



Blue Growth

Scenarios and drivers for Sustainable Growth from the Oceans, Seas and Coasts

Annex 1 maritime economic activities data

Call for tenders No. MARE/2010/01

Client: European Commission, DG MARE

Rotterdam/Brussels, 13 July 2012



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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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1 Introduction

The approach of the study is based on the concept of maritime functions rather than sectors as they are usually defined in statistical data and economic studies. The study has developed 6 maritime functions and 27 sub-functions. A selection process was followed to identify:

- The top-7 maritime sub-functions of today
- The top-7 fastest growing sub-functions
- The top-7 sub-functions in terms of their future potential

The result of this ranking was used to select sub-functions that have been elaborated in further detail in the study (see the main report and annex 4).

To estimate the current size, recent growth and future potential of the maritime economy, a number of methodological steps have been taken, which are elaborated in this annex. The following chapters are included:

- Available statistics versus maritime function delineation – choices made (Ch.3)
- The data results and selection process (Ch.4)
- Explanatory notes on data processing and calculations (Ch.5)

2 Available statistics versus maritime function delineation

Summary

The Blue Growth study started with gathering data on maritime functions. Attempts were made to gather statistical data at EU level covering all member states in a similar way, with similar level of detail, time series and accuracy. This proved however insufficient, for several reasons, including:

- Split between land based and maritime activities: many economic sectors are relevant for both, and no clear distinction is available from NACE 4-digit codes, while more detailed data (5- or 6-digit) is either not (publicly) available or data is not provided for all countries.
- Many economic sectors are relevant for more than one maritime function, and levels of detail are insufficient to clearly allocate these. Input/Output tables might be a useful tool to overcome this, however they are not consistently available across EU member states (at least not public), and are not regularly updated.
- 'New', or emerging sub-functions are not well covered in existing statistical definitions. The same holds if we want to dig into deeper layers of sub-functions rather than main maritime functions.
- Geographic breakdown only solves the matter for a few (sub-)functions, as economic sectors relevant for a maritime function are not necessarily geographically based near the sea.

Allocating sectors to functions

In order to define size and development of the maritime functions, a more specific definition of the maritime functions, in terms of the sectors that belong to each function, is necessary. For some sectors this is easy (maritime shipping mainly relates to the maritime transport function; fisheries belong to the function of food, nutrition and eco-system services). For others however this is more complex: supporting sectors that serve various functions (f.i. maritime services, shipbuilding, equipment). Moreover, many supporting sectors may serve not only maritime sectors but also land-based sectors (if statistics are not detailed enough to distinguish maritime components, f.i. manufacturing of wind turbines, which may be meant both for land- or sea-based use). The same holds if we want to move from functions to sub-functions. For instance the separation of shortsea shipping from deepsea shipping is not even easy (i.e. how to deal with feeder shipping or with shortsea containers carried by deepsea ships?).

In order to allocate sectors, several methods are available:

- a. Allocate on the basis of NACE sectors: If done at sufficient level of detail (4-digit or more) for many sectors a clear distinction can be made, but not for all.
- b. Allocate on the basis of NUTS geographic level: for some activities (notably tourism) while sectoral allocation may not link them to maritime activities, a geographic delineation may be applied to assign economic activities to the maritime field.
- c. Continue on the basis of previous DG MARE studies. This implies following definitions made by others and requires some modification as to adapt these to our maritime functions
- d. Additionally, we may be able to make use of Input/Output tables for assigning the contributions of non-maritime sectors to maritime sectors under each function. The availability of I/O tables at sufficient level of detail (geographically and sectoral) has been investigated.

- e. Finally, own estimates based on expert opinions and relative factors may be applied to estimate the size and development of maritime economic activities.

a. Following NACE sector codes

At a 4-digit level, for 4 of the 5 maritime functions, key sectors can be identified:

