Mediterranean levels of governance. Fourteen regional partners and the Conference of Peripheral Maritime Regions (CPMR) will carry out an overview of the policies implemented and their governance, will identify pilot coastal zones for transnational management, operational tools to aid in common decision-making. They will develop means to disseminate these results in order to encourage integrated maritime management and the sustainable development of coastal zones for the different levels of coastal governance. The partnership with the Conference of Peripheral Maritime Regions (CPMR) will allow the results to be shared with the fifty Regions of the inter- Mediterranean Commission and will encourage discussions with the departments of the European Commission and the Action Centres of the Mediterranean Action Plan	1, 2, 3, 4, 5, 6	Mediterranean area
30	<a href="#">MEMO</a>	Mediterranean Electronic Marine Highways Observatory	The MEMO project aims to develop a transnational initiative for implementing the Mediterranean Electronic Marine Highway (MEMH) Observatory focused on mitigating maritime risks, improving maritime safety and promoting sustainable territorial development of marine and coastal resources. Beneficiaries include the littoral states port operators, shipping companies, governmental bodies, local and regional authorities, NGOs, coast guard, etc).	6	Mediterranean area
31	<a href="#">PORTA</a>	PORTs as a gateway for Access inner regions	The project concerns the congestion of shipping systems because of bottlenecks at the access of urban ports, deepening: infrastructural and intermodal criticality in interregional/local transportation networks, economic influence and environmental impacts of shipping in the coastal metropolitan systems and their hinterland. The project	1	Mediterranean area



Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			will apply a new system of guidelines to integrate regional planning and port management to overcome the dichotomy between Maritime and transport policies and urban/local sustainable development of the areas surrounding the ports		
32	<a href="#">SEATOLAND</a>	Connections between harbours and hinterland	Integration based on a more efficient junction between harbour and the inland system together with improved accessibility can be the key to success in undertaking the support of inshore areas. The project aims at developing strategies to increase the competitiveness of some areas, by improving accessibility between inshore and inland areas, acting not only on infrastructures but also by creating linear network systems where environmental elements can be integrated with territorial functions	1	Mediterranean area
33	<a href="#">Secur Med Plus</a>	Secur Med Plus	SECUR MED PLUS focuses its own methodology on one of the main results of the previous project SECUR MED: the establishment at the regional level of the "Maritime Safety Network of Research, Information and Intervention Centres " (ReCRIS) composed by State and Regional administrations, Maritime and Harbour Authorities, Research centers and Universities as well as representatives of economic operators. The main instrument for the development of this Network at the transnational level was the creation of a data base shared and filled by each partner on issues related to harbour and maritime navigation, as well as safety and environmental implications on the territories. In this context, the project aims at improving for the "Reinforcement of the effectiveness of the ReCRIS network research centres, improving the access to the data base and to statistics on maritime safety.	6	Mediterranean area
34	<a href="#">TERCONMED</a>	CONTAINER TERMINALS AS A KEY ELEMENT IN THE MEDITERRANEAN SHORT SEA SHIPPING	Short Sea Shipping between Mediterranean countries is considered to be a valid solution in achieving the goals of EU maritime policy. So far, this type of transport has primarily been undertaken through RO-RO maritime traffic, which consists of loading trucks onto vessels. To carry out these operations, ad hoc port terminals have been used.	1	Mediterranean area

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			Thanks to the container, we believe that with the appropriate type of vessel used by these terminals, and through the use of the LO loading and unloading system (lift on-lift off, a technique that involves moving goods to and from the vessel which uses cranes to move containers), appropriate and high-performance procedures to improve SSS could be developed, in keeping with European policy on Sea Highways. TERCONMED aims to promote SSS through the adaptation of container terminals to the LO-LO system and the simplification of customs requirements. TERCONMED is a project which is co-funded by the European Union MED Programme.		
35	<a href="#">TOSCA</a>	Tracking Oil Spills and Coastal Awareness Network	The core objective of TOSCA is to improve the quality, speed and effectiveness of decision-making process in case of marine accidents (oil pollution, SAR Operations) in Mediterranean, by the development of a long lasting network of local authorities, policy makers and scientists and by the implementation of technical and decision support tools. Till now the control of fires has been based on theoretical models or on traditional experiences. The negative data emerged in "Forest fires in Europe 2007" induce to reconsider the current strategies and address toward the search of new solutions. The main objective of Cyp.Fire is to demonstrate that cypress made fire-breaks represent an innovative way to replace the traditional firebreaks with better economic and ecological results in fire control. The innovative aspects of TOSCA is to implement an integrated and scientific sustainable monitoring/forecasting design based on state of the art technology that will be implemented at the territorial scale and for local n	6	Mediterranean area
36	<a href="#">CoastAdapt</a>	The Sea as Our Neighbour: Sustainable Adaptation to Climate Change in Coastal Communities and Habitats	CoastAdapt is a project aimed to safeguard people living in North Atlantic coastal communities and help them adapt to the impacts of climate change. Five pilot study sites in Iceland, Norway, Ireland and Scotland have been identified to determine the issues experienced by local communities. Municipalities and citizens, working together	4	Northern Periphery: Norwegian Sea+ Celtic Seas

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
		on Europe's Northern Periphery	<p>with project partners, will develop and trial adaptation strategies designed to cope with the impacts of climate change. The CoastAdapt project will focus on how people, businesses and local authorities will cope with and plan for the longer-term changes that a changing climate will bring for example, loss of land through erosion, increasing vulnerability to coastal flooding, increasing risk of avalanches and consequent effects on transport and communications, aquaculture, housing, agriculture, and most importantly on community confidence.</p> <p>A main objective of the project will be to investigate the environmental, social and economic impact of projected climate change and accele</p>		
37	<a href="#">EcoFish</a>	Environment friendly fish farming and use of cleaner fish	The project intends to develop the methods and technology required to rear cleaner fish for use by the cod and salmon farming industry in the partner countries. The physical outcome of the project will be a substantial number of wrasse for field application for farm testing the technique on cod and salmon farms in partner countries. Dedicated marine hatchery areas to rear wrasse will be established in Ireland, Norway and in Scotland with the focus on developing successful rearing techniques and production through close collaboration and exchange of information. The part of the project to examine the management of wrasse in salmon and cod cages will focus on the welfare of the wrasse	2	Northern Periphery: Norwegian Sea+ Celtic Seas
38	<a href="#">Northcharr</a>	Sustainable Aquaculture of Arctic Charr	<p>This project aims to increase the production of farmed Arctic charr in the Northern periphery area.</p> <p>by identifying production potential and bottle-necks in different regions and with different technologies (WP2). The present situation for charr farming in the area is analyzed to identify production potential and bottlenecks in different regions and with different</p>	2	Northern Periphery: Norwegian Sea+ Celtic Seas

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>technologies. This will provide knowledge for future development of the industry.</p> <p>by developing and implementing solutions to problems in farming that we have identified already (WP3 ). Solutions to problems in will be suggested from knowledge obtained in activities targeting brood-stock handling, feeding practice, optimised temperature regimes, slaughtering and environmental impact. Sustainability, for farming and the environment, and welfare issues are aspects involved in these targets.</p> <p>by initiating triple-helix structures in order to provide stakeholders with tools and contact network that will facilitate development (WP4). We will initiate tri</p>		
39	<a href="#">WATER</a>	Warning of Algal Toxin Events to support aquaculture in the NPP coastal zone Region	<p>a) Provide the aquaculture industry with rapid, safe techniques for the analysis of shellfish for algal toxins.</p> <p>b) Demonstrate how simple models describing the onset of harmful phytoplankton events can be applied through the NP region.</p> <p>c) Provide easier and more effective monitoring of aquaculture waters for the presence of toxic algae in the water column.</p>	2	Northern Periphery: Norwegian Sea+ Celtic Seas
40	<a href="#">EfficienSea</a>	Efficient, Safe and Sustainable Traffic at Sea	<p>Increased traffic in the Baltic Sea is a result of the growing economic activity. In EfficienSea, we are concerned with improving maritime safety and environmental sustainability as traffic increases in the Baltic Sea, a Particularly Sensitive Sea Area. We will take a common, consistent and efficient approach into maritime safety and protection of the environment through accident prevention and mitigation. We need to raise public awareness of the impacts and opportunities that maritime affairs bring to both the economy and the environment.</p> <p>The project consists of four thematic work packages (WP3-6). Each is led by a project manager representing a national authority. Work packages are interlinked in clearly defined inputs/outputs. WP3 on</p>	6	Baltic Sea (Baltic)

