Assessment of pressures impacting the open sea environment of the WP6 Pilot cases in socio-economic terms

Deliverable Nr. 1.4

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EXECUTIVE SUMMARY / ABSTRACT

This report presents the economic and social analysis of the human activities which exert pressures on marine ecosystems of three of the pilot cases areas: Balearic Sea and Gulf of Lyon, Aegean Sea/Saronikos Gulf in the Mediterranean and Western Black Sea. Analysis has been done on main marine sectors such as fisheries and maritime transport and ports, submarine cable and pipeline operations and marine hydrocarbon (oil and gas) extraction.

This work completes identification of human pressures and their impact on marine ecosystems carried out in parallel, both being preliminary to the design of programme of measures to achieve or maintain good environmental status (GES). This is done in the background of the experimental implementation of an innovative Adaptive Policy Framework in these pilot cases areas. Methods for socioeconomic assessment have been adapted from guidance issued for the MSFD implementation. It was also attempted to estimate the cost of degradation due to differences between the present environmental status and the GES to be achieved. Another innovative feature is that human activities impacting open waters, defined as those beyond 200m depth were distinguished from those impacting coastal waters. This approach is in coherence with the distinctive characteristics of these two categories of ecosystems but raised difficulties due to lack of data and its limited relevance when designing programme of measures, rather framed by the jurisdictional responsibilities. Gap analysis has shown that part of required data to perform these assessments are missing or not publicly available, especially those needed to assess value added and employment wages as well as the cost of degradation, even if the initial assessments performed by Member states for the MSFD have provided a lot of new data.

SCOPE

The EU Marine Strategy Framework Directive (MSFD) 2008/56/EC presents a further set of challenges in its requirements relating to marine environmental policy. Article 8.1 (c) calls for 'an economic and social analysis of the use of those waters and of the cost of degradation of the marine environment'. It is within this scope, and the further interest in socio-economically assessing the pressures impacting the Mediterranean and Black Sea marine and coastal environments, that the deliverables of WP1, task 2 D1.2 and D1.4 have been delivered. This deliverable follows the D1.2, the scope of which was the whole Mediterranean and Black Seas, and provides a focus on the WP6 Pilot cases areas, thus preparing the experimentation of the PERSEUS Adaptive Policy Framework (APF) in these Pilot cases. As for the D1.2, this deliverable presents distinctly the main activity sectors possibly impacting ecosystems in open sea (>200m), D2.3 of WP2, task 2 dealing more specifically on coastal areas.

This analysis focusing on the Pilot Cases is an extension of the DoW, possible because D1.2 went far beyond the gap analysis requested by the DoW, and will provide a useful background for the testing of the APF planned in Task 6.4.

1 INTRODUCTION

1.1 The MSFD context

As already recalled in the Scope of this report, the EU Marine Strategy Framework Directive (MSFD) 2008/56/EC presents a further set of challenges in its setting out of community action relating to marine environmental policy. The MSFD, in particular, requires EU MS to perform an economic and social analysis for describing the economic importance of sectors that impose pressures on, or benefit from, marine ecosystems, and the costs imposed on society because of the degradation of these ecosystems. This information is then used for supporting the selection of measures that will cost-effectively contribute to improving the ecological status of marine ecosystems. More precisely, Article 8.1 (c) calls for 'an economic and social analysis of the use of those waters and of the cost of degradation of the marine environment'.

All uses of the waters have economic, social and environmental dimensions which are even interconnected. However, each and one of these dimensions mostly seek to achieve sustainability, which implies maximizing its capacity and outcomes (in economic, social and environmental terms).

Social and economic indicators may be useful as tools by providing criteria for a better management as imbalances, on those and other indicators may cause unsustainability and resources limitations.

Therefore, the assessment of the pressures impacting the environment of the WP6 Pilot cases in socio-economic terms will allow us not only to give an answer to the MSFD requirements, but also to acknowledge the socio-economic issues that arise from certain pressures impacting the marine environments at the PERSEUS WP6 Pilot Case areas, named as: The Balearic Sea and Gulf of Lyon; the Northern Adriatic Sea; the Aegean Sea/Saronikos Gulf and the Western Black Sea.

The social and economic assessment of a marine or coastal zone set of issues must be underpinned by biophysical research and data relating to the various ecosystem processes, structures, stocks, flows and dose response relationships. Together, the socio-economic and environmental assessments would, however, serve to identify data gaps and could set the foundations for a more extensive analysis which would facilitate the decision making process for policy-makers (Turner et al., 2010).

1.2 Links with other deliverables

This deliverable, D1.4, is the second of the Task 1.2 (Analysis of socio economic activities in open sea areas) which is included in the Work package 1 (Pressures and Impacts at Basin and Sub-basin scale) of the PERSEUS project. The spatial scope of this deliverable is the WP6 Pilot Cases areas. It is worthwhile to mentions that this deliverable, although understandable by itself, is strongly linked to some other deliverables of the WP2 and WP1 of the project.

D1.4 follows the deliverable D1.2 untitled "Pressure in the SES open waters, gap analysis on data and knowledge". Deliverable D1.4 have the same objective and the same time line as the deliverable D2.3 of the Task 2.2 (Analysis of socio-economic activities in the coastal areas) untitled "Assessment of pressures impacting the environment of the WP6 Pilot cases in socio-economic terms", the only difference being that the first was devoted to the coastal areas whereas the second is dedicated to the open sea.

It should be noted that the analysis of the pressures in socioeconomic terms have been never attempted before at the scale of the Mediterranean Sea and the Black Sea. When done elsewhere, generally at national scale, no distinction has been done so far between coastal waters and open sea.

When working on D1.2 and D2.2, it appeared clearly the distinction between coastal areas and open sea, defined as areas where the depth is deeper than 200m, was relevant regarding ecosystems but without incidence on the way to analyse pressure in socio-economic terms. Moreover socioeconomic data are currently collected irrespectively of the water depth and thus analyses of pressures on coastal areas or open sea can only be derived from the analysis of pressures on the marine waters as a whole. In order to avoid useless duplication of text, it has been decided to develop the complete analysis in D2.2, including both coastal areas and open waters presented distinctively as far as possible and to focus D1.2 on the open sea specificities.

The same approach has been followed for the deliverable D2.3 and D1.4, the first one presenting the analysis done for coastal areas and open waters, the second being devoted on the open waters.

D2.3 and D1.4 follows also the same methodology as for the D2.2 and D1.2 adapting to the PERSEUS case guidance provided by the Working Group on the Economic and social analysis established in the setting out of the MSFD Common Implementation strategy (CIS).

The main difference between D2.3 and D1.4 on the one hand and D2.2 and D1.2 on the other hand is the spatial scope: D2.3 and D1.4 are focusing on the WP6 Pilot cases areas although D2.2 and D1.2 were dealing with the Mediterranean Sea and the Black Sea at basin and sub-basin scales.

Furthermore, the socioeconomic analysis delivered in this report complements the ecological assessment of pressure presented in D1.1, Pressures and their impacts on the SES open water ecosystems, Gap Analysis- Preliminary report and in the similar deliverable on the coastal areas (D2.3), as well as the ensuing characterization of the main risks of non-achievement of the Good Environmental Status (GES) in the WP6 Pilot cases areas carried out within the Task 2.1 and T 1.1 (Milestone M17, Identification of the socio economic issues to be treated by WP4) thus setting the background for the Task 6.4, Implementation of the PERSEUS Adaptive Policy Framework (APF) and lesson learned at Pilot cases level.

1.3 Objectives of the deliverable

In this context, the objectives of the work underlying this deliverable are:

- Makes an economic and social analysis of the use of the waters and of the cost of degradation of the marine environment, waters being here a generic term including the seabed and subsoil;
- Carry out this analysis at the scale of the WP6 Pilot cases,
- Covers as distinctly as possible the open sea

- Following methods in coherence with the recommended for the MS initial assessment
- Using existing and available data and in particular the MSFD EU Member State initial assessments, when relevant,
- Be complementary of the work done under the T1.1 (Identification of pressures and processes and their impact on the ecosystems and gap analysis) and so be focused on the open sea areas.

1.4 Content of the deliverable

The report is divided into five chapters. After the Introduction, chapter 2 presents the methodology used, details the spatial scope of the work, discusses the distinction required between open waters and coastal areas and defines the range of the economic and social analysis of the drivers and pressures impacting the marine and coastal waters. The following chapter 3 provides views on the data used to perform the socio economic assessment. Chapter 4 and chapter 5 present respectively the socioeconomic analysis of marine activities and the cost of degradation as far as possible at Pilot Case scale. Final chapter 6 presents conclusions of the study in terms of findings and next steps.

2 METHODOLOGY

2.1 Scope of the analysis

The scope of the socio economic analysis of pressures on marine waters in the present report follows the preliminary analysis of issues at risk of non-achievement of GES in SES (see Deliverable D6.2) by focussing on the following sectors possibly using or impacting marine waters.

- Fisheries
- Maritime transport and cruises
- Submarine cable and pipeline operations
- Marine hydrocarbon (oil and gas) extraction

Fisheries constitute a predominant market sectors substantially depending on a resilient marine environment while at the same time impacting on it. For other sectors, the status of the marine environment is not essential.

A consistent, economic and social analysis of the uses of waters has been performed for all these sectors. Effort has been undertaken to quantify as fully as possible the parameters describing the socio-economic importance of the sectors examined but wherever this is not possible - within the time and resource constraints of the present research - analysis takes a more qualitative aspect. Studied parameters include:

- Production parameters
- Production value
- Gross value added (when possible), and
- Employment

Finally, the cost-of-degradation objective is to provide a first assessment of the gap between present status and GES for marine environments in SES in the Pilot Case areas. Cost of degradation will be assessed on the basis of information available in the national preliminary assessment reports of MS, supplemented by information on marine non-market valuation assembled within research in task 6.3 (Deliverable D6.8).

At this stage of our research, the overall analysis referring to both the economic characterization of marine uses and sectors as well as the cost of degradation intents to fulfil the needs of a gap analysis, and when possible to provide assessments. It does not pretend to present new data and/or methodological applications in relation to the issue of socio-economic assessment of pressures in the SES marine environment.

2.2 Coastal and open waters

In agreement with the European Nature Information System (EUNIS), the PERSEUS DoW defines the coastal domain as the one including the continental shelf, broadly the marine area from a depth of 0 to 200 m. This is in coherence with most of the marine ecosystem processes, which are different in the two domains. However, this distinction is not present in the MSFD approach which should be implemented by MS in marine water under national jurisdictions without specific distinction between coastal and marine waters, in line with the objective to develop national programs of measures aiming to achieve or maintain GES, while insuring a regional cooperation.

In the Mediterranean Sea, where few EEZ have been claimed due to the complexity of many territorial situations, waters under national jurisdiction range from 12 nautical miles (nm), or less in straights, up to a theoretical maximum of 200 nm (Montego Bay convention) in case of EEZ. This situation could change, as illustrated by the recent claim by France of an EEZ in the Mediterranean Sea, replacing a former Ecological Protection Zone (EPZ). More recently, Italy has deployed an EPZ in the Western Mediterranean and Spain has also claimed its EEZ for the Mediterranean Sea, with potential disputes with the French EEZ. It should be noted that if each Mediterranean Country would deploy its maximum EEZ, the whole Sea would be under National jurisdictions, as it is the case for the Black Sea.

This distinction also increases the data constraints as most of the statistics related to marine activities exercising pressure on marine ecosystems are assessed in reference the waters under national jurisdictions, without taking depth into consideration.

A pragmatic examination of the marine activities shows that most of them are mainly impacting coastal areas (see Table 1). Practically, it has been decided that most of the assessments presented in the D2.3 deliverable deal distinctly with coastal waters and open sea areas giving thus a complete picture, while the open sea deliverable (D1.4) is mostly devoted to qualitative considerations about the impacts of some marine activities in open sea. The same convention regarding the segregation between coastal areas and open sea activities has been adopted for the D2.2 (Coastal areas and open sea) and the D1.2 (open areas).

Table 1. Broad analysis of the coastal sea / open sea segregation of human marine activities

Marine Activities	Coastal Sea (< 200 m depth)	Open sea (>200 m depth)
Fisheries	All	Focus on some high sea species.
Aquaculture	All	
Maritime transport, cruises and ports	Coastal shipping	High sea shipping (Quantitative considerations when possible)
Recreational activities and coastal tourism	All	
Underwater pipeline and cables	Coastal sea lay out and operations (if segregation possible)	High sea lay out and operations (Quantitative considerations when possible)
Oil and gas offshore extraction	Most	Few deep sea explorations (Quantitative considerations when possible)
Desalinisation	All	
Population, Urban areas and WWTPs	All	

2.3 Spatial considerations

In order to identify pressures and drivers, the spatial aspect of the analysis needs to be determined. This is a key consideration, given an assessment results may be markedly different depending on the scale at which it is carried out. It is also important that the chosen geographic assessment scale allows for the evaluation of the functioning of ecosystem at the scale where they may be compromised. For these reasons, the PERSEUS project considers different geographic scales from the SES basins to local pilot cases areas and distinguishes coastal waters from open waters.