Table 1 Maritime functions and core NACE Rev.2 sectors

Maritime function	NACE Rev.2 4-digit sectors at their core + comments
1. Maritime trade and transport	50.10 Sea and coastal passenger water transport 50.20 Sea and coastal freight water transport 50.30 Inland passenger water transport 50.40 Inland freight water transport
2. Food, nutrition, health and ecosystem services	03.11 Marine fishing 03.21 Marine aquaculture 10.20 Processing and preserving of fish, crustaceans and molluscs 47.23 Retail sale of fish, crustaceans and molluscs in specialised stores
3. Energy (including grid infrastructure) and Raw materials (including carbon storage)	Many sectors are relevant. However mining sectors (oil & gas, sand, other minerals) do not distinguish between sea or land activities. The same holds for energy production. Allocation by NUTS appears not useful as e.g. a power plant located near the sea would be assigned to be maritime just for the sake of its location.
4. Living, working and leisure in coastal regions and at sea (including naval defence)	30.12 Building of pleasure and sporting boats 3012 Hotel/accommodation sectors do not distinguish a maritime function but are usually allocated on the basis of their geography (NUTS II or III level), with allocation rules where these are not available
5. Coastal protection and nature development	None

A variety of NACE sectors is relevant for more than one function, such as the following:

Table 2 NACE sectors contributing to multiple functions (examples)

NACE 4-digit sector	Contributes to functions
30.11 Building of ships and floating structures	1, 2, 3, 5 (separate sector for 4)
33.15 Repair and maintenance of ships and boats	1, 2, 3, 4, 5
42.91 Construction of water projects	1, 2, 3, 4, 5 (+ partly non-maritime)
77.34 Renting and leasing of water transport equipment	1, 2, 3, 4, 5

Assigning these sectors to one function would disregard their importance for other functions. A possibility is to gather more detailed data within countries where these are available to estimate relative importance of these sectors for the functional core sectors, and assume ratios for the overall sector based on this. If possible, the more sophisticated method of using Input/Output tables may be applied (see item d below).

Conclusion on NACE codes:

- Many sectors appear not relevant at all, as they are defined too generic and might only on a geographic basis be assigned and/or a greater detail (5-6 digit) is needed before assignment can be made. It is questionable if that level is available.

- Also for more specific sectors, still at the 4-digit level they cover also land-related activities and marine is only part of it. Geographic basis might be used for assignment, although this is then only very indicative.
- Several sectors are relevant for multiple functions. Think for example of shipbuilding which (at 4-digit) does not specify among ship type related to function.
- None of the 4-digit sectors is specifically targeting the maritime function 'coastal protection'. Sectors like 'construction of water projects' are relevant but also cover works related to the other functions which cannot be distinguished.
- When sectors/indicators have been defined by Eurostat and included in their databases, still we often find empty tables, or data only inserted for part of the EU member states. Thus incomplete pictures arise.
- It seems sometimes different definitions are applied by individual member states, resulting in figures not matching the common understanding of data (f.i. employment in shipbuilding in Spain much higher than in Germany, which contradicts the general understanding of the importance of Germany and other data like the order book information from CESA for the same years).
- The notion of 'ports' is also complex: many (secondary) studies have tried to grasp figures on employment or added value, but in itself, a port is not an economic sector, but just a geographic site where economic sectors are gathered.

In 2007 DG MARE commissioned a study to Ifremer¹ to investigate the set-up of a new database by Eurostat to distinguish maritime activities and overcome the above problems. Until date however the follow-up has not been published.

b) Geographic assignment

Especially for activities for which their location defines whether they can be considered maritime, an allocation on the basis of geographic data is useful. This especially applies to function 4 (tourism/leisure). In previous studies on tourism, allocations have been made on the basis of NUTS-breakdown data, where it was assumed that for example activities in all coastal NUTS-II or NUTS-III regions are included, or where – on the basis of secondary sources – an assumption was made on the share of these activities taking place within a distance of 10 km (or 50 km) from the sea.

It is believed that this method is not suitable for functions 3 (energy/raw materials) and 5 (coastal protection) as underlying economic activities may be registered elsewhere than in the coastal regions themselves.

c) Previous studies

The Blue Growth study did not have to start from scratch. DG MARE has conducted a multitude of studies on maritime sectors in the recent past. In these studies, sectors have been defined and data gathered, either from primary or secondary sources. However in most of these studies not all of the five functions are covered. Sometimes they overlap and modifications are necessary. Below table presents the structure of the most recent integral study done (by PRC in 2008²) and how that could fit to our structure.

¹ Ifremer (2009), STUDY IN THE FIELD OF MARITIME POLICY, "Approach towards an Integrated Maritime Policy Database". March 2009.