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>Competence and Recruitment Challenges addresses the shortage of competent recruits in the maritime sector. WP4 on e-Navigation, establishes one or more e-Navigation Trial Zones, maturing both administrations and industry for the investments ahead.</p> <p>WP5 on Vessel Traffic Data</p>		
41	<a href="#">BaltSeaPlan</a>	Introducing Maritime Spatial Planning in the Baltic Sea	<p>BaltSeaPlan will support the call of the EU for its member states to draw up integrated national maritime strategies and implement Integrated Maritime Spatial Planning (IMSP). It realises Helcoms recommendation on Broad Scale Planning and the VASAB Gdansk declaration and builds on the results of projects like BaltCoast, Balance, Coastman, EWW and PlanCoast.</p> <p>It is the growing pressure on the Baltic Sea space and resources both on- and offshore which calls for an urgent and unified action by all countries of the region. Shipping, wind farming, nature protection, mineral extraction and shore protection (climate change) are only examples.</p> <p>Integrated Maritime Spatial Planning offers a neutral tool to arbitrate between these conflicting or competing activities or interests. It can, however, only yield its full benefits if all coastal Member States introduce compatible and comparable IMSP systems! But with the exception of Germany no BSR country has an appropriate legislation so far.</p> <p>This represents not only a ch</p>	1, 2, 3, 4, 5, 6	Baltic Sea (Baltic)
42	<a href="#">BRISK</a>	Sub-regional risk of spill of oil and hazardous substances in the Baltic Sea	The project is a response to an increased risk of accidents and environmental damage in the Baltic Sea due to the significant increase of ship traffic, particularly the oil tanker traffic in the Baltic Sea. Major oil spills can affect economy of several countries and are	5, 6	Baltic Sea (Baltic)

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>hence a trans-national problem. The increased risk of oil spills is of great concern in the whole Baltic Sea region.</p> <p>Geographical area : The Baltic Sea will be divided into sub-regional areas of responsibility according to international law and treaties in order to implement a three tier approach. Cost-efficiency will be achieved by sharing resources between the countries.</p> <p>Objectives: Increase co-operation The project will result in increased preparedness of authorities to respond to medium size oil spills and enhanced sub-regional co-operation. The network of responsible persons will be further developed.</p> <p>The project will promote build-ing partnership and cooperation among trans-national, national and regional authorities that are respons</p>		
43	<a href="#">COHIBA</a>	Control of hazardous substances in the Baltic Sea region	<p>With the recently adopted HELCOM Baltic Sea Action Plan (BSAP) the Baltic Sea countries have committed themselves to achieve a “Baltic Sea with life undisturbed by hazardous substances”. An important part of the Action Plan is to further work on the identification of sources and development of measures for hazardous substances being of concern for the Baltic Sea and by 2010 to develop national implementation programmes. The overall objective of this COHIBA project is to support the implementation of the BSAP with regard to hazardous substances by developing joint actions to reach the goal. Taking into account their potential hazard the BSAP identifies 11 substances/substance groups as being of special concern to the Baltic Sea, which are also the focus of this project. The project includes partners and activities in all Baltic Sea coastal countries giving it a strong transnational character, and providing input for decision making for common actions needed for a healthy</p>	5, 6	Baltic Sea (Baltic)

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			Baltic Sea.		
44	<a href="#">Baltic Master II</a>	Maritime safety - Transport and Environment in the Baltic Sea Region	Baltic Master II is a follow up project to its successful predecessor, Baltic Master I, and is a maritime safety project aiming to enhance cooperation between Baltic Sea countries to increase maritime pollution prevention and response capacity in the BSR. The results generated in Baltic Master I constitutes the base for Baltic Master II, which will take these results one step further. One of the strategic goals of Baltic Master I was to define the ability of local and regional maritime safety stakeholders and investigate how these stakeholders can increase maritime safety in the Baltic Sea. Due to the successful work of Baltic Master I, the project managed to fulfil this strategic goal and clearly demonstrated that regions and municipalities play a crucial role in increasing maritime safety in the Baltic Sea. This was confirmed through the election of Baltic Master I as the best maritime safety project in 2007 by the Committee of Regions.	6	Baltic Sea (Baltic)
45	<a href="#">SMOCS</a>	Sustainable Management of Contaminated Sediments in the Baltic Sea	<p>Baltic Sea has many “hot-spots” with highly contaminated sediments in ports, estuaries etc. Human activities often take place in coastal areas and are affected by these “hot-spots”. Activities e.g. development, maintenance and dredging in ports and fairways due to more deep-draught ships will imply dredging of several million m<sup>3</sup> incl. contaminated sediments in coming years.</p> <p>How to handle contaminated sediments is a major problem. Alternatives are few, costly and require complicated technical methods to reduce environmental impact. Dredged sediments are normally deposited on land or at sea. The first is very costly and the latter is often not possible due to environmental restrictions. Emerging treatment technologies make it possible to consider beneficial use of contaminated sediments. One potential method is</p>	5	Baltic Sea (Baltic)

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>stabilization reducing environmental impact and improving technical properties.</p> <p>This method can prove to be sustainable for handling at land or at sea. HELCOM e.g. gives high priority to decontaminat</p>		
46	<a href="#">SUBMARINE R</a>	Sustainable Uses of Baltic Marine Resources	<p>The BSR faces enormous challenges including growing transport, new installations, fishery declines, severe marine pollution with excessive nutrient input and the effects of climate change. But the future is not all bleak: novel technologies and growing knowledge provide opportunities for new uses of marine ecosystems, which may in the future not only have commercial appeal but also contribute to solve environmental problems. Algae and mussel cultivation reduce nutrient inflow while providing a source for bioenergy; offshore wind farms can smartly be combined with mariculture or wave energy installations; blue biotechnology utilises substances from marine organisms for development of new products that can improve overall BSR health.</p> <p>All these uses and technologies have, however, not been tested sufficiently within the fragile conditions of the Baltic Sea and their cumulative impacts on the environment, economic feasibility and regional applicability are not yet fully understood.</p> <p>It is thus currently difficul</p>	2	Baltic Sea (Baltic)
47	<a href="#">WATERMODE</a>	Transnational Network for the Promotion of the Water-Ground Multimodal Transport	<p>The South East Europe area is crossed by relevant freight traffic flows, originated and directed in- and outside it. This traffic is mainly supported by road infrastructures, that were not planned for these flows. This involves a negative impact on the territorial competitiveness and environment, due to air pollution, noise and reduced mobility. The project objective is to promote the coordination between actors dealing with logistics for a better management of the</p>	1	South East Europe Region: Adriatic Sea + East Mediterranean area+Black Sea



Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			transport policies and an efficient implementation of the multimodal logistics cooperation, especially exploiting the ground/water connections. This will be achieved through a monitoring on the existing multimodal platforms, the coordination of strategies for the promotion of the water/ground multimodality, the definition of common quality standards in transport and logistics services, the implementation of pilot studies for multimodality based on sea and inland waterways as factor of competitiveness and environmental sustainability. The project wi		
48	<a href="#">ECO-PORT 8</a>	ENVIRONMENTAL MANAGEMENT OF TRANSBORDER CORRIDOR PORTS	The increase in SEE shipping traffic has raised critical issues concerning the environmental quality of coasts and sea water, above all due to the lack of shared environmental policy. ECO-PORT 8 aims to improve the quality of ports, placing the prevention of pollution and preservation of natural resources in port areas and nearby coastal zones as pivotal to the maritime system. The project is to carry out studies, tests and provide services, attempting to define the basis for environmental port certification. Such actions are to take into account the productive needs of ports and EU and national standards in force and create pilot monitoring systems. ECO-PORT involves PAN-EU corridor 8 ports, integrating existing international dialogue on developments in maritime traffic docking in ports, with a common environmental policy aimed at defining shared standards. In this way it is possible to guarantee the overcoming of non-physical barriers and develop healthy and eco-sustainable competition ECO-PORT 8 is divided in	1, 2, 6	South East Europe Region: Adriatic Sea + East Mediterranean area+Black Sea
49	<a href="#">ECO-LAGUNES</a>	Gestion environnementale des zones lagunaires à vocation aquacole	To improve the protection and sustainable conservation of the environment and nature in the lagunes. The project aims dealing with the algae, and the impact of eliminating algae on the quality of the environment. Furthermore the project aims to show that environmental management can also guarantee economic activities. Dans le cadre de l'amélioration de la protection et de la conservation	2, 5	South West Europe incl. Bay of Biscay