There are some differences with the approach to be followed for the implementation of the MSFD, for which each Member State should "develop a marine strategy for its marine waters which, while being specific to its own waters, reflects the overall perspective of the marine region or sub region concerned". One of the main objectives of PERSEUS being to promote across the SES the MSFD principles, these differences and their practical consequences have been considered for this study in terms of definition of the Mediterranean sub regions, and their relationships with the marine waters under the jurisdiction of the riparian states. Moreover reporting format of pressures is necessarily influenced by the fact that most of the publically available socioeconomic data are generally collected at the levels of national administrative territorial units. Finally this specific study should prepare the work to be done in the WP6 sub regional Pilot Cases.

2.3.1 Mediterranean sub regions

First tasks of the WP1 (Pressures and Impacts at basin and Sub basin scale) dealing with the open sea and of the WP2 (Pressures and impacts at coastal level), the conjoint initial analysis of pressures and process and their impacts on the ecosystems have been chosen to be presented at the intermediate scale of large sub-regions for the Mediterranean Sea and of the sea as a whole for the Black Sea. In order to be compatible with the deliverables resulting of these tasks, the same intermediate scale has been adopted for the reporting of the pressures in socio economic terms in D1.2 and D2.2.

The PERSEUS marine sub-regions are:

- The West Mediterranean
- The Central Mediterranean
- The East Mediterranean
- The Black Sea

These sub-regions are not strictly those stated in the Article 4.2 of the MSFD regarding the Mediterranean Sea:

- The Western Mediterranean Sea
- The Adriatic Sea
- The Ionian Sea and the Central Mediterranean Sea
- The Aegean-Levantine Sea

The Mediterranean Action Plan, in charge of the application of the Barcelona Convention, is currently implementing an Ecosystem Approach for the management of human activities has selected the same sub region breakdown (see Figure 1.).

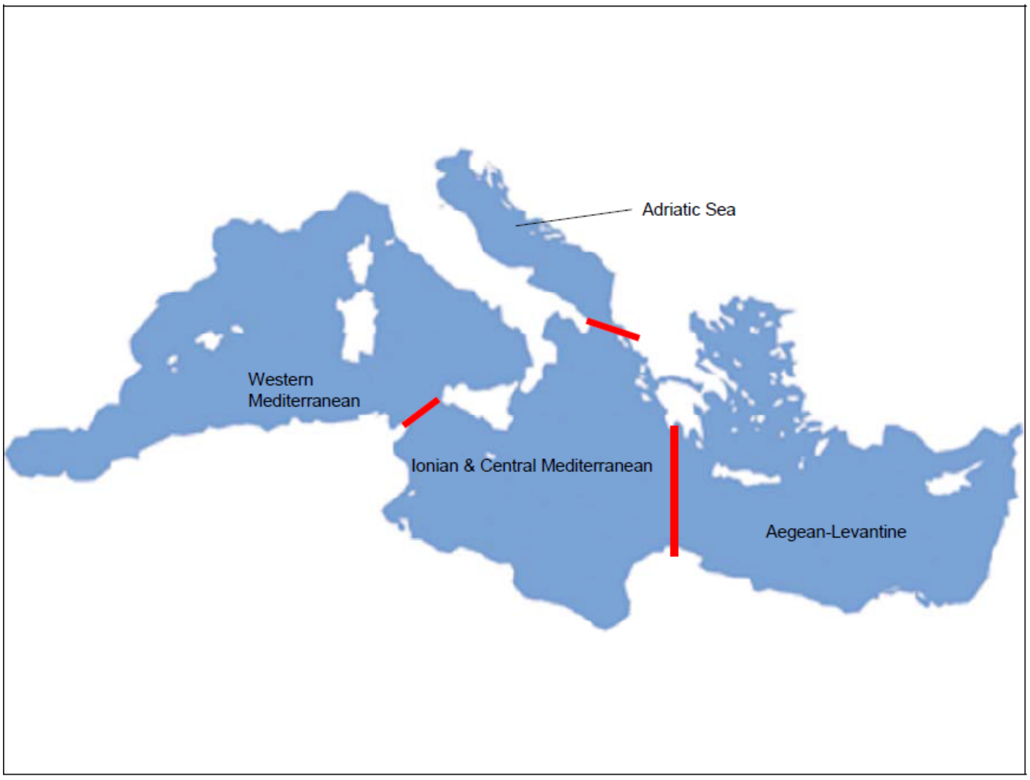

Figure 1. MSFD and MAP Mediterranean sub-regions Source: UNEP/MAP, 2011.

2.3.2 The WP6 Pilot Cases

This assessment should also prepare the work to be done in the WP6, "Adaptive policies and scenarios", which aims to develop an Adaptive Policy Framework to be implemented and tested in four sub-regional Pilot Cases and at basin scale.

The building of adaptive policies requires having a good knowledge of the socioeconomic context in which these policies will be implemented. As such, Article 8(c) of the MSFD requires Member State to provide an economic and social analysis of the use of the waters and an assessment of the cost of degradation of the marine environment, which shall be carried out as a part of the initial assessment to prepare the development of marine strategies aiming to reach or maintain GES.

In this context, the PERSEUS three of the four Pilot Cases are examined, namely:

- the Balearic Sea and Gulf of Lyon (abbr. W. Med)
- the Northern Adriatic Sea (abbr. N. Adriatic)
- the Western Black Sea (abbr. W. Black Sea)

The fourth WP6 Pilot Case, the Aegean Sea/Saronikos Gulf (abbr. Aegean) is out of the scope of this deliverable focusing on Open Sea, as completely included in the coastal domain, with depth inferior to 200m.

They presented in Figure 2. Some details regarding the areas covered by the pilot cases are provided below.

Figure 2. The four WP6 Pilot Cases.

Balearic Sea and Gulf of Lyon

This Pilot Case includes the Balearic Sea, also known as Catalan Sea (i.e. the Community of Catalonia, the Community of Valencia and the Balearic Islands), and the Gulf of Lyon.

The Balearic Sea lies between the Iberian coast and the Balearic Islands in the north-western Mediterranean. At its southeaster it merges with the Alboran Sea, which is the westernmost element of the Mediterranean Sea. It is separated from the Tyrrhenian Sea to the east by Sardinia and Corsica and abuts the sea to the west. The bathymetry is dominated by the Balearic Abyssal Plain, which covers over 77,700 square kilometres, covering the majority of the basin floor at depths ranging from 2700 to 2800 meters (Hogan, 2013).

The Gulf of Lions is located in the north-western Mediterranean Sea, covering a total area of 20,000 square kilometres from the coastal area up to 2500 m depth (Indicators for the Seas, unknown).

Aegean Sea/Saronikos Gulf

The Aegean Sea is located between the Greek peninsula on the west and Asia Minor on the east. It is about 612 kilometres long and 299 kilometres wide, it has a total area of some 215,000 square kilometres (Britannica, unknown).

The Saronicos Gulf has an area of about 2,600 square kilometres and its maximum depth is 450 meters (Dassenakis et al., 2001).

Western Black Sea

The Western Black Sea involves the regions Sud-Est in Romania and Severoiztochen and Yugoiztochen in Bulgaria, thus stretching from the Danube delta to the Rezovo river. The EEZs of Bulgaria and Romania cover together nearly 65,000 square kilometres or roughly 15% of the Black Sea surface area (Sea around us, unknown). The shelf area is around 30,000 square kilometres with an average depth of 140 m (Lampert et al., 2007).

2.4 Environmental Risk analysis

The analysis of the ecosystem status and the analysis of pressures and impacts, presented in the D1.1 and D2.1 deliverables, has identified the most important environmental risks for not achieving GES in the Mediterranean and Black Seas, in relation to the 11 GES descriptors of the MSFD. These risks were categorized into risks in coastal and open sea areas (see for example Figure 3 and Figure 4) in order to be further analysed in the three selected pilot cases.

Although the environmental risks affect a number of the ecosystem services of the marine areas, both final (e.g. food provisioning, raw materials and energy, recreation, maritime transport) and intermediate (e.g. habitat, climate regulation, eutrophication mitigation, and resilience), due to the absence of appropriate data, at this stage, the cost of degradation for each of the four pilot cases was based on appropriate scaling of available information provided from the MSFD Initial Assessment reports of the Member States. For this purpose, the geographic area covered by each pilot case was considered.

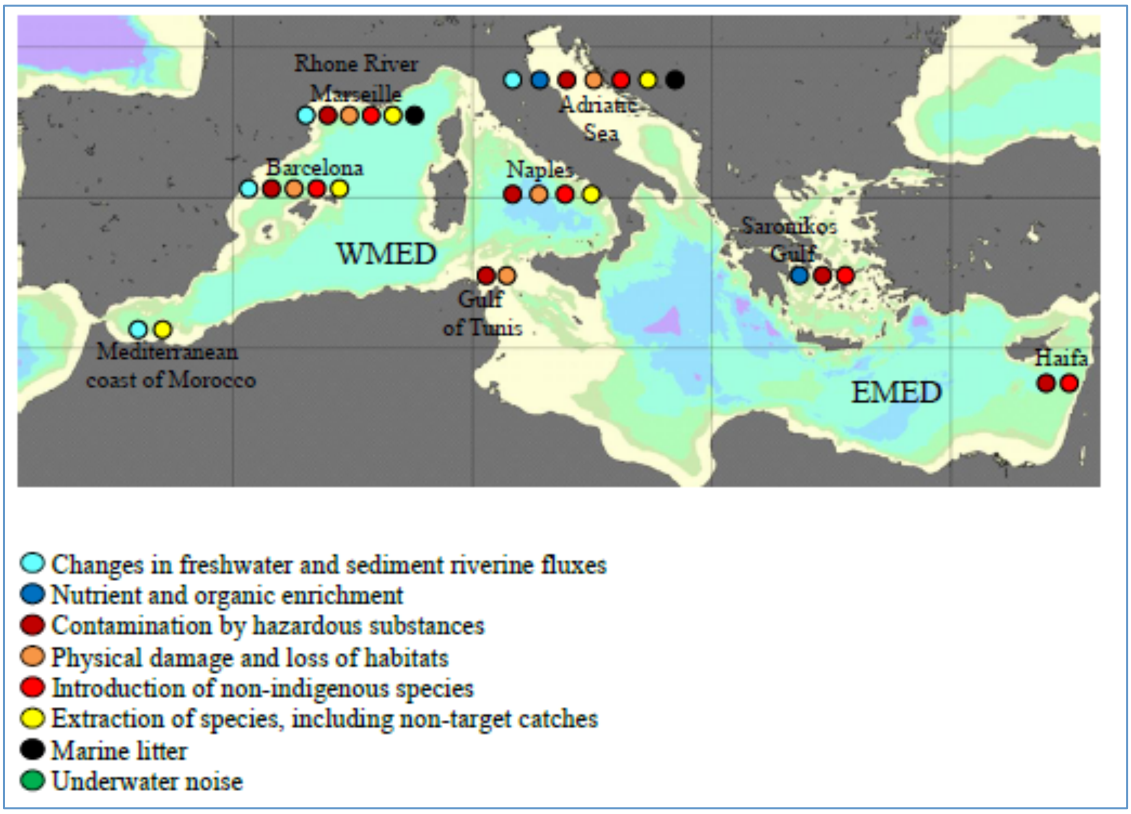

Figure 3. Areas identified as "most impacted" with regard to the investigated pressures in the Mediterranean Sea.

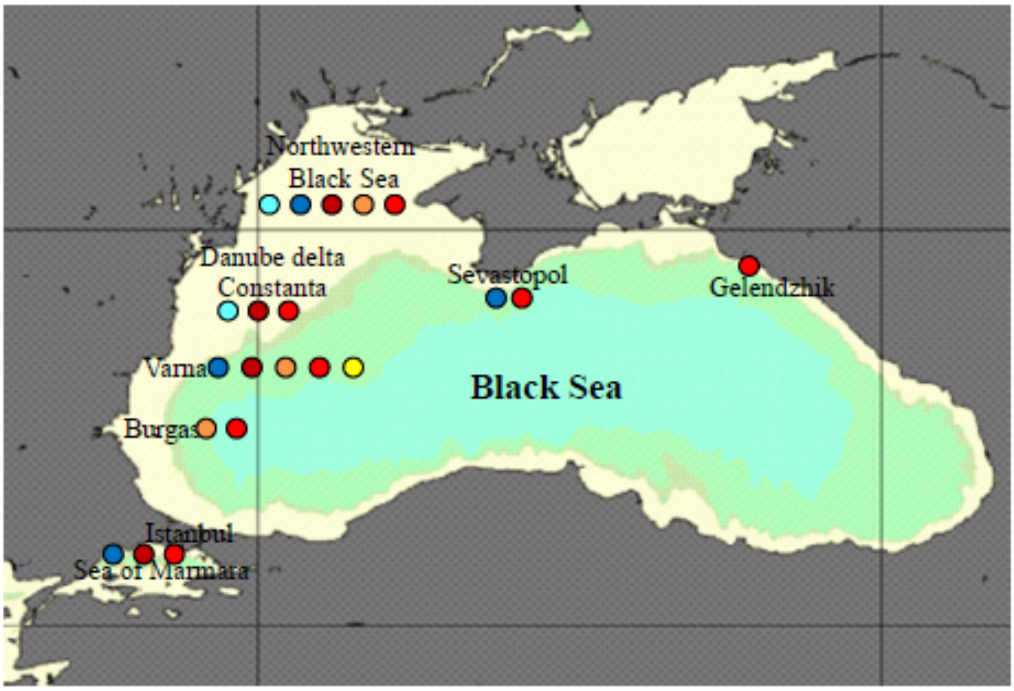

Figure 4. Areas identified as "most impacted" with regard to the investigated pressures in the Black Sea.