² PRC (2008), The role of Maritime Clusters to enhance the strength and development of European maritime sectors

Table 1 Maritime areas and sectors involved (PRC 2008)

Area PRC	Sectors involved	ECORYS function & comments
Area 1: Traditional maritime sectors	– Inland navigation: Inland shipping and ship management; chartering-out; inland cruises and ferries; harbour and river towage; freighting	1. maritime transport
	– Marine aggregates: Exploitation of marine aggregates	3 energy & raw materials
	– Marine equipment: Manufacturing and wholesale trade in maritime equipment for all maritime (sub-)sectors (no building, repair and/or conversion and no offshore supply)	1. Maritime transport (but actually linked to all five functions, so would disregard importance of other sectors. Consider to allocate using available breakdown)
	– Maritime services: Research and development; education; classification and inspection; bunkering; maritime insurance; maritime financing; maritime brokerage; maritime law; crewing; associations; government services; rescue; diving; ship supply (no port services)	1. Maritime transport (assumed hardly relevant for the other functions)
	– Maritime works: Dredging; nautical cable and pipelines; river works; construction of canals, dykes and ports; support vessels; sand transport	Requires to be split between function 1 (transport, 3 (energy & raw materials), 4 (tourism) and 5 (coastal protection)
	– Navy and coastguard (no shipbuilding)	4 Leisure/tourism (incl. navy (excluded from our scope), 6 Maritime security & surveillance
	– Offshore supply: Construction and installation of platforms, storage vessels and equipment; drilling; offshore-related transport, engineering, communication, consultancy and other support; seismic research; manufacturing, installation and maintenance of offshore and coastal wind turbines (no extraction of oil such as operators of oil rigs)	Mainly relevant for function 3 (energy & raw materials)
	– Recreational boating: Boat chartering and renting; marinas; inland boat basins; supporting services concerning the construction of and trade in recreational vessels; boating-related training and trade (no manufacturing)	4 tourism/leisure
	– Seaports: Cargo-handling; shipping related storage, agency, maritime logistics and forwarding; port authorities; pilotage	1. Maritime transport (although also necessary for all other functions)
	– Shipbuilding: Construction and repair of sea-going vessels (commercial ships, fishing boats and naval ships), recreational boats and inland vessels; ship scrapping; floating sections; dry docks (no offshore-rigs and/or -vessels)	Would require split between the functions. In terms of volume mainly relevant for 1 maritime transport, but in terms of value also large for 4 tourism (cruise vessels, yachting)
– Shipping: Merchant shipping and ship management; short-sea shipping; chartering-out; ferry services; ocean towage (only national seafarers and onshore persons employed)	1. maritime transport	
Area 2: Coastal (and marine) tourism and recreation;	– Coastal tourism: Tourism within 10 km from the coast	4 tourism (10 km seems arbitrary. Study actually applies NUTS-II for lack of more detailed data)
	– Cruise tourism: Service on board of cruise ships (no land-based tourism and/or related services)	4 tourism
Area 3: Fisheries.	– Fisheries: Maritime and inland fishing; fish processing; aquaculture	2. fisheries

It is noted that PRC has heavily relied on data from secondary sources, and combined a great variety of data with various basis and various statistical years. For our study we will need to ensure

that consistency exists as well as coverage of time series. Furthermore Maritime security & surveillance was not covered at all.

In a study by ECOTEC (2006)³ on maritime employment, a slightly different breakdown is used, which may be applied if PRC sources are lacking indicators.

d) Input/Output tables

The use of I/O tables is considered for investigating the role of supplier sectors to core maritime sectors. As mentioned a variety of industry sectors is serving not only maritime but also land-based activities. For the Netherlands, I/O tables contain a number of 104 sectors, including core function sectors such as fisheries (function 2), shipbuilding and sea shipping (function 1). The relative importance of supporting non-maritime sectors can be derived. However for functions 3, 4 and 5 the Dutch table does not contain core tables. It is questionable whether a similar level of detail (or better) is available at EU level or in other Member States. Also the age of data is relevant, as I/O tables are not always updated yearly.