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>durable de l'environnement et du milieu naturel du SUDOE, les zones lagunaires de l'Espace sont des milieux riches en biodiversité et représentent une ressource économique locale importante qu'il faut préserver d'agressions telles que la prolifération d'algues envahissantes. Le projet ECO-LAGUNES propose de traiter la problématique environnementale liée au développement des algues envahissantes, à leur limitation dans le milieu et aux impacts de cette élimination sur la qualité du milieu et sur la biodiversité. Un autre objectif d'ECO-LAGUNES est de démontrer que la gestion environnementale des mi</p>		
50	<a href="#">ODYSSEA SUDOE</a>	Création d'un réseau de cités maritimes, fluviales et territoires ruraux basé sur un modèle de développement éco-touristique, nautique, fluvial, oeno-gastronomique, culturel et intégré de l'Espace SUDOE	<p>Aim is to create network of maritime and river cities with historical routes. The project wants to develop an innovative model for sustainable tourism for maritime and river cities.</p> <p>Le projet ODYSSEA SUDOE veut créer un réseau structuré de villes maritimes et fluviales sur une logique de gestion durable composée d'itinéraires historiques qui mettront en valeur le patrimoine, le paysage, la culture, la gastronomie et l'artisanat des zones concernées. L'intention est de définir et mettre en place un modèle innovateur de développement touristique durable commun aux régions participantes qui associera des destinations nautiques et fluviales en connectant la mer, la rivière, le port et la ville portuaire avec leur territoire rural, en créant ainsi un nouveau concept d'intégration entre les zones de haute et faible densité en matière touristique.</p> <p>Pour atteindre cet objectif, le projet prévoit de créer un modèle de développement st</p>	4, 5	Western Mediterranean (MED)
51	<a href="#">Ballast Water Opportunity</a>	North Sea Ballast Water Opportunity	<p>Aim: Improving the NSR environment and economy by facilitating ratification of the IMO Ballast Water Management Convention (BWMC) through enabling implementation while stimulating the maritime industry to utilize the NSR leading scientific position on aquatic invasions to capitalize this new market opportunity.</p>	1, 5, 6	North Sea Region

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>Background: The maritime sector is a very important economic pillar for the NSR. As a result, the North Sea is one of the worlds most intensively shipped seas. Unfortunately, ships ballast water is the main source of invasive aquatic organisms. As the North Sea harbours have many important Natura 2000 areas the impact on biodiversity can be massive.</p> <p>Ships' induced bio-invasions in the recent past has lead to the IMO BWMC. Implementation of the BWMC is expected to reduce these invasions, however, the Convention has not entered into force as only 14 states -including Norway-, representing 3.5% of world shipping tonnage have ratified the BWMC while 30 States, representing 35% of this tonnage is required.</p>		
52	<a href="#">BLAST</a>	Bringing Land And Sea Together	<p>The overall aim of the project is to improve Integrated Coastal Zone Management and Planning (ICZM&amp;P) and maritime safety in a broad sense, by improving and contributing to harmonising terrestrial and sea geographical data, by developing planning and visualisation tools as well as improvement of navigation, in the context of climate change.</p> <p>The project will provide a prototype for land/sea interoperable database for testing by practitioners in a study area. The project will develop a conceptual model for integrated spatial planning utilising GIS, tools for spatial planning in respect to renewable energy plants, and a web based decision support system for ICZM in a transnational context. An important aspect of the aim is to structure and supplement geographical data and provide planning/management tools that are consistent between sea and land.</p>	5, 6	North Sea Region
53	<a href="#">C2CI</a>	Cradle to Cradle Islands	<p>The project will focus on the development of new and sustainable energy-related technologies and strategies on islands around the North Sea Region. C2CI will develop and implement the cradle-to-cradle (C2C) methodology for NSR islands, i.e. designing intelligent</p>	3	North Sea Region

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>products and materials that can be used over and over again and thus replace the concept of waste.</p> <p>Three development clusters that focus on sustainable energy in relation to mobility, water and materials will create relevant networks and deliver sustainable innovations for the islands' environments. Incubator centres on the partner islands will foster further development and implementation.</p> <p>The overall aim is to make a substantial contribution to environmental sustainability and to stimulate economic profit of the North Sea Region by:</p> <ul style="list-style-type: none"> <li>•applying the 'cradle to cradle' concept to develop energy responsible and sustainable solutions for island environments;</li> <li>•using islands as labs and testing grounds where research institutes and businesses can experiment</li> </ul>		
54	<a href="#">CNSS</a>	Clean North Sea Shipping	<p>CNSS will focus on emission and greenhouse gas reduction from ships, using studies to reveal the status of air quality in ports and surrounding areas. The partnership of CNSS (ports, business, regions, public authorities, NGOs, research institutes) will change this by creating transparency on cost-efficient technology solutions and develop and improve the introduction of successful air quality programs.</p> <p>The present challenge is to develop and implement environmentally friendly, cost-effective concepts and practical solutions in line with upcoming standards.</p> <p>Promoting the development of efficient and effective logistics solutions, the maritime transport system (ships, ports and surrounding areas) will step into a transition processes to meet the demands of enlargement and sustainable development at the same time.</p> <p>The project aims to reduce air pollution and greenhouse gas emission by looking into available technology and the implementation</p>	1, 2, 5, 6	North Sea Region

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			of cost effective and cleaner energy supply infrastructure to ships in		
55	<a href="#">CRUISE GATEWAY</a>	CRUISE GATEWAY - towards sustainable growth of cruise shipping in the NSR	<p>Cruise Gateway will increase the maritime accessibility by developing the NSR as a cruise destination of its own and promoting it as a "lighthouse" for sustainable cruise. Main outputs are the creation of a brand for cruise in the NSR, the improvement of service quality in ports and environmentally friendly economic growth.</p> <p>Within the work packages, the brand will be jointly designed and best practices for a NSR cruise cycle will be identified and transferred. Cruise Gateway, at the end of the day, will have launched the "Green Cruise North Sea" and will have opened up "white spots", thus attracting more and new cruise passenger consumer groups to the NSR ports and their hinterland.</p> <p>Cruise Gateway seeks to develop the recognition and attractiveness of the NSR by highlighting the cultural richness as well as sustainable, economic development. Being at an early stage in this respect, the NSR has a unique chance to set the course for success while at the same time taking into consideration aspects of sustainabil</p>	1, 4	North Sea Region
56	<a href="#">DiPol</a>	Impact of Climate Change on the quality of urban and coastal waters	<p>The DiPol project has the aim of identifying impacts and suggesting measures to reduce the adverse consequences of climate change that affect the quality of urban and coastal waters.</p> <p>A programme tool, (SIMACLIM) that illustrates the impacts of climate changes on water quality will be developed and implemented within the DiPol project. By introducing the results into the level of European policy making, a long term impact on the Water Framework Directive and the Marine Strategy is expected.</p> <p>DiPol aims to collect knowledge on the impact of climate change (CC) on water quality, to communicate and raise awareness towards this knowledge, to improve the ability of decision makers to</p>	4, 5	North Sea Region

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>counteract these impacts on local and international level, and to facilitate public participation herein.</p> <p>SIMACLIM, as a tool developed within the DiPol project, will illustrate these complex environmental processes and simulate different scenarios, which can aim at certain societal goals.</p> <p>On international level, DiPol partners will pr</p>		
57	<a href="#">Dryport</a>	Dryport - a modal shift in practice	<p>The project's aim is to develop, design and set effective Hinterland inter-modal freight transport nodes - dryports - which are fully integrated with the Gateway freight handling systems, to adapt a public concept to a private sector model, and to integrated dryports into the EU Motorways of the Sea concept.</p> <p>The project includes the identification of suitable dryport land sites in the North Sea Region, to start a planning process that will support the increased number of logistics hubs, to assess the environmental and socio-economic impact of improved inter-modality, to develop a business model blueprint and to develop and start-up a IT system.</p> <p>All project activities will contribute to connecting the dryports with the short sea shipping system to shift interregional transport from road to sea.</p> <p>The project aim is to develop, design and set effective Hinterland intermodal freight transport nodes -Dryports that are fully integrated with the Gateway's freight handling systems, to adapt a public concept to a priva</p>	1	North Sea Region
58	<a href="#">E-Harbours</a>	E-Logistics in NSR Harbour Cities	<p>E-Harbours aims to create a lasting change towards sustainable energy logistics for NSR harbour cities. It will set innovative energy standards to create a transformation of the energy network in harbour areas. Show cases will provide examples for the NSR, guided by a European expert platform. By this the project will implement EU energy policies, develop innovative solutions and allow economic growth. The aim of E-Harbours is a transformation of the energy network in NSR harbour cities towards a more</p>	3	North Sea Region

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>sustainable and accessible energy model. This will be achieved by setting/implementing new standards with a focus on two key aspects: virtual power plants for industrial end-users and electric mobility.</p> <p>The network plans to:</p> <ul style="list-style-type: none"> <li>•Enlarge the uptake of renewable energy;</li> <li>•Enlarge energy efficiency strongly;</li> <li>•Integrate the electric mobility;</li> <li>•Maintain the stability of the energy network.</li> </ul> <p>The partners aim to set new, high level standards for future energy management in NSR harbours and feed into ambitions of the EU/Nati</p>		
59	<a href="#">enercoast</a>	BlueGreen Coastal Energy Community	<p>The project focuses on strengthening the regional production of biomass as a source of bio energy. A substantiated and consolidated investment plan based on commercially viable bio-energy supply chains will be presented and implemented. The business model will be applied in parallel to differentiated blue-green energy clusters in the NSR and ensure transfer of management expertise between the clusters and identify market interdependences.</p> <p>The aim is to enable the successful further exploitation of the region's blue-green low carbon energy sources by integrating the biomass grower at one end and the energy producer at the other end. enercoast will thereby open new sources of bio energy, reduce the regional dependency of energy imports and increase the competitiveness of regional energy producers as well to ensure their income in a long-term perspective.</p> <p>Key aims of the project are:</p> <ul style="list-style-type: none"> <li>•Reduce regional dependency on imported energy through activation of domestic resources,</li> <li>•Intensify co-operation between producers</li> </ul>	3	North Sea Region
60	<a href="#">Food Port</a>	Food Port - Connecting Food Port Regions - Between and Beyond	<p>Food Port aims to develop the North Sea Region (NSR) as the best food cluster and hub in Europe for food products delivered via efficient and sustainable transport systems e.g. 'green transport</p>	2	North Sea Region