Main selected risks to be treated within the WP6 Pilot Cases are shown in Table 2, taking into consideration the environmental importance of the risks as well their adequacy with the strength of PERSEUS scientific expertise.

Table 2. Main risks identified per WP6 Pilot Cases by PERSEUS experts

Pilot cases	G.of Lion and Balearic sea		Northern Adriatic		Agean Sea, Saronikos Gulf		Western Black Sea	
Main Risks	Coastal	Open Sea	Coastal	Open Sea	Coastal	Open Sea	Coastal	Open Sea
Alteration of hydrographical conditions (D7)								
Chemical Pollution (D8, D9)	x		x				x	
Nutriments and organic enrichment (D5)							x	
Physical damanges and losses of habitats (D6)								
Introduction of non-indigenous species (D2)		x	x	x		x		x
Overfishing (D3)		x	x	x	x	x		x
Marine litters (D10)	x				x		x	
Underwater noise (D11)								
Jelly blooms (D1, D4)								

These risks are expressed as risks of excessive pressures to achieve or maintain GES if specific programmes of measures are not implemented. These pressures are induced by the main human activities potentially impacting marine environment.

Using the indicative list of human activities and their possible pressures on the marine environment of matrix in Annex 4 of the Commission working paper entitled "Relationship between the initial assessment of marine waters and the criteria for good environmental status" (EC, 2011a) it has be possible to derive the Table 3, indicating what are the main risks induced by each analysed activities per Pilot cases.

Table 3. Main risks induced by main human activities per WP6 pilot cases

Cases		Risks	Fisheries	Aquaculture	Martime T & ports	Recreationnal activities & tourism	Submarine cables	Offshore exploitation	Land based activities
W. Med /GL, BS	Coastal Areas	CP ML	ML	CP	CP ML	ML		CP ML	CP ML
	Open Sea	NIS OF	OF	NIS	NIS				
N. Adriatic	Coastal Areas	CP NIS OF	OF	CP NIS	CP NIS	NIS		CP	CP
AEGEAN	Coastal Areas	OF ML	OF		ML	ML		ML	ML
	Open Sea	NIS OF	OF	NIS	NIS				
W. Black Sea	Coastal Areas	CP ML	ML	CP	CP ML	ML		CP ML	ML
	Open Sea	NIS OF	OF	NIS	NIS				

Legend:

CP	Chemical Pollution (D8, D9)
NIS	Introduction of non-indigenous species (D2)
OF	Overfishing (D3)
ML	Marine litters (D10)

For example, main risks to be considered regarding the coastal area of the West Mediterranean case are Chemical Pollution (CP) and Marine Litters (ML). These pressures on the marine ecosystems are potentially induced by Fisheries (lost gears: Marine Litters), Aquaculture (Pharmaceutical contamination due to animals treatments: Chemical Pollution) Maritime transport and Port activities generate both Chemical contamination and Marine litters and so on.

These pressures are subject to specific analyses, including their trends for the years 2020-2030 in the paragraph "Links to environmental pressures" of each human activity presented in the chapter 0, Results of the socioeconomic analysis.

3 DATA

3.1 Data sources

Data on marine water uses and economic sectors are scattered in a variety of sources: EU publications, MS official statistical compendia, ad hoc databases within specific International Agencies and Conventions, private sector associations, marine NGOs, etc. WG ESA 2010 (pp. 49-61) provides a thorough listing of available data sources for European seas spanning EU-level and international organizations, regional sea conventions, programmes and projects. We note here two:

- The European Environment Agency (EEA[1]), which disseminates mostly physical data, and
- EUROSTAT[2] with a vast amount of economic information relevant to water management issues in the EU MS marine regions.

Complimentary to the above sources, the present report has been benefited by the specific non-market marine valuation database designed and populated within PERSEUS (see Deliverable D6.8). The marine valuation database of PERSEUS covers peer reviewed published literature on marine ecosystem good and services in Mediterranean and Black Sea.

[1] www.eea.europa.eu

[2] http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/

3.1.1 National initial assessment of Member States

Relevance of the National Initial Assessments for this study

The MSFD provides that Member States (MS) may, in order to take into account the specificities of a particular area, implement this Directive by reference to subregions. It is in particular the case of the initial assessments due by the MS for July 2012. WP6 Pilot cases have not been sized initially to fit to national waters or MSFD subregions. However, Table 4 shows that differences between WP6 Pilot Cases areas and aggregation of the closest MS subregions are nil (cases of East Mediterranean and west Black sea) or small.

In consequence, it has been considered that MS initial assessments could be used for the socioeconomic analysis of the WP6 Pilot cases. However, MS initial assessments do not take into consideration distinction between coastal areas and marine waters.

Table 4. Geographical scope WP6 Pilot Cases areas versus MSFD subregions

PERSEUS WP6 PC (D1.4, D2.3 scope)	Closest Member States MSFD subregions	Differences between MSFD subregions and WP6 Pilot cases
West Mediterranean (Gulf of Lion and Balearic Sea)	Spain (Levantine Balearic Area) France (Western Med)	In excess: Comunidad Autónoma Murcia and Provincia de Almeria In excess: Corsica
Northern Adriatic Sea	Italy (Adriatic) Slovenia Croatia	In excess: South of Adriatic Idem Idem
East Mediterranean (Aegean Sea/Saronikos Gulf)	Greece (Aegean-Levantine Sea)	Idem
Western Black Sea	Bulgaria Romania	Idem Idem

Progress of the MSFD initial assessments

The Initial Assessment reports of the Member States riparian of the PERSEUS Pilot cases were publicly available for this work, both regarding the Mediterranean Sea and the Black Sea, with the exception of Croatia.

It should be mentioned that Table 5 does not give any indication as to whether the notified reports conform to the requirements of the Directive, and the Commission intends to present an assessment report later in 2013.

Table 5. ESA IA reports for MS riparian of the Pilot cases

Italy:http://cdr.eionet.europa.eu/Converters/run_conversion?file=it/eu/msfd8910/madit/e

nvuxzwa/MSFD8cESA_20130506_101824.xml&conv=385&source=remote

Greece:http://cdr.eionet.europa.eu/Converters/run_conversion?file=gr/eu/msfd8910/madgr/envux5bcg/MADGR_MSFD8cESA_20130430.xml&conv=337&source=remote

France :http://cdr.eionet.europa.eu/Converters/run_conversion?file=fr/eu/msfd8910/mwefr/envuwqs1q/MWEFR_MSFD8cESA_20130405.xml&conv=337&source=remote

Spain :http://cdr.eionet.europa.eu/Converters/run_conversion?file=es/eu/msfd8910/mwees/envuwavra/MWEES-ESAL_MSFD8cESA_20130521.xml&conv=337&source=remote

Bulgaria :http://cdr.eionet.europa.eu/bg/eu/msfd8910/msfd4text/envubapw and

http://cdr.eionet.europa.eu/Converters/run_conversion?file=bg/eu/msfd8910/msfd4text/envubapw/art.8_I_SUMMARY_EN_1_.pdf&conv=tohtml&source=local

Romania: http://cdr.eionet.europa.eu/ro/eu/msfd8910/msfd4text/envux98hw

3.1.2 Other data sources:

In general, sources other than the MS countries initial assessment considered for this report have been:

- National Statistical Authorities
- Private sector and trade associations
- Non-European, international organizations (e.g. FAO, FishStat)
- Reports that inter alia contain data on SES marine sectors (e.g. Douglas-Westwood Ltd, 2005)

4 RESULTS OF THE SOCIOECONOMIC ANALYSIS

4.1 Fisheries

Prepared by Benjamin Boteler, ECOLOGIC and by Aleksandar Shivarov, BSNN for the Black Sea.

4.1.1 The context in the SES

It is generally agreed that the European fishing industry is in a state of severe decline. Additional losses to European fish stocks will have immense socio-economic consequences. Impacts to the industry are likely to include reduced fishing opportunities, increased illegal fishing, and decreased profitability resulting in a high level of government subsidy for the sector (EEA, 2010). Other consequences may include employment and income loss to fishing communities, reduced numbers of locally caught fish and higher dependency on imports meaning weakened food security. At the same time, fish consumption throughout Europe remains high and is even expanding. Aquaculture production is often considered a solution to help meet demand for fish and fishery products, yet it is unable to do so. Europe is only able to meet its demand for fish with imports (NEF, 2011). The fishing and aquaculture industry also represent a major challenge to policy makers and fisheries management. While capture fisheries are unable to meet demand, aquaculture also brings with it a number of questions regarding its sustainability and its contribution to fishing overcapacity, as it is dependent on caught fish for feed.

Reforming the European fishing industry requires reforming the Common Fisheries Policy, which is currently underway, and the management of European fish stocks and resources. This therefore also includes Illegal Unreported and Unregulated (IUU) fishing, which can be economically lucrative for fishermen and which not only contributes to the exhaustion of fish stocks but makes it more challenging to fisheries management because of unreported data. It is also recognised that many subsidies may stimulate the problems facing European fisheries management by creating artificial profits for the industry and adding to the problem of overcapacity. Spain, France, and Italy are among the top five receivers of fisheries subsidies in the EU.

In the following report the catch and socio-economic data of the countries bordering the areas of the PERSEUS pilot areas are used, referring to fishing activities in those regions. Most fishing activities are coastal fisheries.

Mediterranean fisheries are dominated by small-scale fisheries, as 82.0 % of the registered vessels in the Mediterranean are less than 12 metres long and therefore have a limited range and more appropriate for coastal fishing (Collet 2011). Thus, in the Mediterranean Sea, Member States generally tend to fish off their own coast and a majority of a country's catches are taken in the fishing areas adjacent to it.

The Black Sea hosts about 200 fish species (Black Sea Commission, 2009). However, no more than two dozen species have any significant economic value and they comprise 98% of the catch (between 1996-2008) (Shlyakhov and Daskalov, 2008). Only Bulgaria and Romania are EU Member States fishing in the Black Sea.

Intensive fishing and overfishing is a major environmental pressure and is causing losses of biodiversity and valuable marine resources and ecosystem services (e.g. food supplies). The effects of fishing on habitats are related to the physical disturbance by bottom gears in contact with the seafloor. These include removal of large physical features, reduction in structural biota and a reduction in complexity of habitat structure (leading to increased homogeneity). However, quantitative data for environmental impacts of different gear types are generally not available. Fisheries impacts may be direct, such as impacts on marine populations or habitats from unselective gear, destruction of the seabed or interactions with rare or endangered species. Fishing impacts may also be indirect, for example contributing to climate change via the carbon emissions of fishing vessels.

The concept of Maximum Sustainable Yield (MSY) has a long history in fisheries management. Conceptually, it calls for fisheries to make the best use of the productivity of the marine system. MSY is used rather loosely defined in political statements. According to the EU Common Fisheries Policy fish stocks should be brought to and maintained in healthy conditions, and exploited at maximum sustainable yield levels. These levels can be defined as the highest catch that can be safely taken year after year and which maintains the fish population size at maximum productivity. This objective is set out in the United Nations Convention on the Law of the Seas (UNCLOS) (UNCLOS, 1982), and was adopted at the 2002 World Summit on Sustainable Development as a world target for 2015.

This assessment was conducted by accessing publically available datasets. Statistics in regard to landings and catches were predominantly gathered from FAO Stat. Fleet specific statistics were collected from the 'Annual Economic Report on the European Fishing Fleet', which is produced by the Scientific, Technical, and Economic Committee for Fisheries (STECF) of the European Commission's Joint Research Centre.

4.1.2 Open sea fisheries

It should be noted that data issues remain a major challenge to assessing the socio-economics of European fisheries. The following, is therefore an attempt to provide a comprehensive overview of fishing in the Mediterranean Sea and Black Sea. It is very challenging to distinguish between coastal and open sea fisheries data, as statistics are collected by local authorities and often presented nationally. Moreover, most fisheries in the Mediterranean and Black Sea are considered coastal fisheries as these are defined as less than 200 metres depth. In this regard, the data represents a combination of data from various sources, though it can be assumed that the data is primarily covering coastal fisheries.

In regard to data on landings, open sea fisheries activities are defined as those targeting some specific species selected according to expert judgment (Pantazi M., HCMR, 2013, Pers. Com.)