It is concluded that neither NACE codes, nor existing studies or input/output tables provide any ground for allocation economic activities to function 5 on coastal protection.

e) Own estimates

While studying the sub-functions (i.e. one level of detail deeper than maritime functions), on a case by case basis it was chosen to use available statistics from Eurostat, data from previous studies, or own estimates. Often a combination of a), b) and c) was combined with assumptions. For instance for many sectors no distinction between maritime and land based activities was available, or data on employment did exist but not on added value. If data was known for one or two countries only, ballpark figures from these were applied to EU totals. In all cases, the choices and assumptions made are documented in the sub-function reports (see annex 4). Results have been validated through sector interviews.

Geographic scoping of the sea basins

The study needed also to distinguish developments and scenarios for seven sea basins, namely:

- Arctic
- Baltic
- North Sea
- Atlantic
- Mediterranean
- Black Sea
- Outermost regions

The definitions on where one sea basin ends and another one starts seem to be not clear, e.g. various sources apply various definitions (see for instance the 1953 publication of the International Hydrographic Organisation: "Limits of Oceans and Seas". The Marine Strategy Framework Directive (2008/56/EC) includes marine regions and sub-regions of European waters. In this directive North Sea is taken as part of the Atlantic. One could also allocate countries to sea basins, which can be useful as statistical data usually relates to countries.

³ Ecotec (2006), Employment trends in all sectors related to the sea or using sea resources. September 2006

Sea basin	Countries
Arctic	Norway (partly)
Baltic	Sweden, Finland, Estonia, Latvia, Lithuania, Poland, Germany (partly), Denmark (partly)
North Sea	Norway (partly), Denmark (partly), Germany (partly), Netherlands, Belgium, France (partly), UK (partly)
Atlantic	UK (partly), Ireland, France (partly), Spain (partly), Portugal
Mediterranean	Spain (partly), France (partly), Italy, Slovenia, Greece
Black Sea	Romania, Bulgaria
Outermost regions	French, UK and Portuguese colonies

Source: Ecorys based on 2008/56/EC and Ifremer (2009).

Whatever definition taken however, statistical data found are based on geographic breakdown of land mainly (NUTS) and one will need to assign these to sea basins. For sea basins not bordering EU member states (e.g. Arctic) this also does not provide a solution. Furthermore economic activities can take place in sea basins but may not be registered in regions bordering these.

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. 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.

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 3.4 of this annex). Furthermore account is taken of ongoing research work by DG MARE as to prevent overlap with other work and keep this study complementary.

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 sub-function reports (annex 4), 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 3.1 Indicative size of sub-functions

Function / activities	Current size		Sources & Comments
	Value added (€ bn)	Employment (*1000)	
1. Maritime transport and shipbuilding			
1.1 Deepsea shipping	98	1,204	Eurostat database (2012); Data 2008; share in total shipping based on freight volumes
1.2 Shortsea shipping (incl. RoRo)	57	707	Eurostat database (2012); 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
1.4 Inland waterway transport	8	36	Eurostat database (2011); Data 2007
2. Food, nutrition, health and eco-system services			
2.1 Catching fish for human consumption	8.7	200-240	Anderson and Guillen 2009; Data 2007
2.2 Catching fish for animal feeding	0.3	6.0	Eurostat database (2011); Data 2007
2.3 Marine aquatic products	0.5	80	Eurostat database (2011); Framian 2007; Production data 2007, employment data 2005
2.4 Blue biotechnology	0.8	<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
3. Energy and raw materials			
3.1 Offshore oil and gas	107-133	25-50	Eurostat database (2011) + own estimate for offshore share; Data appear unreliable; probably much larger
3.2 Offshore wind	2.4	35	EWEA (2010), Euroserver (2010), EWEA (2011); Share based on MW installed offshore compared to onshore; 2010 investment data as a proxy of GVA only
3.3 Ocean renewable energy (wave, tidal, OTEC, thermal, biofuels, etc.)	<0.25	1	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
3.5 Aggregates mining (sand, gravel, etc.)	0.6	4.3	Eurostat database (2011); British Geological survey (2007); Offshore share estimated. Employment estimate based on UK data
3.6 Marine minerals mining	<0.25	<0.5	No data, own estimate based on literature
3.7 Securing fresh water supply (desalination)	0.7	7	Global Water Intelligence (2010); EU share estimated at 10% of global industry
4. Leisure, working and living			
4.1 Coastline tourism	121	2,350	ECB (2011) (GVA), Eurostat database (2011) (employment); GVA calculated based on assumed share in EU total
4.2 Yachting and marinas	23.4	253	Ecotec (2006); Data for 2005.
4.3 Cruise tourism	14.1	143	European Cruise Council (2010); Based on expenditure data for 2009