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>corridors'. Food Port brings together local authorities, knowledge organisations, food industries and ports from 5 countries to find practical solutions to improve the efficiency, effectiveness and sustainability of the food supply chains.</p> <p>The project will investigate and develop green transport corridors for food products between regions around the North Sea. This will lead to concrete modal shift pilots along the identified green transport corridors and to the development of (new) food platforms or hubs. In order to improve the food-logistic chains, new technological solutions will be incorporated, such as a technical support platform</p>		
61	<a href="#">iTransfer</a>	innovative TRANsport Solutions for Fjords Estuaries and Rivers	<p>Improving water-based public transport is a key issue in the NSR to safeguard sustainable accessibility of regions which would otherwise be inaccessible or suffering from their remote location. The iTransfer partners pursue an implementation-oriented TOP approach to improve water-based accessibility by fostering development of Technology (ferries &amp; landings), Operation (integration with public transport &amp; set-up of ferry connections) and addressing Policy issues (tendering of ferry services &amp; barrier-free access for disabled people) on the national and EU level. The aim of iTransfer is to develop and present innovative, sustainable solutions in ferry technology, operation and policy to improve regional accessibility by water-based public transport in the NSR via a TOP approach: - resolve Technological issues (design of ferries and landings), - improve ferry Operation (integration of ferries with the public transport system and set-up of new ferry connections) - support a Policy environment which resolves te</p>	1, 4	North Sea Region
62	<a href="#">LNS</a>	The living North Sea	<p>The Living North Sea project will solve problems surrounding the management of fish species which rely on moving between the North Sea and freshwater systems of partner countries. These species are under considerable threat, some even in hazardous decline. The</p>	2	North Sea Region



Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			Living North Sea project will solve problems surrounding the management of fish species which rely on moving between the North Sea and freshwater systems of partner countries. These species are under considerable threat, some even in hazardous decline. Living North Sea brings together representatives from across the NSR country, in a project that which will make long lasting changes to the way that migratory fish species, whose stocks are shared between nations, are managed in the region. The project will create a permanent management group for migratory fish of these habi		
63	<a href="#">LO-PINOD</a>	LO-PINOD - Logistics Optimisation for Ports Intermodality: Network, Opportunities, Development	LO-PINOD aims to enhance multi-modal accessibility and interconnectivity of ports of regional importance. The project will focus on three aspects: <ul style="list-style-type: none"> <li>•INLAND - A transnational investment preparation approach for inland connections will trigger significant investments and allow assessing suitability of existing national and EU policies and improving them;</li> <li>•PORTS - Building a joint knowledge platform, capacities &amp; procedures will enhance co-operation of regional ports;</li> <li>•SEASIDE - Research into market potential and set up of new short sea shipping and feeder connections will improve seaside accessibility.</li> </ul>	1	North Sea Region
64	<a href="#">NMU</a>	Northern Maritime University	The NMU project is building on the broad range of knowledge and expertise in the North Sea area which is being harnessed within a common and lasting transnational network of universities, The "Northern Maritime University" will directly address the needs of the maritime industry: To better prepare maritime business managers to cope with growing maritime traffic, port development, and rising environmental challenges, by developing multidisciplinary and internationally oriented qualifications at Bachelors and Masters level.	4	North Sea Region

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			NMU is thereby working towards establishing a Area of Research and Innovation for the maritime industry in the North Sea Region, contributing towards the Lisbon strategy to create a more effective maritime business sector and an enhanced competitiveness of the maritime sector.		
65	<a href="#">NS FRITS</a>	North Sea Freight and Intelligent Transport Solutions	The project addresses efficiency and effectiveness of the North Sea Region transport freight. To secure the NSR as a global competitor, the project develops an intelligent transport solution (ITS), which will improve accessibility, reduce environmental damage in the North Sea Region and enable the NSR to develop a dynamic logistics solution which is scalable across the EU. As the main result, the project will develop a multi-lingual electronic communication and data capture system for the freight supply chain to provide information to end users, transport managers, freight handlers about the conditions in the area that they are about to enter. Thereby the project aims to improve efficiency, safety and security in the supply chain of the NSR and promotes the development of efficient and effective logistics solutions.	1	North Sea Region
66	<a href="#">POWER cluster</a>	Developing the North Sea Offshore Wind Power Cluster	As a direct successor of NSR Interreg IIIB's POWER project, POWER cluster is centred on the development of a strong Offshore Wind Industry (OWI) cluster in the NSR. Core activities include a strengthened stakeholder and business-to-business network, energy grid reinforcement across the NSR, developed skills training courses (including higher education and addressing unemployment) and raising acceptance among the wider public as a basis for wider roll-out of wind energy installations.	3	North Sea Region

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
67	<a href="#">StratMos</a>	Motorways of the Seas Strategic Demonstration Project	The project aims to promote and facilitate the shift of cargo from road to sea based inter-modal transport. STRATMOS strives to improve accessibility within the North Sea Region by supporting the implementation of the Motorways of the Sea concept and related transport networks in integrated logistical chains. On the strategic level, the project intends to provide input for the Master Plan to be developed by the North Sea MoS Task Force as well as to EU entities. On the implementation level practical demonstration projects will be carried out in order to demonstrate actions to be taken by public and private actors to improve the effectiveness of inter-modal transport, in particular related to hubs and hinterland connections.	1	North Sea Region
68	<a href="#">SUSCOD</a>	Sustainable Coastal Development in Practise	SUSCOD aims to make a step change in the application of integrated coastal zone management (ICZM). 7 partners from 5 countries will develop an innovative Integrated Coastal Zone Management (IZCM) 'assistant'. The ICZM approach has been explored in several parts of the NSR and often the focus of these interventions has often been for public safety. Although these interventions have offered opportunities to realise the full development potential of the areas concerned, in practice a fully integrated, holistic approach has rarely been taken and this is regrettable because coastal potentials are not fully utilised. SUSCOD brings together partners that want to change this through a well coordinated transnational team approach. This practical web based tool will allow coastal development practitioners to fully realise coastal potentials: economical, social and environmental.	3, 4, 5	North Sea Region
69	<a href="#">TIDE</a>	Tidal River Development	TIDE considers tidally influenced NSR estuaries with large sediment transportation which are used as shipping channels to large harbours. The ecosystem services of intertidal and shallow estuarine	1, 2, 5	North Sea Region

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
			<p>habitats are threatened and need to be considered to ensure economic benefits and the maintenance of ecologically important areas. At the same time decision-makers at these estuaries are faced with an increasingly challenging legal and global economic framework.</p> <p>TIDE will lead the path towards a more sustainable and effective use of large scale investments made into mitigation and compensation measures in NSR estuaries by applying for the first time a unified ecosystem approach to guide the process of integrated participatory management planning. Thus TIDE will not only improve the effectiveness of European, national and regional policy and provide instruments for regional development, but will make an essential contribution towards a more sustainable and effective use of investment into North Sea estuaries - since</p>		
70	<a href="#">DeltaNet</a>	Network of European Delta Regions - Sustainable Delta Governance	<p>The delta and estuaries regions in Europe share similar characteristics, problems and opportunities as they have to deal with a very dynamic development of urbanisation, economic activities, infrastructure, natural and technological risks. The high spatial and economic demands are a threat to sustainable development and to the safeguarding of the uniqueness of Delta regions. This is why nine Delta areas from seven EU Member States decided to exchange experiences and improve their regional policy instruments, methods and approaches by joining DeltaNet. The overall objective of DeltaNet is to improve the effectiveness of regional development policies in Delta Regions through interregional cooperation (Part of the C strand of the ETC (as well as of the former Interreg III Community Initiative), its aim is to promote exchange and transfer of knowledge and best ...) in the areas of environmental risk prevention, specifically through the development of appropriate coordinated spatial planning measures in geographic</p>	3, 4, 5	North Sea Region

Number	Acronym	Full name	Aim / Scope / Output	Maritime Function	Regions of focus
71	<b>SuPorts</b>	Sustainable Management for European Local Ports	This project endeavours to help smaller ports and the local authorities managing them address environmental issues. Most EU ports are small-scale, combining shipping, fishing and leisure activities. They face challenges related to the application of the EU environmental policy and legislation, as well as to the residents' high expectations towards the development of small ports regions. At the same time local ports lack the tools to respond to these challenges. The aim of the SuPorts project is to help local ports design better environmental strategies and to have easy access to suitable environmental management tools in order for them to remain competitive and to contribute to a more sustainable EU. The project activities are carried out along two axes: • The exchange of experience to identify and promote better practice in the fields of dredging, protecting the marine biodiversity and involving stakeholders; • The development of appropriate environmental management tools for smaller ports. The partners come	1, 4, 5	