<u>Pelagic fishes:</u>

- Bluefin tuna (Thunnus thynnus)
- Swordfish (Xiphias gladius)

Demersal fishes:

- Hake (Merluccius merluccius)
- Norway lobster (Nephrops norvegicus)
- Blue and red shrimp (Aristeus antennatus)
- Giant red shrimp (Aristacomorpha foliacea)

Landing data regarding these species have been extracted from the FAO Fishstat. However it has not been found any economic or social data specific to these species. For this reason, these indicators are presented indistinctly for coastal areas and open sea fisheries.

4.1.3 Sector and socio-economic analysis

This section provides information for three sections – sector, economic and social data. The analysis is made for the Black Sea and the Mediterranean Sea four pilot case areas. However, because data is only available on a National basis, the statistics presented here are according to national fleets. When possible, future projections are provided.

W. Med Sea

The Western Mediterranean Sea PERSEUS pilot area includes Spain and France. In the Western Mediterranean Sea pilot area, open sea waters contribute 7,750 tons of landings (7 % of total landings).

Sector Analysis

Table 6. Landing statistics for the Western Mediterranean Sea pilot area

	Open sea	Coastal areas	Total
	2010	2010	2010
Landings (t)	7,750	99,904	107,654

Source: FAO STAT, 2012 Notes: Fishing areas in the Balearic, Gulf of Lion and Sardinia. Data is for Spain and France. Open sea data includes France (European Hake and Norway Lobster), Spain (Blue and Red Shrimp, European Hake, Giant Red Shrimp, and Norway Lobster).

Fleet capacity statistics aggregate coastal areas and open sea.

Table 7. Sector statistics for the Western Mediterranean Sea pilot area.

	Spain	France	Total
	2011	**2010**	**2010**
Fleet			
Vessels (nr)	1,821	6,100	7,921
GT (1000)	142	164	306
kW (1000)	257	885	1,142
Effort			
Days at sea (1000)	n.a.	507	

Source: For France EC, 2012, for Spain: Ministerio de Agricultura, Alimentación y Medio Ambiente, 2013, Cataluña, Valenciana and I. Baleares

Economic Analysis

Economic analysis aggregates coastal areas and open sea.

Table 8. Economic statistics for the Western Mediterranean Sea pilot area (Million Euros).

	Spain	France	Total
	2011	**2010**	**2010**
Landings value	308	924	1,232
Gross value added [a]	141	503	644
Gross profit	119	116	235
Net profit excluding subsidies	29	39	68

Source: for France EC, 2012 for Spain: Ministerio de Agricultura, Alimentación y Medio Ambiente, 2013, Mediterrranean façade

Social Analysis

Social analysis aggregates coastal areas and open sea.

Table 9. Social statistics for the Western Mediterranean Sea pilot area.

	Spain	France	Total
	2010	**2010**	**2010**
Total employed	8,310	10,871	19,181
Full Time Equivalent (FTE)	7,279	8,410	15,689

Source: for France EC, 2012 for Spain: Ministerio de Agricultura, Alimentación y Medio Ambiente, 2013, Mediterrranean façade

North Adriatic Sea

In the following section, data on fishing activities in the North Adriatic pilot Case focus on fishing activities of Italy and Slovenia as they are main fleets active in the Adriatic. Italy has by far the largest share in total landings in the Adriatic Sea and generates the highest income with its fisheries sector compared to the other countries. Italian and Slovenian landings show an overall decreasing trend. The Slovenian fisheries sector is still negatively affected by the independence in 1991. The fisheries segment of small vessels is the most important segment in both Italy and Slovenia in terms of numbers of vessels and employed workers (EC, 2012).

Sector analysis

In the North Adriatic Sea Pilot case area, open sea waters provided about 3,223 tons, 3.5% of total landings..

It should be noted that all the North Adriatic Sea pilot area is included in the coastal area domain defined as areas where the depth is inferior to 200m. Open sea data are concerning here data on species generally fished in open sea and landed in the pilot case areas.

Table 10. Landing statistics for the North Adriatic Sea pilot area.

	Open sea	Coastal waters	Total
	2010	**2010**	**2010**
Landings (t)	3,223	90,784	94,007

Source: FAO STAT, 2012 - Notes: Fishing areas includes the Adriatic Sea. Includes data for Italy and Slovenia. Open sea data Includes data for Italy only (European Hake and Norway Lobster)

In 2011, 14 715 vessels were registered in Italy and 186 in Slovenia, see Table 11. In the Mediterranean, 35% of vessels registered belong to the Italian fleet. The capacity of the Italian fleet has followed a decreasing trend between 2008 and 2011. The number of vessels declined by 2% while the total GT and kW of the fleet declined by 7% and 3%, respectively during the same period (EC, 2012). The capacity of the Slovenian fishing fleet followed a stable trend between 2008 and 2011. The number of vessels increased by 3% (or 5 vessels) while total GT and kW both increased by 2% during the same period of time (EC 2012).

Fleet capacity statistics aggregate coastal areas and open sea.

Table 11. Sector statistics for the Adriatic Sea pilot area.

	Italy	Slovenia	Total
	2011	**2011**	**2011**
Fleet			
Vessels (nr)	14,715	186	14,901
GT (1000)	185	1	186
kW (1000)	1,236	11	1247
Effort [a]			
Days at sea (1000)	167	8	175

Source: FAO STAT, 2012; EC 2012
Notes: a, Days at sea for Italy and Slovenia is for 2010.

Economic analysis

In 2010 the total landings income for the Italian fleet was about €1115 million. This consisted of €1115 million in landings value and €22 million in direct subsidies (EC, 2012). In terms of landings, in 2011 European hake accounted for the highest value of landings (€90 million), followed by crustaceans (€84 million), European anchovy (€75.9 million) and then Deep water rose shrimp (€75.6 million) (EC, 2012). Demersal trawlers represent the most important fisheries segment in terms of value and volume of landings. In terms of profitability in 2010, the total gross value added (GVA) was €653 million, gross profit was €335 million and net profit (excluding subsidies) €114 million (EC, 2012). The subsidies that the Italian fleet receives vary across the years. In 2010 €22.2 million direct subsidies were received, accounting for 1.9% of the total income. In 2009 €12.6 million direct subsidies were received whereas in 2008 €30 million were received by the Italian fleet (EC, 2012).

The total amount of income generated by the Slovenian fleet in 2010 was €2.4 million (EC, 2012). Landings accounted for a value of almost 2€ million. The value of landings is stable since 2008. In 2010 European pilchard accounted for the highest value of landings (€0.57 million), making up 29% of the total landed value, followed by European squid (€0.28 million) and accounting for 14% respectively (EC, 2012). In terms of profitability, the total amount of GVA, gross loss and net loss generated by the Slovenian fleet in 2010 was €0,46 million, -€0,8 million and -€1,1 million, respectively, see Table 12 (EC, 2012). Data on previous years is not available. In 2008 €0.08 million direct subsidies were received, accounting for 3.3% of the total income. Since then no subsidies were received in Slovenia.

Economic statistics aggregate coastal areas and open sea.

Table 12. Economic statistics for the Adriatic Sea (Million Euros) pilot area.

	Italy	Slovenia	Total
	2010	**2010**	**2010**
Landings value [a]	1,115	2	1,117
Gross value added	653	0.46	654
Gross profit	335	-0.8	334
Net profit excluding subsidies	114	-1.1	113

Source: EC, 2012
Notes: a: Data for landings value i for Slovenia is for 2011;

Social analysis

In Italy the total employment was around 28982 jobs in 2010, equalling to 22 002 full-time equivalents (FTEs) (EC, 2012). The level of employment shows a stable trend between 2008 and 2010. The total number of employed decreased by 1% while the number of FTEs increased by 3%. In 2010 9789 fishing enterprises were operating in the Italian fleet. With 91% the greater part of these enterprises owned a single vessel. 7% of the enterprises owned two to five fishing vessels and only 2% of the enterprises owned six or more fishing vessels. Enterprises with more than 6 vessels are mostly represented in fishing cooperatives. The fisheries segment of passive gear, small vessels 6-12m is the most important segment in terms of numbers of employed workers.

In Slovenia, the fisheries sector insignificantly influences the national economy. It however has a social impact on employment within the sector. In 2010 total employment was 116 jobs and 82 FTEs in the Slovenian fleet (EC, 2012). Whereas the level of employment increased between 2008 and 2010, with the total number employed increasing by 6%. Living from marine fisheries became more difficult due to the reduction of fishing capacity, weight and value of landings. As a consequence the FTEs decreased by 3.5%. 134 fishing enterprises were operating in the Slovenian fleet in 2011. 62.7% of these enterprises owned a single vessel, 36.57% of them owned two to five fishing vessels. There existed only one fishing enterprise that owned six or more fishing vessels.

Table 13 below provides the statistics for the Italian and Slovenian fleets.

Social statistics aggregate coastal areas and open sea.

Table 13. Social statistics for the Adriatic Sea pilot area.

	Italy	Slovenia	Total
	2010	**2010**	**2010**
Total employed	28,982	116	29,098
Full Time Equivalent (FTE)	22,002	82	22,084

Source: EC, 2012

Projections

In Italy a reduction in the demand of seafood and a consequent reduction in fish prices were observed in 2010. As a consequence the economic performance of the sector showed a decrease. Moreover the landed volume of seafood shows a decreasing trend. As no relevant change has been registered in these factors, it is expected that the economic performance will also be influenced by those in 2011 and 2012 (EC, 2012).

In Slovenia number of vessels, GT and kW are expected to remain relatively stable in 2011 and 2012 (EC, 2012). Effort is expected to increase in 2011 and 2012, because of low fish stocks in the Adriatic Sea. Therefore landings are also expected to decrease in 2011 and 2012. Because of the fleet is old, reduced catches and increased costs may be expected, so that profit might decline in 2011 and 2012. Due to the poor profitability of the Slovenian fleet, no increases in GVA, gross profit and net economic profit is expected as well (EC, 2012).

Aegean-Levantine Sea

The Aegean-Levantine Sea pilot case area is focused on Greece. Greek fishing takes place in the territorial waters, the high-sea and the deep-sea. It is both commercial and recreational. Structural measures by the EU, the Common Fisheries Policy and other regulations concerning the Aegean Sea as well as declining fish stocks have led to a decrease in the Greek fishing fleet since 2000, with more than 90% of the fleet comprised of small-scale coastal fishing vessels (Kousta, 2012). The main fishing areas are inshore around the islands and along the extensive mainland coast, as well as certain areas of the Mediterranean. The fleet's quality has also decreased with a decrease in average tonnage and horsepower. The most common species landed in the Aegean Sea are the two pelagic species European anchovy and pilchard. The highest value of landings however comes from European hake, a deep-water demersal species. With more fishing vessels than any other country in the EU, Greece landed tonnage only makes up approximately 4.6% of the EU total. Significant data is missing for the Greek fleet and its corresponding fishing activities. No data was submitted to 'The 2012 Annual Economic Report on the European Fishing Fleet' compiled by the European Commission, and limited data was provided for 'The 2011 Annual Economic Report on the European Fishing Fleet'.

Sector analysis

The whole Greek fishing fleet, not only fishing in the Aegean Sea shows a decreasing trend since 2000. With 17 657 registered vessels in 2008, with a combined gross tonnage of 84.4 thousand GT and total power of 506.1 thousand kW, see Table 12, the Greek fleet has the most vessels in the Mediterranean and Black Sea. Its share of vessels in the EU fleet was 45% in 2009, but in terms of tonnage it corresponds to 19.5% of the total catches (Collet 2011).

The Cypriot fleet decreased significantly between 2008 and 2012, and the number of vessels decreased by 47%, total GT by 49%, and total kW by almost 44%.

In 2010 in the Aegean-Levantine Sea pilot area, 4,517 tons landings came from open sea, 7 % of total landings.

Table 14. Landing statistics for the Aegean-Levantine Sea pilot area.

	Open sea	Coastal waters	Total
	2010	**2010**	**2010**
Landings (tons)	4 ,517	65,266	69,783

Source: FAO STAT, 2012

Notes: Fishing areas includes the Aegean-Levantine Sea. Open sea includes data for Greece (European Hake and Norway Lobster).

Fleet capacity aggregate coastal area and open sea.

Table 15. Sector statistics for the Aegean-Levantine Sea pilot area.

	Greece / Total
	2008
Fleet	
Vessels (nr)	17,657
GT (1000)	84
kW (1000)	506
Effort	
Days at sea (1000)	2721

Sources: EC, 2011

In 2010, European anchovy accounted for the highest volume of landings in the Greek landings with 12,042 tonnes followed by European pilchard, a sardine species (6511 tonnes), hake (4601 tonnes) and bogue (3201 tonnes). The type of gear used in the Greek fleet are surrounding nets, seine nets, trawls, dredges, gillnets and entangling nets, traps, hooks and lines. In 2008 the Greek fishing fleet spent a total of 2721 thousand days at sea, showing a decreasing trend of 12% since 2003.