Function / activities	Current size		Sources & Comments
	Value added (€ bn)	Employment (*1000)	
4.4 Working	4,108	89,000	Eurostat database (2011); GVA in coastal regions (NUTS 3), 2008 data; employment data 2007
4.5 Living	n/a	205,000	Eurostat database (2011)
5. Coastal protection			
5.1 Protection against flooding and erosion	1.0-5.4	10-50	Eurostat (2004), IPCC (2009), EC (2004), Hinkel (2010) (GVA), own estimate (employment)
5.2 Preventing salt water intrusion	<0.25	<0.5	No data, own estimate based on literature
5.3 Protection of habitats	<0.25	<0.5	No data, own estimate based on literature
6. Maritime monitoring and surveillance			
6.1 Traceability and security of goods supply chains	0,6-3	5-10	Own estimate based on EC (2006)
6.2 Prevent and protect against illegal movement of people and goods	1-3	18	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	4	25	Ecorys (2011); 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 3.2 Top-7 sub-functions based on current size

Rank	Sub-function	GVA (mIn EUR)	Employment (*1000)	Score
1	4.1 Coastal tourism	121	2,350	1,780
2	1.1 Deepsea shipping	98	1,204	1,090
3	1.2 Shortsea shipping	57	707	640
4	3.1 Oil, gas and methane hydrates	120	37.5	619
5	4.2 Yachting and marinas	23.4	253	244
6	1.3 Passenger ferry services	20	245	222
7	2.1 Catching fish for human consumption	8.7	220	154

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 the explanatory notes section in

chapter 4 of this annex. from these tests it is concluded that the top-7 list would be the same and therefore is robust for data used.

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 3.3 Recent relative growth of sub-functions

	Recent growth		Sources	Comments
Function / sub-function	Value added (€ bn)	Employment (*1000)		(See explanatory notes at the end of this annex for further elaboration and underlying data)
1. Maritime transport and shipbuilding				
1.1 Deepsea shipping	5.8%	4.0%	Eurostat database (2012)	Data for 2003-2008
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				
2.1 Catching fish for human consumption	2.6%	-4.0%	Anderson and Guillen (2009); Joint research centre, Eurostat	Data for 2003-2008
2.2 Catching fish for animal feeding	-3.0%	-0.5%	Green (2010); Joint research centre, Eurostat	Data for 2003-2008
2.3 Marine aquatic products	4.6%	+	Eurostat (2010)	Based on production value increase 1998-2008
2.4 Blue Biotechnology	+	+	no data, score based on literature review	Sub-function still in early stage of its development
2.5 Agriculture on saline	+	+	no data, score based	Sub-function still in early stage

	Recent growth		Sources	Comments
Function / sub-function	Value added (€ bn)	Employment (*1000)		(See explanatory notes at the end of this annex for further elaboration and underlying data)
soils			on literature review	of its development
3. Energy and raw materials				
3.1 Offshore oil and gas	-4.8%	-4.8%	Eurostat database (2012)	Data for 2003-2008, based on production of oil & gas
3.2 Offshore wind	21.7%	21.7%	Eurostat database (2012)	Data for 2003-2008, based on growth of energy output
3.3 Ocean renewable energy (wave, tidal, OTEC, thermal, biofuels, etc.)	+	+	no data, score based on literature review	Sub-function still in early stage of its development
3.4 Carbon capture and storage	+	+	no data, score based on literature review	Sub-function still in early stage of its development
3.5 Aggregates mining (sand, gravel, etc.)	0.4%	-0.7%	Eurostat database (2012)	Data 2004-2008. Based on total production (land + sea)
3.6 Marine mineral s mining	0/+	0/+	no data, score based on literature review	Sub-function still in early stage of its development
3.7 Securing fresh water supply (desalination)	12.3%	12.3%	Global Water Intelligence (2010)	
4. Leisure, working and living				
4.1 Coastal tourism	2.8%	2.8%	Eurostat database (2012)	data for 2003-2008, based on tourist growth
4.2 Yachting and marinas	5.0%	+	SRN/Ecorys/ Euromapping (2007)	
4.3 Cruise tourism	12.3%	12.3%	European Cruise Council (2010)	Data 2005-2009, CAGR, output growth
4.4 Working	4.5%	4.5%	Eurostat database (2012)	data 2003-2008, growth of total GVA in coastal regions
4.5 Living	0.1%	0.1%	Eurostat database (2012)	growth of inhabitants
5. Coastal protection				
5.1 Protection against flooding and erosion	4.0%	+	EuroSION (2004)	based on 7 year old data
5.2 Preventing salt water intrusion	+	+	no data, score based on literature review	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	Will grow with increased attention for nature development
6. Maritime monitoring and surveillance				
6.1 Traceability and security of goods supply chains	+	+	no data, score based on literature review	
6.2 Prevent and protect	+	+	no data, score based	