### Motorways of the seas projects

Acronym	Full name	Aim/Scope/Output	Martime Function	Relevance	Regions of Focus
<b>BALTIC MARITIME</b>	<u>Study on goods flows and maritime infrastructure</u>	By presenting the current status and a forecast of the maritime transport sector in the Baltic Sea region, the study aims at contributing to an increased knowledge of the current situation of goods flows and maritime infrastructure as well as the likely future development and demand of maritime transport in the Baltic Sea region.	1	The initiative taken by the Motorways of the Baltic Sea Task Force to study trade and transport in Baltic Sea Region calls for further initiatives to improve the information on the conditions for maritime transport in the area.	Corridor 3: The Baltic sea Region
<b>PORTMOS</b>	<u>Organisation and configuration of pilot actions for the development of the motorways of the sea in Portugal</u>	<p>The project aims to identify the technical and organisational requirements of the national port and logistic system, envisaging the integration of the national ports in the Sea Highways European Network, integrated in the Trans European Transport Network.</p> <p>Those requirements involve the following:</p> <ul style="list-style-type: none"> <li>•Infrastructures;</li> <li>•Inter modality;</li> <li>•Taxes applicable;</li> <li>•Customs activities</li> </ul> <p>This study defines the concept and requirements from a Portugues perspective for the Motorways of the Sea. It assesses the capabilities of the Portuguese Port and Maritime system, defines criteria and requirements for the operationalisation of the Motorways if the Sea, evaluates the capacity of ports and operators</p>	1	<p>The project was developed in 3 phases as follows:</p> <p>Phase 1 – Definition of the Concept / Model for the Motorways of the Sea in Portugal</p> <p>Phase 2 – Design and Development of the Info-structure of Support to the Motorways of the Sea in Portugal</p> <p>Phase3 – Project for the Organisation and Configuration of Pilot Actions for the Development of Motorways of the Sea in Portugal – Pilot Action</p>	Corridor 4: Western Europe motorway of the sea
<b>WESTMOS</b>	<u>Western Europe Sea Transport &amp; Motorway of the Sea</u>	The project aimed to make progress with the preparation and implementation of Motorways of the sea corridors in the Western area of Europe (West and South West European sea areas) and to provide a platform for co-ordination for the development of the Western European and South-Western European corridors of the Motorways of the sea, involving the key stakeholders in these corridors	1	This study supports the development of the Motorways of the Sea of Western Europe. It includes a market analysis and assesses the impact of various subsidy schemes on the market	Corridor 2 and corridor 4

Acronym	Full name	Aim/Scope/Output	Maritime Function	Relevance	Regions of Focus
<b>East Med MoS</b>	<u>ELABORATION OF THE EAST MEDITERRANEAN MOTORWAYS OF THE SEA MASTER PLAN</u>	The EastMed-MoS project aims at the successful implementation of the MoS concept in the Eastern Mediterranean region providing the framework for the development of the Eastern Mediterranean Motorways of the Seas.	1	This study entails the elaboration of a Master plan for the development of the Motorways of the Sea of in the Eastern Mediterranean. It identifies a number of potential Motorways of the Sea corridors and analyses what is required for their implementation.	
<b>MEDAMOS</b>	<u>Mediterranean Motorways of the Sea – Maritime transport connections</u>	It aims at improving transport connections between the EU and its Mediterranean neighbours and to promote the Motorways of the Sea (MoS) concept and assisting the partner countries in further implementing the maritime transport and port operations actions as adopted in the Regional Transport Action Plan (RTAP), a road map for transport cooperation adopted in 2007 (covering 2007-2013).	1	Promotes the Motorways of the Sea concept and the creation of better maritime transport connections in the Mediterranean through support to Ministries, port authorities, customs and relevant private sector stakeholders	Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Occupied Palestinian Territory, Syria, Tunisia, Turkey
<b>TRACECA</b>	<u>Motorways of the Sea for the Black Sea and Caspian Sea</u>	The overall objective of the project is to facilitate trade and transport along the corridor Europe- Black Sea region- Caucasus- Central Asia through improved interoperability and multi-modal transport on the Black Sea and the Caspian Sea. The specific objective is to promote the concept of “Motorways of the Sea” in TRACECA countries in order to support efficient intermodal freight transport connecting the Black and Caspian Seas’ neighbouring countries with the enlarged EU territory.	1	The project promotes the MoS concept to all involved in the transport sector and explores the existing potential. It also fosters the development of transport intermodality in the region, and supports pilot initiatives. Several pilot projects will be identified, to illustrate concrete benefits, improve intermodal/maritime transport axes and schemes, and increase the use of maritime routes where feasible. They will serve as reference models for future MoS, starting with the replication of their best features as part of integrated transport solutions. The MoS project promotes effective connections of ports to road and rail networks, the creation of logistical platforms facilitating these connections, efficient port services and the minimisation of transit times, through which a boost to economic and social development is anticipated	Azerbaijan, Georgia, Kazakhstan, Turkmenistan and Ukraine

Acronym	Full name	Aim/Scope/Output	Maritime Function	Relevance	Regions of Focus
N/A	<u>Motorways of the Sea projects in the Baltic Sea Area Klaipėda-Karlshamn link</u>	The objective of the action is to increase the share of intermodal transport in the Southeast/Southwest Baltic Motorways of the Seas link through Klaipėda, Lithuania and Karlshamn, Sweden.	1	the implementation of the Action will considerably improve and enhance the capacity of unitised rail goods handling on the Swedish side, as well as providing infrastructure investment in Karlshamn.	Sweden, Lithuania
Open Call	<u>Motorways of the Sea projects in the North Sea Region</u>		1	concentrate flows of freight on sea-based logistical routes in such a way as to improve existing maritime links or to establish new viable, regular and frequent maritime links for the transport of goods between Member States in order to reduce road congestion and/or improve access to peripheral and island regions and States.	Belgium, Denmark, France, Germany, Ireland, the Netherlands, Sweden, the United Kingdom and Norway
N/A	<u>The Baltic-Link Motorways of the Sea Karlskrona-Gdynia</u>	This project is a continuation and realization of investments, which were recommended in the former SEBTrans-Link project concluded in 2005 by Polish and Swedish partners	1	The MoSproject F23 will have a catalytic effect on the regional economy, releasing economic values significantly larger than the investments costs	Sweden , Poland



Acronym	Full name	Aim/Scope/Output	Martime Function	Relevance	Regions of Focus
N/A	<a href="#">High Quality Rail and Intermodal Nordic Corridor Königslinie</a>	The objective of this project is to upgrade the existing rail ferry link between the ports of Trelleborg (Sweden) and Sassnitz (Germany) in order to increase the share of rail and intermodal transport on the Swedish-German corridor in particular and the Sweden-Central Europe/Italy corridor.	1	Improving the existing rail ferry service by offering more capacity, more efficiency, faster handling in the ports and more flexibility due to the option of a sixth departure (in peak demand periods only), will help it compete with alternative and less sustainable routes on this transport corridor.	Sweden, Germany
N/A	<a href="#">Motorways of the Sea Esbjerg - Zeebrugge</a>	The project is part of a broader global action which, on the Danish side, consists of the development of intermodal capacity in the south section of the port of Esbjerg	1	On the Belgian side, in addition to the investments in facilities and the ro-ro jetty, the broader project consists of the strengthening of the role of Zeebrugge as a MoS hub. It includes – in addition to the activities covered by this project – the ongoing adaptation of the Britannia dock, whose current layout is not optimal for efficient handling of ro-ro cargo.	Belgium, Denmark
<b><u>Ro RO</u></b>	<a href="#">Ro-Ro Past France</a>	this project provides a motorway-of-the-sea alternative to get freight off the congested international road transit corridor across France. Ro-Ro Past France sails between Bilbao in northern Spain and Zeebrugge in Belgium	1	this project provides a motorway-of-the-sea alternative to get freight off the congested international road transit corridor across France.	Belgium, Spain