Economic analysis

The total amount of income generated by the Greek fleet in 2008 was €714.7 million, which consisted of €544 million in landings values (EC, 2011). These numbers refer to all Greek fishing activities, not only in the Aegean Sea. European Hake accounted for the highest value of landings (€84.7 million) by the Greek fleet, followed by swordfish (€53.7 million) and then European pilchard (€40.6 million) (EC, 2011). Recent data on the other profitability indicators is only available until 2006 (see Table 14). In 2006 the Gross Value Added (GVA) of the Greek fishing fleet was 591 million Euros, and the Economic profit € 477.1 million (EC, 2011).

The total income of the Cypriot fishing fleet in 2010 was 12.19 million Euros which was made up of 10.2 in value from landings. However, when including fleet expenditures, the fleet created a gross value added of -€5.7 million.

Economic statistics aggregate coastal area and open sea.

Table 16. Economic statistics for the Aegean-Levantine Sea pilot area (Million Euros).

	Greece / Total
	2008
Landings value	544
Gross value added	n.a.
Economic profit	n.a.

Source: EC, 2011

A study on the characteristics of small-scale coastal fisheries in Europe (Macfadyen et al. 2011) analysed the Greek fishing fleet according to the categories small scale fleet (<12 m) which predominantly fishes in coastal areas and large-scale fleet (>12 m) which mostly fishes in open sea areas. The study indicated an average value of landings between 2006 and 2008 of 601.1 million Euros for the small-scale fleet and 220.5 million Euros for the large-scale fleet. This shows that the small-scale fleet is economically more important than the large-scale fleet in Greece.

Social analysis

Social statistics aggregate coastal area and open sea.

Table 17. Social statistics for the Aegean-Levantine Sea pilot area.

	Greece/ Total
	2008
Total employed	23 862
Full time equivalents	n.a.

Source: EC, 2011

Total employment in the Greek national fleet was 23,862 jobs in 2008 (EC 2011). It shows a decreasing trend with a decrease of 15% between 2003 and 2008. Small-scale coastal fisheries employ the most people in the Greek fleet. Between 2006 and 2008 in average 21 608 people were employed in the small-scale sector (<12 m) whereas 4,163 people were employed in the large-scale fleet (>12 m) (Macfadyen et al. 2011). The Greek statistical authority estimates a total of 12169 employees in 2010 (EL.STAT, 2012). Seasonal employment however accounts for about 27.5% of the total employment (EC, 2011).

Western Black Sea

The Western Black Sea PERSEUS pilot area includes Bulgaria and Romania. The two EU member states with access to the sea account for about 2% of the total landings in the Black Sea during the period 2000-2010. The bulk of the catch, over 80%, goes to Turkey. Species listed by PERSEUS experts as being generally fished in open sea (see 4.1.2) being not in the records of Fishstat, all the catches in this pilot case are accounted as coastal.

Sector analysis

The coastal waters of the Western Black Sea contribute 9,899 tons of landings. The most common species landed in terms of weight and value in 2010 was Thomas rapa whelk and European sprat.

Table 18. Landing statistics for the Western Black Sea pilot area

	Open waters	Coastal areas	Total
		2010	**2010**
Landings (t)	Nil	9,900	9,900

Source: FAO STAT, 2012

In 2012, 1010 active vessels were registered in Bulgaria and 510 in Romania. The size of the Bulgarian fishing fleet has fluctuated between 2008 and 2012. There was a net increase of 18,3% in the number of vessels, while the fleet underwent a net decrease of 7.8% in total tonnage over the same period. A comparable increase in the number of the Romanian vessels by 16% was observed between 2008 and 2010, while the total tonnage and power of the fleet declined by 55% and 38%, respectively during the period. Both the Bulgarian and Romanian fleet are rather outdated with an average age of 22 and 17.4 years, respectively. (EC, 2012)

Table 19. Sector statistics for the Western Black Sea pilot area.

	Bulgaria	Romania	Total
	2011	**2011**	**2011**
Fleet			
Vessels (nr)	1010	488	1498
GT (1000)	5.0	0.9	5.9
kW (1000)	33.7	7.0	40.7
Effort			
Days at sea (1000)	16.1	6.5	22.6

Source: EC, 2012

Economic Analysis

The total amount of income generated by the Bulgarian fishing fleet in 2010 was €4.65 million. This consisted of €2.15 million from landings, €1.67 million in other income and €0,83 thousand in direct income subsidies. At the same time total fleet operating costs in 2010 amounted to €8.03 million, almost 173% of total income. In terms of profitability the Bulgarian national fleet performed negatively in 2010, generating an overall gross value added (GVA) of -€1.7 million. The Bulgarian fleet suffered a gross loss of € 4.2 million and a net loss (excluding subsidies) of €5.4 million in 2010. The data suggests that the profitability of the Bulgarian fleet has significantly worsened in recent years, due to a fall in income from landings accompanied by simultaneous increase in total operating costs in 2008-2010. The data for 2011 point at a slight recovery, leading to a smaller gap between income and expenditures. (EC, 2012)

The total income generated by the Romanian national fleet in 2010 was €0.49 million. It shrank by one third between 2008 and 2010. Total expenditure by the Romanian fishing fleet in 2010 was €0.45 million, amounting to 92% of total income. The largest expenditure items were fuel costs and wages. In terms of profitability, the total amount of GVA, gross profit and net profit generated by the Romanian fleet in 2010 was €0.24 million, €0.05 million and €0.03 million, respectively. The economic indicators improved slightly during 2011, mainly due to increased catches of Thomas rapa whelk. (EC, 2012)

Table 20. Economic statistics for the Western Black Sea pilot area (Million Euros).

	Bulgaria	Romania	Total
	2011	**2011**	**2011**
Landings value	2.70	1.41	4.11
Gross value added	-2.19	1.29	-0.9
Gross profit	-4.38	0.75	-3.63
Net profit excluding subsidies	-4.83	0.74	-4.09

Source: EC, 2012

Social Analysis

The total employment in the Bulgarian fishing sector was estimated at around 3933 jobs and 2889 full time equivalents (FTEs) in 2010 (EC, 2012). The data for 2011 point at 1668 FTEs (NAFA, 2012), which is more in line with the estimates for 2008 and 2009 – 1507 and 1430 FTEs, respectively (EC, 2012). At the same time other studies support the higher number of employed in the marine fisheries sector, indicating 3 430 jobs on average for the period 2006–2009. There were a total of 99 fishing enterprises in the Bulgarian fleet in 2011. The vast majority of them, 68%, owned a single vessel and 30% of enterprises owned two to five fishing vessels. Only 2 fishing enterprises owned six or more fishing vessels (EC, 2012). The processing sector provides about 2 230 jobs, nearly 90% of them occupied by women, mostly on a seasonal basis. The fishing sector may play an important role for the labour market in small coastal municipalities providing 5 to 7% of all local jobs. (EC, 2011c)

Total employment in the Romanian fleet was around 444 jobs and 403 FTEs in 2010. The level of employment increased between 2009 and 2010, with the total number of employed increasing by 53% and the number of FTEs increasing by 65% over the time period. The total number of fishing enterprises in the Romanian fleet was 105 in 2011. The vast majority of fishing enterprises, 83%, owned a single vessel and 19% of enterprises owned two to five fishing vessels. Only 3 fishing enterprises owned six or more fishing vessels. (EC,2012).

For both Black Sea countries the fishing sector has only a minor contribution to the national economy, but it may play a sizeable role in smaller coastal communities.

Table 21. Social statistics for the Western Black Sea pilot area.

	Bulgaria	Romania	Total
	2010	**2010**	**2010**
Total employed	3933	444	4377
Full Time Equivalent (FTE)	2899	403	3302

Source: EC, 2012

4.1.1 Links to environmental pressures

Pressures caused by Fisheries

Fisheries are associated with a variety of environmental pressures and impacts. These vary according to factors such as local ecosystem dynamics, intensity of fishing activities, and types of fishing practices used. The MSFD uses eleven descriptors of GES of marine waters. These descriptors include: 1) biological diversity; 2) non-indigenous species; 3) commercially exploited fish and shellfish are within safe biological limits; 4) marine food webs occur at a normal abundance and diversity; 5) human-induced eutrophication; 6) sea-floor integrity; 7) alteration of hydrographical conditions; 8) concentrations of contaminants; 9) contaminants in fish and other seafood for human consumption; 10) marine litter; 11) introduction of energy, including underwater noise (EC, 2008). Several GES descriptors are affected by fishing activities.

Biological diversity affects the capacity of living systems to respond to changes in the environment, underpins ecosystem function and provides the ecosystem goods and services that support human well-being. It is therefore important for the future sustainability of marine natural resources, including commercial fisheries. Intensive fishing and overfishing is causing losses of biodiversity and valuable common property marine resources and ecosystem services (Worm et al., 2006; World Bank and FAO, 2008; Pusch and Pedersen, 2010).

Non-indigenous species (i.e. invasive species) can threaten ecological and economic well-being. Invasive species can carry disease, alter ecosystem processes, change biodiversity, disrupt cultural landscapes, reduce the value of land and water for human activities and cause other socio-economic consequences. Fisheries activities and vessels act as a pathway for non-invasive to enter new areas of Europe (DAISIE, 2010).

Fishing can overexploit stocks and damage habitats. Population assessments of *commercially exploited fish* are available for only a small fraction (<100 populations, <30 species) of Europe's marine species and the long-term viability of many targeted and non-targeted fishes is unknown. This situation applies to large parts of the Mediterranean and to deepwater species that are particularly vulnerable to overexploitation (de Juan and Lleonart. 2010).

Overfishing and excessive fishing can reduce the spawning biomass of a fishery below desired levels such as maximum sustainable or economic yields which may reduce the capacity of marine food webs to occur at a normal abundance and diversity (FAO, 2012).

Fisheries may impact marine populations or habitats because of unselective gear and *destruction of the seabed*. The effects of fishing on habitats are related to the physical disturbance by bottom gears in contact with the seafloor. These include removal of large physical features, reduction in structural biota and a reduction in complexity of habitat structure.

Marine litter is a common and costly problem for coastal local communities, organisations and the private throughout the world. Marine litter has a large impact on the marine environment and it is estimated that more than 1 million birds and 100 000 marine mammals die each year from becoming entangled in or ingesting marine litter. Fishing-related litter are lost or abandoned fish/lobster traps, crab pots, fishing lines, floats and nets. Derelict fishing gear, including nets, lines, tarps and floats and are a major worldwide concern (Ten Brink et al., 2009).

Underwater noise is an environmental pressure of ships, including from fishing vessels. The noise pollution caused by sonar, vessel engines and acoustic deterrent devices may have an effect on distributions of marine mammal species (Nowacek et al., 2007). Fishing activities may cause stress, impact food availability, and by-catch marine mammals (Herr et al., 2009).

Pressures caused by deep sea fisheries

A recent study (Villasante et al., 2012) found that increased fishing depths put new pressure on vulnerable deep-sea species. The study also suggests that deep-sea populations are often more vulnerable to fishing activities and that as a result, the ecological impact of fishing in deep-sea areas may be greater than in shallow waters. Fishing is moving to deeper waters as resources in shallow coastal areas are overexploited and technological advances enable fishing in these waters. However, fish in deep sea waters often live longer, grow slower, mature later and also have a slower fertility rate than species in shallow waters. This makes them more vulnerable to the pressures placed on them by fishing activities. Indeed, the data shows that the average age of fish caught in shallow waters was 13, while this was 25 for fish caught in deeper waters (Villasante et al., 2012).

In 2005, the General Fisheries Commission for the Mediterranean (GFCM) banned bottom trawling at depths beyond 1000m. Sea beds below 1000m have not yet been explored by Mediterranean fleets and the ban is a precautionary one to protect the still-intact and poorly understood deep sea ecosystems. Over half the area of the Mediterranean is banned from the harmful impacts of bottom trawling. Over a quarter of Mediterranean marine fauna are endemic and the percentage of endemism is higher in deep waters. Fragile areas of ecological significance are found in the deep waters of the Mediterranean, and new ecosystems have been recently discovered in the area. Vulnerable deep sea ecosystems include seamounts or submerged mountains, submarine canyons and cold-water corals. Deep water systems are also highly vulnerable to commercial exploitation due to the low turnover rates of the species adapted to these environments. Furthermore, protecting deep sea habitats benefits fisheries. The nursery area for deep water shrimps are at below 1000m, and excluding this area from trawling means protecting juvenile shrimps and thus the shrimp fisheries.

4.1.2 Gap analysis

Data issues remain a major challenge to assessing the fisheries sector in the Mediterranean and Black Seas, especially for open waters. Reporting differences (e.g. temporal coverage) also creates challenge for assessment, as fleets or regions are not comparable. In addition, because data (especially socio-economic data) is often available for national fleets it is often not possible to assess specific marine or coastal regions in terms of socio-economics.

Greece did not submit significant amounts of data for evaluation of the overall economic performance of its fleet. Data is not available on the number of fishers employed, complete data on weight and value of landings by species, income, Gross Value Added (GVA), Operating cash flow (OCF) and economic profit of the fleet and incurred subsidies since 2009. For the 2011 Annual Economic Report on the EU Fishing Fleet there is no data available from Greece.