	Recent growth		Sources	Comments
Function / sub-function	Value added (€ bn)	Employment (*1000)		(See explanatory notes at the end of this annex for further elaboration and underlying data)
against illegal movement of people and goods 6.3 Environmental monitoring	+	+	on literature review no data, score based on literature review	

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 3.4 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)	5.8%	4.0%	4.9
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 below under 'Explanatory notes'. From these tests it is concluded that the selection is robust for the data applied.

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 have been 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 and sub-function analyses conducted within this study. 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.

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, which are based on an elaboration of sub-each function. 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 3.5 Future potential of sub-functions

Function	Sub-function	Indicator						Sustainability	Overall score
		Innovativeness	Competitiveness	Employment creation	Policy relevance	Spill-over effects			
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 Marine aquatic products	+	+	+	+	?	?	++++	
	2.4 Blue Biotechnology	+	+	+	+	+	+	+++++	
	2.5 Agriculture on saline soils	+	?	+	+	?	+	++++	
3. Energy and raw materials	3.1 Offshore oil and gas	+	0	-	+	+	0	+	
	3.2 Offshore wind	+	+	+	+	+	+	+++++	
	3.3 Ocean renewable energy (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 minerals mining	+	+	?	+	+	?	++++	
	3.7 Securing fresh water supply (desalination)	?	0	?	+	?	+	++	
4. Leisure, working and living	4.1 Coastal tourism	0	0	+	0	+	0	++	
	4.2 Yachting and marinas	+	+	+	0	+	0	++++	
	4.3 Cruise tourism	+	+	+	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	+	+	+	+	+	+	+++++	
	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 3.6 Top-7 sub-functions based on future potential

Rank	Sub-function	Score
1	2.4 Blue biotechnology	6+
	3.2 Offshore wind	6+

Rank	Sub-function	Score
4	5.1 Protection against flooding and erosion	6+
	3.3 Ocean renewable energy (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 ⁴	4+

3.4 Resulting sub-functions to be analysed in-depth

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

Table 3.7 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 Coastal tourism	3.2 Offshore wind	2.4 Blue biotechnology
1.1 Deepsea shipping	4.3 Cruise tourism	3.2 Offshore wind
1.2 Shortsea shipping (incl. RoRo)	3.7 Securing fresh water supply (desalination)	5.1 Protection against flooding and erosion
3.1 Offshore oil and gas	1.2 Shortsea shipping (& 1.1 deepsea shipping)	3.3 Ocean renewable energy (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 Marine aquatic products	6.3 Environmental monitoring
2.1 Catching fish for human consumption	5.1 Protection against flooding and erosion	3.6 Marine minerals mining

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

A total of 13 sub-functions has been selected out of this list. To arrive at a final selection first a number of sub-functions have been combined since they are logically connected.

- 4.2 Yachting and marinas seems to be growing mainly in combination with coastal 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 Coastal 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.

⁴ 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.

The list of sub-functions was then 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

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 Marine aquatic products
- 2.4 Blue biotechnology
- 3.1 Offshore oil and gas
- 3.2 Offshore wind
- 3.3 Ocean renewable energy (wave, tidal, OTEC, thermal, biofuels, etc.)
- 3.6 Marine minerals mining
- 3.7 Securing fresh water supply (desalination)
- 4.1 + 4.2 Coastal tourism i.c.w. yachting and marinas
- 4.3 Cruise tourism
- 5.1 Protection against flooding and erosion (renamed coastal protection)
- 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

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 although it is larger than 1.2 Shortsea shipping, but the latter was chosen because of its 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 of the main report).

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, which has been renamed coastal protection..