Acronym	Full name	Aim/Scope/Output	Martime Function	Relevance	Regions of Focus
<b><u>FRESMOS</u></b>	<u>FRESMOS PROJECT</u>	This project aims at shifting trucks from the Atlantic coast roads between France and Spain. GLD Atlantique will operate a modern ro-pax vessel between the ports of St Nazaire (France) and Gijon (Spain).	1	The Fres Mos Motorways of the Sea project intends to capture between three and five per cent of the road traffic passing through the western part of the Pyrenees.	France, Spain
<b><u>MEDAMOS</u></b> II	<u>EuroMed Transport Mediterranean Motorways of the Seas</u>	The overall objective of the project is to give a follow - up to the first Mediterranean Motorways of the Seas Project. It aims at improving transport connections between the EU and its Mediterranean neighbours and to promote the Motorways of the Sea (MoS) concept and assist the partner countries in further implementing the maritime transport and port operations actions as adopted in the Regional Transport Action Plan (RTAP), a road map for transport cooperation adopted in 2007 (covering 2007-2013).	1	<ul style="list-style-type: none"> <li>* Contribute to the overall completion of the physical and economic integration of the Euro - Mediterranean region</li> <li>* Facilitating an efficient flow of goods between the both sides of the Mediterranean.</li> <li>* Adapting the regulatory framework determining port operations, maritime operations and logistical operation</li> </ul>	ENPI South – Morocco, Algeria, Tunisia, Egypt, Jordan, Israel, Occupied Palestinian Territory, Lebanon and Syria. To be associated; Turkey, Croatia, Bosnia - H, Albania and Montenegro

### MEDA / 'Union for the Mediterranean' projects

Name	Functions	Budget	Start	End	Description	Website	Participants
<b>I. Relevant Projects from MEDA</b>							
<b>Euro-MedMigration I</b>	Security		2004	2007	Assisted governments and other bodies in the Partner Countries in their migratory policy; Monitored, analysed and forecasted migratory movement through 4 research programmes; Maintained an updated database with information on migratory flows in the Mediterranean region; Published studies on different thematic areas (legal, economic and social), such as the Annual Report on Mediterranean migration, 16 research reports, 37 Analytical and Synthetic Notes.	<a href="http://www.carim.org/">www.carim.org/</a>	Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Occupied Palestinian Territory, Syria, Tunisia
<b>Euro MESCO - Foreign policy Institutes</b>	Security		2005	2009	Supports a network of 48 foreign policy institutes and 24 observer institutes. Offers analytical expertise in the policy and security fields. Produces publications, including issue papers, reports, briefs and a regular online newsletter. Holds 2 annual conferences and 8 workshops on topics such as human rights, democracy and security in the Mediterranean. Organises 3 crisis management seminars. Maintains an updated and active website.	<a href="http://www.euromesco.net">www.euromesco.net</a>	Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Occupied Palestinian Territory, Syria, Tunisia, Turkey
<b>MEDSTATII - Statistical Cooperation</b>	Sector Statistics		2006	2009	Strengthens the capacity of the relevant authorities in the Mediterranean Partner countries to collect updated, timely and relevant statistics, that ensure reliability and coherence.	<a href="http://ec.europa.eu/eurostat/medstat">http://ec.europa.eu/eurostat/medstat</a>	Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Occupied Palestinian Territory, Syria, Tunisia, Turkey
<b>EAMGM- Euro-Arab Mashreq Gas Market</b>	Energy		2005	2008	Supports the development of an integrated gasmarket between four countries (egypt, Jordan, lebanon and syria), in order to create a regional gas market and as a step towards integrating with the eu gas market.	<a href="http://www.eamgcc.org">www.eamgcc.org</a>	Egypt, Jordan, Lebanon, Syria

Name	Functions	Budget	Start	End	Description	Website	Participants
<b>II. Most relevant projects from the re-launched 'Union for the Mediterranean'</b>							
<b>EuroMed Police II</b>	Security	€5 M	2007	2010	It aims at strengthening police cooperation between the EU and the Mediterranean Partner Countries, in the ight against all major types of organised crime such as terrorism, drug traicking, human traicking, weapons, nuclear, bacteriological and chemical substances, inancial and cyber crime etc.	<a href="http://www.cepol.europa.eu/index.php?id=97">http://www.cepol.europa.eu/index.php?id=97</a>	Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, OccupiedPalestinian Territory, Syria, Tunisia
<b>Euro-Med Migration II</b>	Security	€5 M	2008	2011	Contributes to the development of a Euro-Mediterranean area of cooperation on migration and assists Partner Countries in their efforts to find solutions to various forms of migration	<a href="http://www.euromed-migration.eu">www.euromed-migration.eu</a>	Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Occupied Palestinian Territory, Syria, Tunisia
<b>FEMIP</b>	SME Developme nt	€32 M per year	2007	2013	Supports FeMIP's efforts to promote sustainable economic growth in theMediterranean Partner countries through investments in infrastructure and especially in private sector development.	<a href="http://www.eib.org/projects/regions/med/index.htm">http://www.eib.org/projects/regions/med/index.htm</a>	Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Occupied Palestinian Territory, Syria and Tunisia
<b>INVESTinMED</b>	Trade	€9 M	2008	2011	A euro-Mediterraneannetwork of organisations committed to investment promotion and trade facilitation, strengthening sMe collaboration and exchange of best-practices.	<a href="http://www.invest-in-med.eu">www.invest-in-med.eu</a>	Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Occupied Palestinian Territory, Syria, Tunisia
<b>EAMGM II</b>	Energy	€5 M	2010	2013	Supports the development of an integrated gas market in order to create a regional gas market and as a step towards integrating with the EU gas market	<a href="http://www.eamgcc.org">http://www.eamgcc.org</a>	Egypt, Iraq, Jordan, Lebanon, Syria, Turkey
<b>MED-EMIP</b>	Energy	€4.1 M	2007	1010	A platform for energy policy dialogue and exchange of experiences, leading to enhanced Euro-Med cooperation, integration of the energy markets and improved security and sustainability	<a href="http://www.medemip.eu/">http://www.medemip.eu/</a>	Participating Countries: Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Occupied Palestinian Territory, Syria, Tunisia, Turkey

Name	Functions	Budget	Start	End	Description	Website	Participants
<b>Sustainable Water Management and De-pollution of the Mediterranean</b>	Water quality	€22 M	2009	2013	Aims at enforcing sustainable water management policies, disseminating good practices in the region and supporting the initiative for the de-pollution of the Mediterranean		Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Occupied Palestinian Territory, Syria, Tunisia
<b>Euromed Transport Project</b>	Transport	€6 M	2010	2012	Aims to assist the implementation of the Regional Transport Action Plan (RTAP) for the Mediterranean 2007-2013, contributing to the establishment of an integrated, efficient, safe and secure transport system in the Mediterranean	<a href="http://www.euromedtransport.org/">http://www.euromedtransport.org/</a>	Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Occupied Palestinian Territory, Syria, Tunisia
<b>Mediterranean Motorways of the Sea – Maritime Transport Connection</b>	Transport	€9 M	2007	2012	Promotes the Motorways of the Sea concept and the creation of better maritime transport connections in the Mediterranean through support to Ministries, port authorities, customs and relevant private sector stakeholders	<a href="http://www.euromedtransport.org/14.0.html">http://www.euromedtransport.org/14.0.html</a>	Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Occupied Palestinian Territory, Syria, Tunisia, Turkey
<b>SAFEMED II – Maritime Safety and Pollution Prevention</b>	Transport	€5.5 M	2009	2011	Promotes co-operation in maritime safety and security and prevention of pollution from ships by providing technical advice and support	<a href="http://www.safemed-project.org/home">http://www.safemed-project.org/home</a>	Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Occupied Palestinian Territory, Syria, Tunisia, Turkey

## Annex 6: Trends and drivers for the scenarios

### Annex 6.1 General trends towards 2025; sources

General trends towards 2025				
category	world	Europe	source(s)	
Demographic trends, health issues	population growth		UN, 2007. World population ageing 2007. Department of Economic and Social Affairs; Population Division	
		stabilizing or decreasing population	EC, DG Research, 2009. The world in 2025; rising Asia and socio-ecological transition	
		ageing population	UN, 2007. World population ageing 2007. Department of Economic and Social Affairs; Population Division	
				US National Intelligence Council (NIC), 2008; Global Trends 2025: A Transformed World
	international migrations			Moritz Lennert and Jacques Robert, 2007. Scenarios on the territorial future of Europe. Espon project 3.2
		immigration		EC, DG Research, 2009. The world in 2025; rising Asia and socio-ecological transition
				id.
	urbanisation		Moritz Lennert and Jacques Robert, 2007. Scenarios on the territorial future of Europe. Espon project 3.2	
			UN, 2007, World Urbanization Prospects: The 2007 Revision Population Database. Department of Economic and Social Affairs: Population Division	
	food & water availability		EC, DG Research, 2009. The world in 2025; rising Asia and socio-ecological transition	
			UK Government Office for Science, 2011. The Future of Food and Farming: Challenges and choices for global sustainability	
	new risks for human health	new risks for health situation	EC, DG Research, 2009. The world in 2025; rising Asia and socio-ecological transition	
Economic and market trends	globalising economy		EC, DG Research, 2009. The world in 2025; rising Asia and socio-ecological transition	
			US National Intelligence Council (NIC), 2008; Global Trends 2025: A Transformed World	
			Moritz Lennert and Jacques Robert, 2007. Scenarios on the territorial future of Europe. Espon project 3.2	