4.1.3 Inventory of data sources

Table below provides an overview of the main data sources used for the above assessment.

Table 22. Overview of main data sources.

Name	Link
EC, 2011, The 2011 Annual Economic Report on the European Fishing Fleet	http://stecf.jrc.ec.europa.eu/documents/43805/256769/11-11_STECF+11-16+-+2011+AER+on+the+EU+fishing+fleet_JRC67866.pdf
EC, 2012, The 2012 Annual Economic Report on the European Fishing Fleet	http://stecf.jrc.ec.europa.eu/documents/43805/366433/12-08_STECF+12-10+-+AER+EU+Fleet+2012_JRC73332.pdf
FAO Stat, 2012	http://www.fao.org/fishery/statistics/gfcm-capture-production/en

Note: additional sources used throughout the assessment are included in the reference list.

4.2 Maritime transport & ports, Cruises

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4.2.1 Introduction

Maritime transport is the transport of both people (passengers) and goods (cargo) by sea-going vessels. The international trade and the exchange of goods and commodities are essential to improve the quality of the life of human beings all over the world. Shipping is the main mean of transport for international trade and the United Nations Conference on Trade and Development (UNCTAD) estimates that more than 80% of world trade is transported by the shipping industry (United Nations, 2012).

There are over 50 000 merchant ships trading internationally, transporting every kind of cargo, such as raw materials and commodities, finished goods, food or fuel. The world fleet is registered in over 150 nations and manned by over a million seafarers of almost every nationality (Shipping Facts, 2011).

Most freight cargo is transported from the producer to the consumer using various modes of transport and passing through a number of nodal points. Sea ports play a crucial role because they are the point of contact between water and land and they constitute one of these nodal points. There are more than 2,900 commercially active ports worldwide (Lloyd's Marine Intelligence Unit, 2007), being the United States the country with the largest number of ports (364) (Freight Transport for Development, 2012). The world's busiest port is the Port of Shanghai (China) in terms of both total cargo throughput and container traffic (American Association of Port Authorities, 2010).

In Europe, there are more than 1200 ports along the 100 000 kilometres of coastline, providing more than half a million direct and indirect jobs (European Commission, 2011).

The Mediterranean Sea is one of the world's busiest areas for maritime activity. There are 480 ports and terminals with recorded ship movements in the Mediterranean Sea, almost half of which are located in Greece and Italy (Lloyd's Marine Intelligence Unit, 2008). Regarding the Black Sea, the website World Port Source (2012) identified 62 active ports located in that sea area.

Shipping presents advantages to transporting goods compared to highway, railway and air transportation. The main strengths of marine transport are: i) it is an economical mode of transportation; ii) it consumes less energy than other forms of transportation; iii) it is an environmentally friendly transport mode, producing fewer exhaust emissions; and iv) it is a safe transport method having less frequency of accidents (St Lawrence Seaway, 2011).

4.2.2 Sector and socioeconomic analysis

This section presents facts and figures on the performance of the port sector and the maritime industry, initially from a Mediterranean and Black Sea level and later in a PERSEUS Pilot Cases sub-regions. These data provide the reader with information on the current status of the sector and its trends year over year.

Mediterranean and Black Sea

Figure 5**Error! Reference source not found.** displays the gross weight of goods handled year-over-year since 2001 in the EU ports as a whole, in the Mediterranean and in the Black Sea ports.

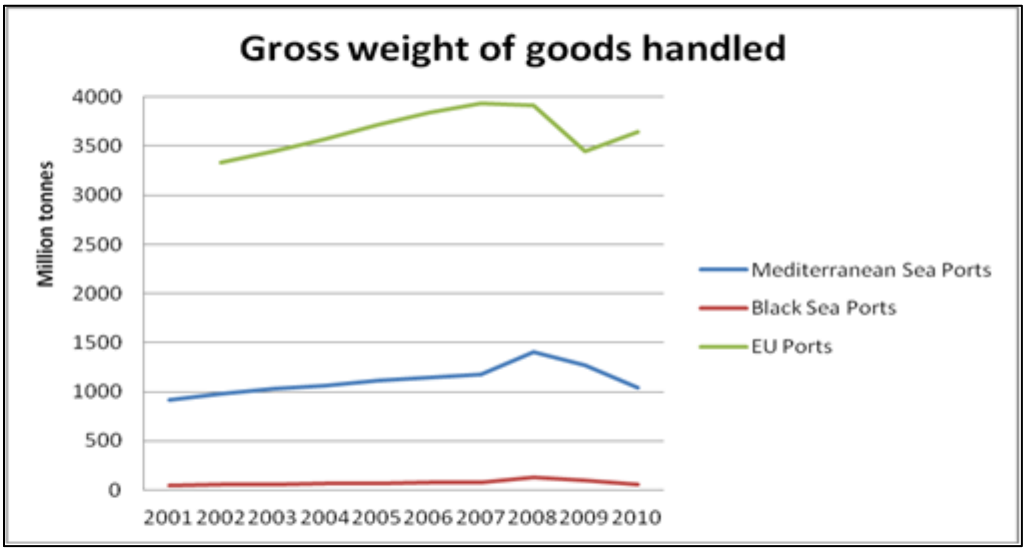

Figure 5. Gross weight of goods handled in Mediterranean, Black Sea and EU ports from 2001 to 2010. Source: Eurostat, 2012b.

According to Figure 5, in general, Mediterranean ports had a positive growth of their gross weight of goods handled from 2001 to 2010, handling a total amount of 1,046 million tonnes of goods in 2010, representing a 28.8 % of the goods handled in all the EU ports (Eurostat, 2012e).

Around 61 million tonnes of goods passed through the EU Black Sea ports in 2010 (See Table 23**Error! Reference source not found.**), representing a 1.7% of the gross weight handled the same year in all EU ports (Eurostat, 2012e). Although it cannot be properly distinguished in Figure 11, from 2008 to 2009, the gross weight of goods handled in the Black Sea ports fell sharply by almost 25%, much more than the EU port as a whole which fell by 12%. However, the overall change from 2001 to 2010 was a growth of 27.7%, higher than the EU average which was 9.2%.

In 2010, almost 232 million passengers passed through the Mediterranean and Black Sea ports, accounting for more than half (58.6%) of EU passenger seaborne traffic. Between 2009 and 2010 the number of passengers in the EU Mediterranean and Black Sea ports decreased by 4.2%, whereas in the same period the number of passengers in all EU ports fell by 2% (Eurostat, 2012i).

The number of vessels that entered in Mediterranean and Black Sea ports in 2010 was 1,358,717 vessels (based on inwards declarations), representing this figure the 68% of the total EU calls (Eurostat, 2012d), and therefore proving the high maritime and port activity existing in these coastal regions.

This deliverable focuses on the PERSEUS Pilot Cases. In each sub-region the traffic statistics are presented in terms of gross weight, liquid bulk, dry bulk, containers, ro/ro, and general cargo. In addition, the number of passengers embarked and disembarked in each sub-region is provided. Finally, the number of vessels that entered yearly in ports (based on inwards declarations) is given.

Balearic Sea and Gulf of Lyon

This Pilot case comprises of the coastal Member States of Spain and France. The statistics of this region are provided in Table 23

Table 23. Traffic statistics of the West Mediterranean sub-region (MS of Spain and France)

West Med	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Gross weight	328030	333579	352713	373355	398822	414969	419773	414093	366714	376412
Liquid bulk	158984	158938	163597	166264	174825	177453	175524	178634	166760	167368
Dry bulk	66221	68825	69601	72429	80170	81270	81573	70409	51799	54028
Containers	6219	6435	7755	7415	10166	10727	12204	12335	11103	11835
Ro-ro	12266	12522	13467	14599	16281	19988	18480	18523	17674	15105
General cargo	14401	14957	14661	15713	15831	16631	16110	13984	11419	12323
Passengers	21776	22622	23711	25391	26423	26768	27737	27302	25758	27005
Vessels	189630	197202	202948	203023	196626	187791	207027	195538	117095	122889

Source: Adapted from Eurostat, 2012d,e,g,h,i. Units: thousands of TEUs (containers), thousands of tonnes (cargo), thousands of people (passengers), and units (vessels).

The traffic statistics about the West Mediterranean demonstrate that this sub-region has a high level of maritime activity, despite the fact that they only include data from the Mediterranean coast of Spain and France.

In fact, Spain is the second EU Mediterranean country, after Italy, in the volume of goods handled by the maritime transport. Out of the 376 million tonnes handled in all the Spanish ports, 284 were transported in the Mediterranean Sea (75.5%) (Eurostat, 2012e). France is ranked as the third country in the overall gross weight of goods handled; however, only a 30% of its port activity is done in the Mediterranean Sea, the rest is handled in the Atlantic Ocean.

Container traffic has, undoubtedly, increased rapidly in the recent years in almost all ports, in a global, European, Mediterranean and Black Sea level. According to Eurostat (2012h), between 2001 and 2010 the transport of containers in the Mediterranean ports has increased, on average, almost 61%. In the West Mediterranean sub-region it has increased 90.3%, the highest rise of the Mediterranean sub-regions.

In Spain, this rate has been exceeded, having an increase of +97.4%. The Port of Valencia (Spain) is the port that handles the largest number of TEUs among the whole Mediterranean ports (Eurostat, 2012h). Although almost all types of commodities have increased its annual cargo handled (except dry bulk and general cargo), the number of vessels has dropped. It may be understood as there are less vessels calling at ports but they are transporting more cargo in the ship.

Aegean Sea/Saronikos Gulf

The East Mediterranean sub-region includes the EU coastal country of Greece. Traffic statistics are displayed in Table 24.

Table 24. Traffic statistics of the Agean Pilot case (Greece)

East Med	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Gross weight	86420	96772	110460	106889	103816	107320	108318	100469	92989	88284
Liquid bulk	34634	37211	36608	36575	36789	40706	40702	46074	44087	41717
Dry bulk	24591	26054	27046	28361	28904	27537	28599	26653	22424	21214
Containers	1395	1652	1884	1867	1767	1760	1336	830	1001	1132
Ro-ro	7078	12846	23239	19072	16059	16856	18111	16083	14494	11051
General cargo	6874	6703	5623	5603	5723	5537	5468	5432	4285	4106
Passengers	50149	101210	102760	96744	86068	90402	92423	91101	88351	83993
Vessels	194362	331893	370094	461244	470083	493146	517143	487922	477841	489100

Source: Adapted from Eurostat, 2012d,e,g,h,i. Units: thousands of TEUs (containers), thousands of tonnes (cargo), thousands of people (passengers), and units (vessels).

According to the gross weight showed, this is the area with less port activities in the Mediterranean Sea and with the minor growth since 2001. This is the only Mediterranean sub-region that has a negative growth from 2009 to 2010. This may be caused because in the period 2009 - 2010 most ports recovered and had a positive growth, except only in Greece (-8.2%) and France (-0.6%) (Eurostat, 2012a).

Surprisingly, Greece is the second Mediterranean country in terms of tonnes handled per capita (11), after Malta (14.4) (Eurostat, 2012f). Since Greece does not have a high number of cargo handled, it may be justified by the low population of this country compared to other Mediterranean regions.

It is interesting to point out that the number of vessels in this PERSEUS Pilot Case region has increased the most compared to the rest of the regions, by 151.6% since 2001.

Western Black Sea

In this area, there are two EU countries, Bulgaria and Romania.

Table 25. Traffic statistics of the Black Sea Pilot case (MS of Bulgaria and Romania)

Black sea	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Gross weight	47811	53088	57283	63719	72535	74222	73828	131046	102184	61068
Liquid bulk	7825	16726	17335	21150	25005	26340	25091	29860	24043	19945
Dry bulk	8675	9801	9267	27817	29033	27416	24515	50183	42158	26897
Containers	39	70	82	496	976	1290	1577	1623	758	690
Ro-ro	499	443	499	519	740	580	329	1493	1235	274
General cargo	2569	2178	3210	9023	8979	7916	9189	14137	10056	6069
Passengers	3	6	4	6	13	15	10	8	0	1
Vessels	2821	2834	3076	6018	6629	7283	73439	40851	34331	4990

Source: Adapted from Eurostat, 2012d,e,g,h,i. Units: thousands of TEUs (containers), thousands of tonnes (cargo), thousands of people (passengers), and units (vessels).

As it may appear obvious, the level of port activity in the Black Sea is less intensive as it is in the Mediterranean Sea. For example, there are only a few thousands of passengers in the Black Sea, whereas the Mediterranean Sea there is millions of passengers.

As stated previously, in 2010 around 61 million tonnes were handled in the EU ports of the Black Sea (see Table 25). Out of the 61 million tonnes, 62.5% was handled in Romanian ports and a 37.5% in Bulgarian ports (Eurostat, 2012e).