Additionally the following is noted:

- 1.2. Shortsea shipping: with respect to RoRo traffic we have also included RoRo ferry services with the remark that data did not always allow to distinguish between pax/RoRo ferries completely.
- 3.3 Offshore renewable energy 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.

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 above. This section 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 chapter 1, 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 statistical codes defined yet), and no time series available. For those, in several cases qualitative scores were applied as shown in chapter 3.

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 4.1 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	23	n/a
Shipbuilding	9	10	9	9	10	10	11	13	13	n/a
Port Services	85	97	102	107	123	130	142	154	139	n/a
Total	107	122	125	132	154	159	173	188	175	n/a

Source: Eurostat database (2012)

Data for 2008 are excluding Cyprus and Greece.

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 5.8% on the above time series (growth from 123 to 175 bn EUR GVA).

For employment data, the same level of data is available, as presented in the next table.

Table 4.2 Employment maritime transport and shipbuilding (FTE * 1000)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Shipping	132	119	114	132	133	131	145	142	120	n/a
Shipbuilding	203	189	227	236	224	228	239	246	215	n/a
Port	1.433	1.586	1.693	1.727	1.845	1.944	2.001	2.086	1.852	n/a

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Services										
Total	1.769	1.895	2.035	2.095	2.204	2.304	2.386	2.475	2.155	n/a

Sources: Source: Eurostat database (2012) (Port services: number of employees)

Not all countries are covered in the data set. Data for 2008 exclude Cyprus, Greece and the UK, data for 2005 and 2007 exclude Denmark. Data for 2004 and earlier years exclude a number of countries. Shipbuilding employment data for 2008 are not available yet in FTE terms but are given total number of employees. Data on employment in ports are based on number of employees rather than FTE for all years given.

On this time series, the compound annual growth rate (CAGR) has been calculated taking the latest 5 years for which consistent data is available, e.g. 2002 to 2007 (data of 2008 are not based on FTE). 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 (Stena Lines, 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 4.3 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 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 in 2007 of (2,475 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. 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 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 4.4 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 (2012)

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. For allocating the employment and value added data for 2008 the same ratio has been applied.

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 97 bn EUR for deepsea shipping, 57 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 2008 the sector accounted for 7.9 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), which has reduced to about 36 thousand applying the decline ratio in actual number of employees terms (based on Eurostat, 2012).

Time series for both value added and employment could not be used due to incompleteness. 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 4.5 GVA (mln EUR) of fishing and fish processing

Added value	2003	2004	2005	2006	2007	2008
Fishing	3,043	3,247	3,652	3,860	3,606	
Fish processing	3,735	3,782	3,977	3,955	4,330	

Added value	2003	2004	2005	2006	2007	2008
Total	6,778	7,029	7,629	7,815	7,936	7,800

Source: Eurostat database (2011), Anderson and Guillen (2009). Incomplete coverage of countries.

CAGR over this period amounts to 2.6%.

Employment data also distinguishes between fishing and processing, and is as follows.

Table 4.6 Employment (in FTE) in fishing and fish processing.

	2003	2004	2005	2006	2007	2008
Fishing sector	159,405	131,832	140,877	135,401	119,760	97,812
Fish processing	118,479	116,437	117,296	116,876	116,314	94,998
Total	277,884	248,269	258,173	252,277	236,074	192,810

Source: Eurostat database (2011). Incomplete 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. Marine aquatic products

For this sub-function, data on the production value of aquaculture is available, but not on the added value.

Table 4.7 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. This number is expected to have grown over the past 5 years.

2.4. Blue biotechnology

Economic size today is limited and data scarcely available. A ballpark figure of 0.8 bn is estimated based on the assumption at one third of global activity is taking place in Europe, and the global total to be 2.4 bn (Lloyds Evans 2005). No employment data was found but given the size of value added it is estimated at 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. Offshore oil and gas

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 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. These assumptions result in a production value of 107-123 bn EUR. See further the sub-function report on oil and gas (annex 4).

The growth of oil and gas added value and employment is based on the production volumes. Below table gives the figures applied.

Table 4.8 Production volumes of oil and gas (in 1000 tons of oil equivalent)

	2000	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 (2012)

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.

The growth of offshore wind added value and employment is based on the production volumes. Below table gives the figures applied.