General trends towards 2025			
category	world	Europe	source(s)
	differential growth (strong growth in SE Asia vs. states that fall behind)	slowly growing economy	EC, DG Research, 2009. The world in 2025; rising Asia and socio-ecological transition  UK Government Office for Science, 2011. The Future of Food and Farming: Challenges and choices for global sustainability
	adding value at the source		Functional Profiles, Maritime Trade and Transport
	scarcity of raw materials		EC, DG Research, 2009. The world in 2025; rising Asia and socio-ecological transition  European Commission, 2008. The Raw Materials Initiative - Meeting our critical needs for growth and jobs in Europe
	scarcity of fossil fuels		EC, DG Research, 2009. The world in 2025; rising Asia and socio-ecological transition  Shell, 2008, Shell Energy Scenarios to 2050  IEA, 2009, World Energy Outlook 2009
		resource efficiency	EC Communication: A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy (2011)
Socio-cultural trends	rise of SE Asia  increasing cultural distances		EC, DG Research, 2009. The world in 2025; rising Asia and socio-ecological transition  id.
Technological and scientific trends	R&D concentrates in SE Asia  improving existing technologies ict	Europe and US lose their scientific and technological supremacy	EC, DG Research, 2009. The world in 2025; rising Asia and socio-ecological transition  Functional Profiles Maritime Trade and Transport, Energy and Raw Materials, Tourism, Monitoring and Surveillance, Fisheries, Coastal Protection  Functional Profiles Maritime Trade and Transport and Security
Environmental trends and climate change	increased pressures on the environment  increasing temperature sea level rise  freshwater scarcity	increased pressures on the environment  increasing temperature sea level rise  freshwater scarcity	EC, DG Research, 2009. The world in 2025; rising Asia and socio-ecological transition  European Environment Agency, 2010. The European Environment; state and outlook 2010. Intergovernmental Panel on Climate Change, 2007. IPCC Fourth Assessment Report: Climate Change id. Desalination Market to 2020 - Technology Driven Cost Reduction in Membrane-Based Processes set to Drive

General trends towards 2025			
category	world	Europe	source(s)
	prolonged droughts causing ecological refugees, migrations	immigration	Sustainability Investments into the Market" Nine, Cara, Ecological Refugees, State Borders, and the Lockean Proviso (March 6, 2010). Journal of Applied Philosophy, Forthcoming.
Political and institutional trends	marginalized countries		EC, DG Research, 2009. The world in 2025; rising Asia and socio-ecological transition
	multilateralism instead of bi- or monopolarity	US and Europe increasingly have to share their position with BRIC	US National Intelligence Council (NIC), 2008; Global Trends 2025: A Transformed World
	Africa's strategic importance as supplier of raw materials		European Commission, 2008. The Raw Materials Initiative - Meeting our critical needs for growth and jobs in Europe
	emerging awareness of the importance of sustainability	increased emphasis on sustainability	UK Government Office for Science, 2011. The Future of Food and Farming: Challenges and choices for global sustainability
		ever stronger role of EC	European Environment Agency, 2010. The European Environment; state and outlook 2010. id.



## Annex 6.2 Trends and drivers per Functional Profile connected to General trends

<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	Maritime transport & shipbuilding	Food, nutrition, health and eco-system services	Energy and Raw Materials	Leisure, working and living	Coastal Protection	Maritime monitoring and surveillance
Demographic trends, health issues	population growth	stabilizing or decreasing population		increased demand	increasing demand for energy and raw materials	growing middle class leads to increased demand for coastal tourism	higher population in coastal areas	indirect impact via international migration
		ageing population		demand for medicines and cosmetics for ageing people		20% of the EU's population will be older than 65; increasing numbers spend the winter in Mediterranean coastal areas	stabilizing or decreasing population in coastal areas (less damage when flooded so urge for protection decreases (cost-benefit))	
	international migrations							Risks and threats related to safety; increasing flows of people and goods

<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	Maritime transport & shipbuilding	Food, nutrition, health and eco-system services	Energy and Raw Materials	Leisure, working and living	Coastal Protection	Maritime monitoring and surveillance
		immigration						Risks and threats related to safety; increasing flows of people and goods
	urbanisation/ruralisation			increased pressures on available space in coastal areas for fishery and aquaculture, due to competition with housing, recreation			higher population in coastal areas because urbanisation is concentrated in coastal regions	
	food and water availability			increased demand for marine nutrition sources	oceans can be an abundant source of drinking water once desalination techniques have been put in place	supply of drinking water in dry areas	salt water intrusion as a result of freshwater drawdown	development of flow of ecological refugees; satellite monitoring of drought
	diseases and health-related issues	diseases and health-related issues		fish are rich in omega-3; new sources of medicine and health-related products				

<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	<b>Maritime transport &amp; shipbuilding</b>	<b>Food, nutrition, health and eco-system services</b>	<b>Energy and Raw Materials</b>	<b>Leisure, working and living</b>	<b>Coastal Protection</b>	<b>Maritime monitoring and surveillance</b>
Economic and market trends	globalising economy		growth in maritime transport volumes. Less European seafarers. More eastern employees in European shipping. Shift of shipbuilding industry towards the east. Loss of position of European ship repair sector. Remaining in Europe are niche players. Loss of European position in maritime equipment.	increased pressures on available space in coastal areas for fishery and aquaculture, due to competition with shipping. Globalisation leads to transfer of aquaculture to SE Asia (Vietnam)	economic growth leads to Increasing global demand for oil (primarily from China, India and the Middle East) and acceleration of depletion of resources and raw materials	experience economy		high density traffic on main shipping routes. Increased need for tracking & tracing of shipping

<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	<b>Maritime transport &amp; shipbuilding</b>	<b>Food, nutrition, health and eco-system services</b>	<b>Energy and Raw Materials</b>	<b>Leisure, working and living</b>	<b>Coastal Protection</b>	<b>Maritime monitoring and surveillance</b>
	differential growth (strong growth in SE Asia vs. states that fall behind)	slowly growing economy	moderate growth in short sea shipping; relatively strong growth in container transport volumes; adaptation in seaports receiving container vessels; stimulation of ship building industry; stimulation of maritime functions	leading economies lead also in exploration of deep sea life resources; increased GDP/capita leads to increased protein consumption patterns (fish/meat)	relative high consumption of resources by the leading economies	increasing mobility; tourism demand in the EU grows steadily; demand for single-household products is increasing; increasing demand from newly developing Asian countries	when more assets are stake (due to economic growth) the damage costs of flooding/erosion are higher and the urge for coastal protection and the investment in coastal protection are higher; fierce competition from non-EU countries for buiding coastal protection measurement	development of weak states may lead to flows of refugees or safety issues as a result of piracy.
	adding value at the source		decrease in transport of raw materials, increase in transport of processed goods		improved offshore infrastructure; local mining of raw materials where possible.			

<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	Maritime transport & shipbuilding	Food, nutrition, health and eco-system services	Energy and Raw Materials	Leisure, working and living	Coastal Protection	Maritime monitoring and surveillance
	scarcity of raw materials				shortfall copper and manganese; deep sea mining is promoted; recycling			development of monitoring systems to facilitate exploration of the seas (satellite info on storms, waves, currents)
	scarcity of fossil fuels		more attention for fuel efficiency; slow steaming; fuel efficient ships; modal shift towards shipping	many fishery techniques, including aquaculture, are heavily dependent on fossil energy and may become unprofitable if energy prices continue to rise; increased pressures on available space in coastal areas for fishery and aquaculture, due to	development of renewable energy resources stimulated by high oil prices	travel costs may impede growth of international tourism; oil price is a strong determinant of the viability of desalination; water scarcity may limit development of coastal/island tourism		

<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	<b>Maritime transport &amp; shipbuilding</b>	<b>Food, nutrition, health and eco-system services</b>	<b>Energy and Raw Materials</b>	<b>Leisure, working and living</b>	<b>Coastal Protection</b>	<b>Maritime monitoring and surveillance</b>
	increased price volatility	resource efficiency	moderate further growth in average ship sizes, checked by physical boundaries. Containers and passenger ships: some growth still taking place and further growth	competition with shipping, housing, recreation, wind and tidal energy  increased attention for sustainable (resource efficient) production methods. Shrimp production in SE Asia and export to Europe can be efficient even on CO2-footprint basis		development of eco-tourism, sustainable tourism	application of principles of sustainable building in protection works	

<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	Maritime transport & shipbuilding	Food, nutrition, health and eco-system services	Energy and Raw Materials	Leisure, working and living	Coastal Protection	Maritime monitoring and surveillance
			expected. Dry bulk carriers: limits about reached. Short sea shipping: ??					
Socio-cultural trends	rise of SE Asia	individualisation  network societies	lack of employees willing to work in the sector	consumers become more and more aware of sustainability issues		more SE Asian travelling abroad (consuming tourism)  more local tourism/less international tourism		Competing monitoring and surveillance systems (cf. GPS, Galileo/ Asian nav systems)
	increasing cultural distances							