Analysing the results individually by ports, the Port of Constanta (Rumania) maintains the top position as the major dry bulk centre not only in the Black Sea but also compared to ports in the Mediterranean Sea (Eurostat, 2012g). Overall, the growth of the gross weight handled from 2001 to 2010 in the Black Sea is 27.7%. In Romania this growth has been particularly significant, increasing 38% in the same period of time (Eurostat, 2012e). However, the highest rise has been in the transport of containers (1669.2%), increasing mostly in Bulgaria. The Port of Constanta handles the largest number of containers in the Black Sea with 548,000 TEUs in 2010 (Eurostat, 2012h). The ro-ro traffic decreased dramatically in 2010. Turkey handles, by large, the largest amount of ro-ro traffic, followed by Bulgaria and Romania. Bulgarian ports faced a reduction of a -70.5%, and Romanian ports an increase of a 273.5% from 2001 to 2010 (Eurostat, 2012g).

Selected examples of port's employment and turnover

According to the European Port Performance Dashboard (European Sea Ports Organisation, 2012) the major indicators to express the seaport sector's contribution to the European economy are the direct employment and the turnover of the ports. The turnover (or revenue) is the income that a company receives from its normal business activities, usually from the sale of goods and services to customers. No aggregated data about the turnover of the Mediterranean and Black Sea ports was available, and therefore these data was taken from individual ports, provided in a compilation as an example (**Error! Reference source not found.**

The shipping industry contributed an estimated EUR 26 billion added value to the economy of the EU 27[3] in 2010, which equated to about 26% of the value added generated by maritime activities (Policy Research Corporation, 2010).

Table 26. Turnover of selected ports.

Country	Port	Year	Amount (million €)
Spain	Barcelona	2010	167
		2011	158
	Valencia	2008	112
	Algeciras	2010	101
France	Marseille	2002	151
		2003	154
		2004	165
Greece	Piraeus	2010	122
	Thessaloniki	2007	66
Bulgaria	Burgas	2011	17
	Varna	2010	20
Romania	Constanta	2011	64

Source: website of port authorities

[3] Excluding Bulgaria

Ports are becoming more and more a key node of the global logistic chain and less an isolated place as it used to be in the past. Therefore, ports are important generators of employment at the local, regional, national and even European level (Notteboom, 2010). Notteboom (2010) states that ports create direct port employment through cargo handling services, ship operations and nautical services. Typical direct jobs include dock workers, ship agents, pilots, tug boat operators, freight forwarders, port authority employees, ship chandlers, warehouse operators, terminal operators and stevedores. Indirect jobs of ports' activities are, for example, jobs in local office supply firms, equipment suppliers, maintenance and repair, insurance companies, consulting and other business services.

A report from the European Sea Ports Organisation (ESPO) provided data on average employment in ports in countries in the Mediterranean and Black Sea, although this data is not directly aggregated for the specific seas. The study results are presented according to region (based on a geo-governance typology) being Region 1 France, Portugal, Spain, Malta, Italy, Greece, Cyprus and Israel, and region 2 Slovenia, Croatia, Romania and Bulgaria (European Sea Ports Organisation, 2010).

Table 27. Average number of employees working in a port authority (full time equivalents), 2011

Country group	Administrative	Nautical	Engineering	Equipment drivers	Dock workers	Other	Total
Region 1	103.5	17.8	43.7	34.9	16.8	49.3	265.9
Region 2	83.9	40.4	4.3	30.3	5.3	166	330.1

Source: European Sea Ports Organisation, 2010

Notes: Data is averaged for the country groups, so estimates include data not relevant to the Mediterranean or Black Sea.

4.2.3 Conclusion of the socio economic analysis

The results of the industry, economic and social indicators have demonstrated that shipping is a vital element to the economy as it is essential to the transport of materials and goods and ports play an indispensable role as a node in the global logistic chain. Shipping is also considered one of the most environmentally friendly and energy efficient modes of transporting cargo. As it has been demonstrated in this report, European shipping is recovering progressively from the economic downturn suffered in 2009 and, in general, the industry indicators and the economic records are increasing gradually in ports. It also demonstrates that the Central Mediterranean is the sub-region that has more volume of marine and port's activity in terms of gross weight, followed by the West Mediterranean and by East Mediterranean. Finally, the Black Sea is in the last position because its level of activity is less intensive and it has fewer EU ports.

4.2.4 Links to environmental pressures

Port and shipping activities produce a variety of pressures and impacts on the marine environment. These can be understood as any change to the environment, whether adverse or beneficial, wholly or partially resulting from activities, products or services (ISO 14001, 1996). In this section, the pressures that the ships and ports may cause on the environment are presented, following the 'pressures and impacts' specified in the table 2 of the Annex III of the Marine Strategy Framework Directive (MSFD), which are physical loss and damage, other physical disturbance, biological disturbance, and contamination by systematic and/or intentional release of (hazardous) substances as well as air pollution.

Physical loss and damage

Port construction involves the expansion of port facilities to accommodate loading and unloading of goods; it may entail smothering coastal land as well as the destruction of terrestrial habitats, but it may also involve the filling of wetlands to acquire land for port development. Land reclamation, which is creating new land from sea beds and sand, is often used to increase port capacity to handle ships. This may generate the destruction of natural areas and disturbances to flora and fauna (EcoPorts Foundation, 2004). In addition, dredging activities may impact the physical environment through changes in bathymetry (underwater depth), hydrography (tidal flow, currents, velocity, and waves), sediment transportation (deposition or erosion), elimination of contaminated sediments or by altering the biological environment through disturbances to benthic habitats, increase in turbidity, and re-suspension of contaminants that may lead to a loss of fishery resources (Paipai, 2009). Disposal of dredged material on land may cause destruction of plants, loss of vegetation, and odour and unsightly view to the local community (EcoPorts Foundation, 2004).

Other physical disturbance (noise and marine litter)

Noise in ports is generated by ship traffic, road traffic and cargo operations. It may create stress, reduced working efficiency, and even hearing loss to port and ship employees, as well as be a nuisance and cause sleep loss to nearby residents and wildlife. In the 'ESPO/Ecoports Port Environmental Review 2009', port managers identified noise as the current top environmental priority of the sector. In coastal zones with high vessel traffic, ships are a dominant source of low frequency noise (OSPAR, 2010). Noise from ships can impact fish and sea mammal behaviour by distracting them and impairing their ability to retrieve vital information. For example, fish can be hindered from finding suitable habitats and protection, making them more susceptible to predators and other threats, because of exposure to artificial noise (University of Bristol, 2010). Estimates suggest that background marine noise has doubled each decade since the 1950s in some areas due to the development of faster and larger ships as well an increase in vessel traffic (OSPAR, 2010).

Shipping is considered a major source of marine waste and the most significant source of marine litter from sea-based activities (Sheavly, 2005). Marine litter can harm the marine environment by physical damage and smothering of reefs, sea grasses, mangroves, and transport of invasive species as well as being ingested by fish. Economically, it can cause serious losses, especially in coastal communities (increased expenditures for beach cleaning, public health and waste disposal), shipping (costs associated with fouled propellers, damaged engines, litter removal and waste management in harbours), fishing (reduced and lost catch, damaged nets, etc.) (UNEP, 2009). From a human health perspective, marine litter poses risks through exposure to medical and sanitary waste in bathing water, as well as bioaccumulation up the food chain (GESAMP, 2010; UNEP 2009). In particular, micro plastics (preproduction plastics and deteriorated fragments of larger pieces) are emerging as a major environmental and health issue. Tiny plastic fragments can concentrate persistent organic pollutants (POPs), which then can be ingested by species and make their way up the food chain to humans (GESAMP, 2010).

Nutrient and organic matter enrichment

The introduction of organic matter, such as sewage, fertilisers and other nitrogen and phosphorus-rich substances into the environment can lead to potential harmful effects on human and wildlife health, the environment, fisheries and recreational pursuits (EcoPorts Foundation, 2004). Eutrophication, for example, leads to an increase of phytoplankton in a water body as a response to increased levels of nutrients. Negative environmental effects include the depletion of oxygen in the water, which induces reductions in specific fish and other animal populations. Other species may experience an increase in population that negatively affects other species.

Contamination by the release of (hazardous) substances

Oil spills, leakages and discharges of hazardous or toxic substances (e.g. oils and hydrocarbons discharged into the water, chemical substances, lubricants, fuels, and oily wastes) can severely affect marine ecosystems and air, water, soil or sediment quality (OSPAR, 2010). The release of gases may cause problems such as toxic material emission, explosions, fumes, odours and hazardous air emissions (United Nations, 1992). On land, runoff from raw material storage, spills from bulk cargo handling, and wind-blown dust are possible sources of contamination. Soil pollution may lead to contamination of the surrounding land and groundwater, reduce land value, prevent future development and be an environmental or health hazard (EcoPorts Foundation, 2004). Groundwater contamination may affect specific plants and organisms, but also the natural biological communities (Trozzi and Vaccaro, 2000). Sediment pollution occurs when hazardous substances reach the bottom of the sea (EcoPorts Foundation, 2004) and poses a serious threat to the benthic environment, which includes worms, crustaceans, and insect larvae that inhabit the bottom of a water body. Pollution can lead to their death, reducing the food available to larger animals such as fish. When larger animals feed on contaminated benthic organisms; the toxins are transmitted to their bodies. As a result, fish and shellfish, as well as benthic organisms, may be affected by contaminated sediments (United Nations, 1992). Ultimately, this creates potential harmful effects on the health of humans and wildlife, the environment, fisheries and recreational pursuits (EcoPorts Foundation, 2004).

Biological disturbance

Marine ecology includes aquatic fauna and flora composed of a large number of species of bacteria, phytoplankton, zooplankton, benthonic organisms, coral, seaweed, shellfish, fish and other aquatic biota (United Nations, 1992). The surrounding terrestrial areas of some ports include flora and fauna such as mangroves, wetlands, woodlands, wildlife corridors and Natura 2000 sites (protected areas) (EcoPorts Foundation, 2004). Port activities may disturb the habitat of these species and their natural behaviour. At sea, alien species are also transported in the ballast of ships, and when a ship discharges water they are then introduced into new marine environments (DAISIE, 2010). The risk from invasive species is associated with the amount of water transported, the frequency of ship visits and the similarity of environmental conditions for the species (OSPAR, 2010). According to the DAISIE Project (2010), the main way for the introduction of alien aquatic species in Europe is by vessel. In the Mediterranean, 925 exotic species have been inventoried and over half of these have established populations which have prospered, about 28% entered through maritime transport (UNEP, 2009). Non-indigenous species can create considerable changes in marine ecosystems, causing economic loss and even threatening human health. Alien species place pressure on the environment by transporting diseases, altering ecosystem processes, changing biodiversity, disrupting cultural landscapes, and reducing the value of land and water for human activities (DAISIE, 2010).

4.2.5 Conclusion

The growing capacity of this industry leads to increasing environmental pressures which challenge fragile and valuable marine ecosystems surrounding the ports. These pressures result in significant impacts on the environment and can lead to further impacts across the maritime economy (e.g. fishing and tourism) and to human well-being (e.g. health). For this reason, the major environmental impacts of the shipping and port activities have been presented according to the classification of the Marine Strategy Framework Directive (MSFD). The above-mentioned environmental pressures are intensified not only with these raise in the number of shipping vessels but also with the growth in the speed and in the size of the ships.

Policy makers are facing the complex challenge of integrating environmental and economic goals into maritime transport. Moreover, maritime transport of goods and passengers is often a cross-border activity which involves two or more countries or regions, and therefore it is even more difficult to integrate common policies between countries.

The role of port authorities in the protection of the environment is very important. Ports are moving forward to become greener by introducing new technological initiatives, implementing environmental programmes and carrying out projects to promote the sustainable development in the port. The European Sea Ports Organisation (ESPO) has just published in October 2012 the 'ESPO Green Guide; towards excellence in port environmental management and sustainability' aiming at promoting port authorities to be proactive and to commit themselves to sustainable development and the continuous improvement of their environmental performance.

4.2.6 Gap analysis

The research conducted for this review shows significant gaps in the data available for the Mediterranean and Black seas shipping and port sector. Generally, industry data are available for the EU regions in terms of tonnes of cargo, vessels and passenger traffic.

Furthermore, the analysis also showed that little or no specific economic and social data are available for the Mediterranean and Black seas in regard to the shipping and port sector, such as employment and turnover. Data for these indicators were either not available or not aggregated to the specific seas. Although data on economic indicators (such as gross domestic product or unemployment) were found, they included the whole coastal regions activities, and not exclusively the shipping and ports' activities. It could be possible that further data on economic indicators particularly for ports would exist, although at the moment they are not available. However, some data on the turnover of different Mediterranean and Black Sea ports are provided in this report, which have been obtained from the ports' website.

4.3 Submarine cable and pipeline operations

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4.3.1 Introduction

Context

International trade and sea transport of hydrocarbons represent a vital link in the chain of oil and oil services, since the centres of production of oil and gas are generally far from the centres of consumption. The European Union's hydrocarbon energy supply depends heavily on imports. While the European Commission has recommended diversifying and increasing domestic resources, notably with renewable resources which should grow to 20% by 2020, dependence on hydrocarbon imports will remain not only important, but will increase (Nies, 2011). It is in this context that the scenario of oil and gas pipelines ought to increase too.