Table 4.9 Electricity production from wind energy (onshore and offshore) (in 1000 tonnes of oil equivalent)

	2000	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 (2012)

CAGR amounts to 21.7% over the last 5 years (2003-2008).

3.3. Ocean renewable 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 approximately 1,000 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 the table below. The share of offshore is estimated at 2-3% based on specific data for several countries.

Table 4.10 Aggregate mining economic size (in mln EUR and number of persons)

	2000	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	24.169
Production value	18.911	20.428	19.994	20.923	23.178	25.803	27.276	26.356	23.672
Employment	121.373	128.981	137.028	139.071	138.186	138.224	141.564	134.375	134.400

Source: Eurostat database (2011)

The growth of offshore aggregate mining is based on the production value (onshore and offshore). This results in a CAGR (2003-2008) of 0.4% for value added (production value) and -0.7% for employment.

3.6. marine minerals mining

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 time series on this sub-function were found, but sector reports indicate growth figures.

4. Leisure, working and living

4.1. Coastal 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 4.11 Number of hotel nights in EU countries (* mln)

	2000	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 tourism

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 the main report this sub-function is not considered for the selection.

4.5. Living

As mentioned in the main report this sub-function is not considered for the selection.

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. Based on the available 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%.

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.

5.3. Protection of habitats

No generic statistics on this sub-function were found, but sector reports indicate growth figures.

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.

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.

6.3. Environmental monitoring

No generic statistics on this sub-function were found, but sector reports indicate growth figures.

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 4.12 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	98	106	98	1.204	1.402	1.346
	1.2 Shortsea shipping (incl. RoRo)	57	63	57	707	823	790
	1.3 Passenger ferry services	20	18	17	200-300	n/a	n/a
	1.4 Inland waterway transport.	7.9	6.1	5.5	36	43.4	43.5
2. Food, nutrition, health and eco-system services	2.1 Catching fish for human consumption	8.7	7.9	7.8	220	236	252
	2.2 Catching fish for animal feeding	0.3	0.2	0.2	6.0	5.7	6.6
	2.3 Marine aquatic products	0.5	3.0	2.8	80	n/a	n/a
	2.4 Blue biotechnology	0.8	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 Offshore oil and gas	107-133	n/a	n/a	25-50	n/a	n/a
	3.2 Offshore wind	2.4	n/a	n/a	35	n/a	n/a
	3.3 Ocean renewable energy (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.)	0.6	0.7	0.7	4.3	4.3	4.5
	3.6 Marine minerals mining	<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 Coastal 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 tourism	14.1	n/a	n/a	143	n/a	n/a
	4.4 Working	4.108	3.886	3.678	89 mln	88 mln	85 mln
	4.5 Living	n/a	n/a	n/a	205 mln	203 mln	196 mln
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	6.1 Traceability and	0.6-3	n/a	n/a	5-10	n/a	n/a

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
monitoring and surveillance	security of goods supply chains						
	6.2 Prevent and protect against illegal movement of people and goods	1-3	n/a	n/a	10	n/a	n/a
	6.3 Environmental monitoring	4	n/a	n/a	25	n/a	n/a

As explained in chapter 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 4.13 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	5.8%	8.5%	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	2.6%	4.0%	n/a	-4.0%	-4.0%	n/a
	2.2 Catching fish for animal feeding	-3.0%	-5.8%	n/a	-0.5%	n/a	n/a
	2.3 Marine aquatic products	2.6%	4.6%	n/a	-4.0%	n/a	n/a
	2.4 Blue biotechnology	+	n/a	n/a	+	n/a	n/a
	2.5 Agriculture on saline soils	+	n/a	n/a	+	n/a	n/a
3. Energy and raw materials	3.1 Offshore oil and gas	-4.8%	-5.0%	-4.2%	-4.8%	-5.0%	-4.2%
	3.2 Offshore wind	21.7%	23.9%	25.0%	21.7%	23.9%	25.0%
	3.3 Ocean renewable energy (wave, tidal,	+	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
	OTEC, thermal, biofuels, etc.)						
	3.4 Carbon capture and storage	+	n/a	n/a	+	n/a	n/a
	3.5 Aggregates mining (sand, gravel, etc.)	0.4%	5.9%	8.1%	-0.7%	-0.4%	1.9%
	3.6 Marine minerals mining	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 Coastal 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 tourism	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 chapter 3 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.



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