<b>General trends towards 2025</b>			related drivers and trends identified in the functions						
Category	world	Europe	Maritime transport & shipbuilding	Food, nutrition, health and eco-system services	Energy and Raw Materials	Leisure, working and living	Coastal Protection	Maritime monitoring and surveillance	
Technological and scientific trends	R&D concentrates in SE Asia	Europe and US lose their scientific and technological supremacy	innovations in maritime transport are increasingly developed in SE Asia. Increasing role in "green" shipbuilding and state of the art shipbuilding. more fuel efficient engines. Better hull design. Use of other fuel efficient technologies (large sails, composites).	not many resources spent on R&D	improved hull design leading to higher overall energy efficiency; rationalization of the management of fishing fleet; sourcing of low value proteins to feed the culture; selection and	better drilling at deep depths to withdraw substantial amounts of oil, gas and methane hydrates, improved integration of offshore wind platforms with the grid'; carbon capture and storage (CCS);	focus on innovation related to increasing the quality of services; rise of intercontinental low cost carriers through further development of airplanes as Airbus A380	research and know-how is starting to shift to eastern countries	monitoring and surveillance equipment is still a western dominated subfunction; nevertheless local/regional solutions are being developed in SE Asia.
	improving existing technologies						development of scale of coastal cells and beach fill material ; change from small-scale cells (groyne fields; 100 m scale) to larger scale cells (headland type groynes with beach fills in between; 1 km scale) to accommodate high-quality beach recreation	integrated management system of maritime surveillance; plus monitoring climate change and ocean/sea behaviour	



<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	Maritime transport & shipbuilding	Food, nutrition, health and eco-system services	Energy and Raw Materials	Leisure, working and living	Coastal Protection	Maritime monitoring and surveillance
	nanotechn ology biotechnol ogy			adaptation of new species for aquaculture; inland aquaculture  improved screening due to improved (bio)chemical determination techniques; genetic techniques used to identify promising compounds	desalination techniques; improvement techniques wave, tidal and blue energy to make it commercially viable; Maturing of pre-commercial offshore renewables		requirements and provide protection against flooding	

<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	<b>Maritime transport &amp; shipbuilding</b>	<b>Food, nutrition, health and eco-system services</b>	<b>Energy and Raw Materials</b>	<b>Leisure, working and living</b>	<b>Coastal Protection</b>	<b>Maritime monitoring and surveillance</b>
	ict		monitoring of shipping movements, traffic control	information technologies have improved significantly the fishermen ability to target fish: detection has improved, allowing to target desired species more specifically; global positioning	Remotely Operated Vehicles or Autonomous Underwater Vehicles	integrated real time solutions related to faster, better and easier access to information about destinations, products, services and prices. Emphasis on design and experience	improved connection between physical protection measures and monitoring information	capabilities to ensure surveillance, monitoring, detection (reporting and non reporting vessels, abnormal behaviours), identification and tracking; Capabilities to ensure interoperability and information sharing (classified and unclassified) to increase response capabilities; extensive maritime area coverage combining different sets of sensors and platforms, heterogeneous data processing and fusion, using new methodologies to detect small craft and abnormal behaviours

<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	<b>Maritime transport &amp; shipbuilding</b>	<b>Food, nutrition, health and eco-system services</b>	<b>Energy and Raw Materials</b>	<b>Leisure, working and living</b>	<b>Coastal Protection</b>	<b>Maritime monitoring and surveillance</b>
Environmental trends and climate change	increased pressures on the environment	increased pressures on the environment	oil spills and techniques to prevent them; introduction of exotic species with ballast water; impacts of accidents; possible effects of changing wind patterns; stronger volatility of wind patterns; strong drive for green transport modes	overfishing has led to decreasing catches in Europe; negative impacts from other users (agriculture, industries) on water quality in coastal areas; increased pressure on sustainable fish production (aquaculture)	adverse effects of wind parks at sea; adverse effects of sand dredging; adverse effect of deep sea mining; on the other hand increased pressures on RES	driving eco-tourism		strong increase in environmental monitoring and surveillance (GMES, both in-situ and space)
	increasing temperature	increasing temperature	melting of the Arctic ice cap, opening arctic shipping lanes; changing sea currents (tipping point)	temperature increase leads to changes in ecosystems, northward shift of ecozones		shift of optimal coastal climate from southern mediterranean northward	changing storm conditions and higher water levels lead to increased need for protection against flooding	satellite monitoring techniques

<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	Maritime transport & shipbuilding	Food, nutrition, health and eco-system services	Energy and Raw Materials	Leisure, working and living	Coastal Protection	Maritime monitoring and surveillance
	sea level rise	sea level rise	(ports, long term)			pressure on beaches, needs for sand suppletion		increase pressure to monitoring and surveillance
	freshwater scarcity	freshwater scarcity				desalination plants, their adverse environmental effects; pressure on fresh water consumption by tourism (conflict with other uses in coastal areas)	increased salt water intrusion from the sea inland as a result higher sea levels and lower recharge by precipitation	
	prolonged droughts causing ecological refugees, migrations	immigration	increased attention to security at seas, sea patrols			water scarcity in coastal areas		increased attention to security at seas, sea patrols
Political and institutional trends	marginalized countries		security aspects related to piracy; EU Energy Security and					risks and threats related to Sea border security (unlawful activities: trafficking in human beings and narcotics, illegal

<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	Maritime transport & shipbuilding	Food, nutrition, health and eco-system services	Energy and Raw Materials	Leisure, working and living	Coastal Protection	Maritime monitoring and surveillance
			Solidarity Action Plan; protectionist trade policies					immigration, terrorism, piracy, etc). Legal framework lacks possibilities for interventions; EUROSUR
	multilateralism instead of bi- or monopoly	US and Europe increasingly have to share their position with BRIC	strongly linked with globalisation tendencies	sustainable levels determined by ecology or by national interests	securing supply lines is a national interest	lower openness to external tourists from other regions. Stronger local tourism.		implementation of the international judicial framework enabling the international community as a whole to prevent and curb piracy
	Africa's strategic importance as supplier of raw materials	increased emphasis on sustainability	Regulations on fuel emissions by ships. Regulations of NOx and SOx emissions. Attitude	regulation by quota; new fishing techniques	investments in African infrastructure increase	booming demand for sustainable goods; ecologically responsible consumerism	higher need for protection against coastal erosion	increased need for monitoring and surveillance to enforce new regulations
	emerging awareness of the importance of sustainability				upcoming renewable energy sources.			

<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	<b>Maritime transport &amp; shipbuilding</b>	<b>Food, nutrition, health and eco-system services</b>	<b>Energy and Raw Materials</b>	<b>Leisure, working and living</b>	<b>Coastal Protection</b>	<b>Maritime monitoring and surveillance</b>
		ever stronger role of EC	towards environmental impacts in China is becoming more favourable. Environmental aspects in ports development and operation Regulations on fuel emissions by ships. Regulations of NOx and SOx emissions. Attitude towards environmental impacts in China is becoming more favourable.	EU fishing policy	EU 20-20-20 strategy; European legislative framework is an important determinant for the offshore energy and raw material sector			integration of information systems between the EU Member States

<b>General trends towards 2025</b>			related drivers and trends identified in the functions					
Category	world	Europe	<b>Maritime transport &amp; shipbuilding</b>	<b>Food, nutrition, health and eco-system services</b>	<b>Energy and Raw Materials</b>	<b>Leisure, working and living</b>	<b>Coastal Protection</b>	<b>Maritime monitoring and surveillance</b>
			Environmental aspects in ports development and operation					
	equity							

## Annex 6.3 General trends towards 2025; scores for relevance and degree of certainty

General trends towards 2025	Drivers	Relevance	Certainty
<b>Demographic trends, health issues</b>	Population growth	++	++
	Population ageing	+	++
	International migrations	+	+/-
	Urbanisation / Ruralisation	++	++
	Food & water availability	++	++
	Diseases and health-related issues	+	--
<b>Economic and market trends</b>	Global economy	++	+/-
	Differential growth	++	+/-
	Price volatility	+/-	+/-
	Reshaping of economic structures	+/-	+/-
	Availability of raw materials	++	++
	Availability of fossil fuels	++	++
	Resource efficiency	+	--
<b>Socio-cultural trends</b>	raise of Asia	+/-	-
	Class disparities, equity and conflicts	+/-	-
	Refugees and migrations	+	-
<b>Technological and scientific trends</b>	R&D regional concentration/distribution	++	+
	Technological development	++	+
	Biotechnology	+	+
	ICT	+	+
<b>Environmental trends and climate change</b>	Pressures on the environment	++	+/-
	Global temperature	++	+
	Sea level	++	+
	Freshwater availability	++	++
	Droughts causing ecological damages	++	-
<b>Political and institutional trends</b>	Marginalization/Integration	++	-
	multilateralism vs. bi-/mono-polarity	++	-
	Stability related to supplier of raw materials	+	+
	Commitments towards sustainability and climate mitigation	++	+/-
	Role of the EU	++	+/-



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