Communications are an important part of our nowadays society. As of 2006, overseas satellite links accounted for only 1% of international traffic, while the remainder was carried by undersea cable. The reliability of submarine cables is high, especially when (as noted above) multiple paths are available in the event of a cable break. Also, the total carrying capacity of submarine cables is in the terabits per second, while satellites typically offer only megabits per second and display higher latency.

Activity Description

Both, the oil and gas pipelines and the submarine cables activity description and current situation in the SES was described in detail at D2.2.

Amongst the most important oil chokepoints by volume state the Suez Canal (between the Mediterranean and the Red Sea) and the Turkish Straits (between the Mediterranean Sea and the Sea of Marmara) at the Mediterranean and the Black Sea.

Table 28. Six most important oil chokepoints by volume worldwide.

	Bodies of water	High per capita GDP (2009)	Low per capita GDP (2009)	Oil traffic (2006) million bbd
Strait of Hormuz	Gulf of Oman, Arabian Gulf	UAE: $36,500 (15)[a]	Iran: $11,200 (71)	17
Strait of Malacca	Indian Ocean, Pacific Ocean	Singapore: $50,500 (4)	Indonesia: $4,200 (120)	15
Suez Canal	Mediterranean Sea, Red Sea	N/A	Egypt: $6,100 (101)	4.5
Bab el-Mandeb Strait	Red Sea, Gulf of Aden	Djibouti: $2,500 (135)	Eritrea: $700 (177)	3.3
Turkish Straits	Sea of Marmara, Mediterranean Sea	N/A	Turkey: $12,500 (65)	2.4
Panama Canal	Atlantic Ocean, Pacific Ocean	N/A	Panama: $11,800 (69)	0.5

a. Rank out of 186 countries. The United States ranked sixth with a per capita GDP of $46,300 in 2009 [5].

Source: Komiss and Huntzinger, 2011.

These chokepoints, as well as any possible closure of the main pipelines, should be taken into account when analysing the socioeconomics of oil and gas pipelines as they could cause disruption or divert the oil and gas transport into tankers with the consequent increase in both costs and shipping time.

Table 29. Durations that would cause GDP to drop by 1 percent in one quarter, 100-percent disruption.

	Suez Canal	Bab el-Mandeb Strait	Turkish Straits
Estonia	164	193	266
Greece	317		
Hungary	293	346	
Netherlands	212	251	345
Slovakia	205	243	334
Slovenia	285	336	

Source: Komiss and Huntzinger, 2011. Note: The authors state that disruptions durations are calculated as those mitigated with pipelines and alternative sea routes assuming that mitigation starts at the beginning of the disruption and ignoring travel delays caused by the use of alternative sea routes, for simplicity.

The stability of oil exporting countries is also something to take into account as disruptions might also cause the unemployment rate to increase as well as increases in the oil price inflation rate (Komiss and Huntzinger, 2011).

Regarding submarine cables (telecommunication and electricity submarine cables), the socioeconomic aspects of the activity should not just look at the use and production aspect of the transport of power and information, but also to the installation, operation and dismantling socioeconomic aspects. Furthermore, in an era of cyber-warfare, the need to protect the vulnerabilities of the undersea cable systems has increased and there is a further need to determine how a disruption of submarine communication cables will impact the world's economies.

4.3.2 Sector and socio-economic analysis

Mediterranean Sea region in General

In the Mediterranean region, seven gas pipelines are in operation (7 + 2 projected). In northern Mediterranean countries, many expansions of the existing liquefied natural gas (LNG) terminals have increased over the last few years (from 82 bcm in 2007 to 120 bcm in 2009, expected to reach 189 bcm by 2015) (The LNG Industry in 2011, GIIGNL, 2011). 35.2 and 39.3 billion cubic meters of gas was transported through the Mediterranean, according to the last 2012 and 2013 (respectively) BP Statistical Review of World Energy. Through the data at this 2013 report, it was stated that the turnover of gas transportation via pipeline in the Mediterranean Sea was approximately €1.5 billion, in 2012, excluding €200 million from transit charges levied by third countries through which the pipelines pass. The added value of the gas transportation for the same year, 2012, was approximately €800 million, excluding also €200 million from transit charges (BP, 2013; Factor value based on Pugh, 2008).

Regarding oil pipelines, several different, international oil pipelines connect the Mediterranean region with neighbouring countries and regions by land. However, if compared to the ship or tanker transport, the transport of oil through pipelines crossing the Mediterranean can be considered as marginal. The Mediterranean has extensive marine traffic giving access to the Middle East (and the Suez Canal), the Black Sea and Southern Europe; much of this traffic is oil tankers. The result of such traffic is a high risk of pollution and even ecological disaster, worsened by the fact that it is a near-closed sea. At this section, when data becomes available, the socioeconomics of oil-tankers will be analysed, based on ports landings (SAFEMED, 2008).

Regarding electric and communication cables, and observing the investment costs related, we see large differences among them with an investment of about €2 million for electric cables and a little more than €40,000 for telecommunication cables.

However, the total investment costs related to submarine telecommunication cables in the Mediterranean accounted for €3.2 billion; the investment cost of electrical cables accounted for 674 million and the a total of 460 direct jobs were created on seven cable ships (MED-IMP, 2010; ICPC, 2009; UCTE, 2008). The impact of installation and operation of submarine cables direct employment seems very low, in contrast to the impact on the indirect and induced employment.

Below the existing main oil routes, gas pipelines (Figure 19) and submarine cables (Figure 20) at the Mediterranean PERSEUS Pilot Areas are gathered.

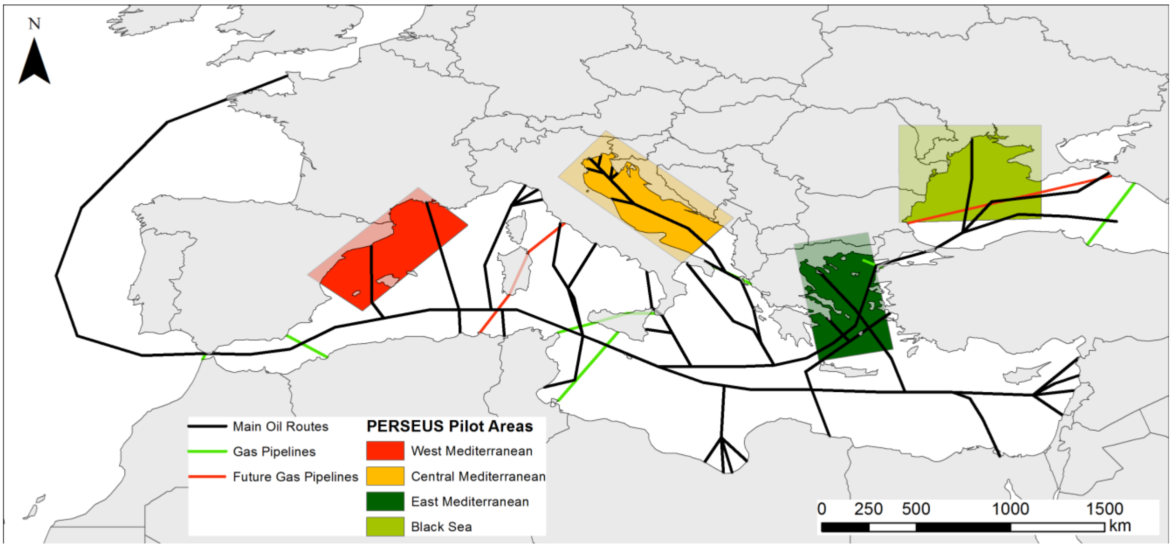

Figure 6. Oil-tanker tracks and gas pipelines at the PERSEUS Pilot Areas at the Mediterranean.

Source:Gathered from www.submarinecablesmap.com, GIWA Black Sea graphics; Nies, 2011; Astiaso Garcia et al., 2013.

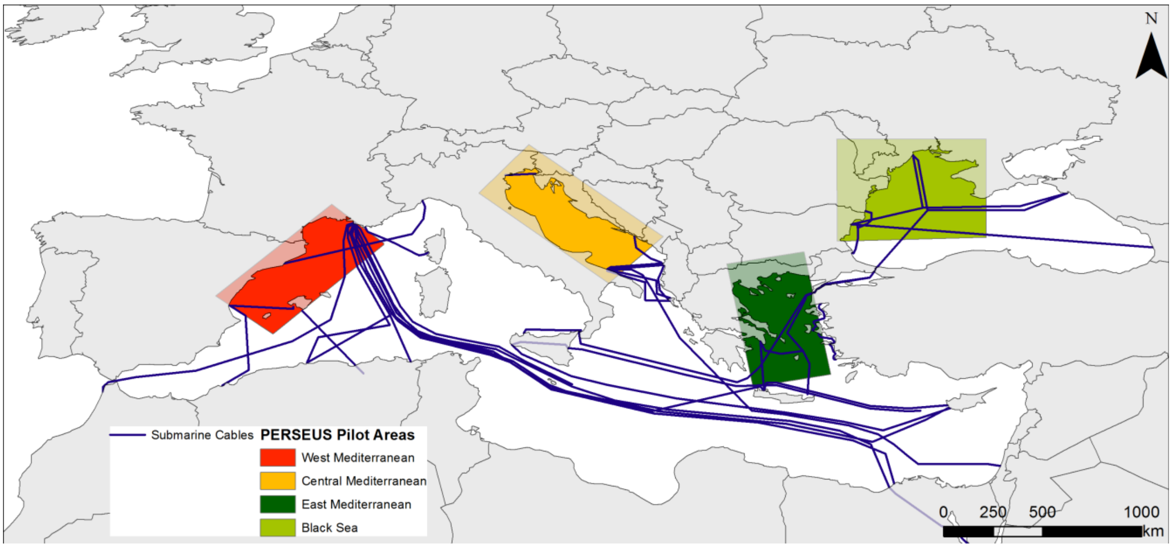

Figure 7. Submarine cables at the PERSEUS Pilot Areas at the Mediterranean.

Source: Gathered from www.submarinecablesmap.com.

Here below we will analyse the socioeconomics of submarine cable and pipeline operations at each of the already described PERSEUS pilot case areas: West Mediterranean; Central Mediterranean; East Mediterranean and Black Sea.

West Mediterranean

No submarine gas pipeline exists at the West Mediterranean Pilot Area. However, as the PERSEUS West Mediterranean Pilot Area accounts for Spain and France as countries, the general socioeconomics of the gas markets in these two countries have been analysed.

At southern Spain, the Medgaz and the Pedro Durán Farell (PDFG) pipelines can be found. The Medgaz pipeline cost was of 900 M€ (630 M€ for the submarine part) and the number of employees at the construction phase was higher than 2000 (>100 employees at the operation phase).

Furthermore, the market of the gas and the Liquefied Natural Gas (involving the regasification, storage, transport, distribution and commercialisation phases) was estimated to be around 5000 M€, in 2010, and increasing. The Gross Value Added (GVA) has also increased along the years; however the GVA is still a 15% lower than that of the remaining of Europe (despite being superior to the one in the UK and Holland).

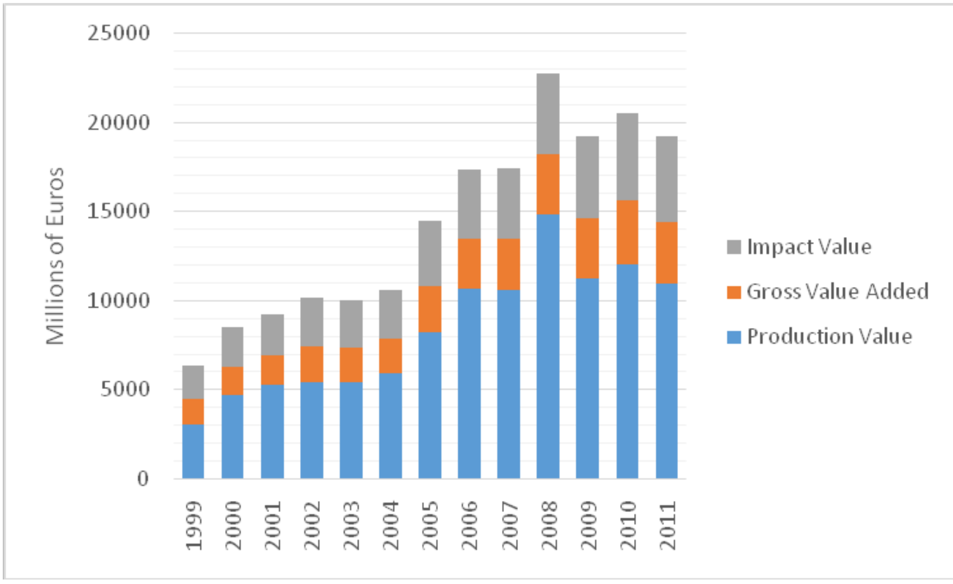

Figure 8. Impact Value, Gross Value Added and Production Value of the Gas Market in Spain
Source: Modified from EMI (Energy Markets International), 2011.

These tendencies in the gas market give us the idea of the importance of the sector for the Spanish economy. This impact is further highlighted if we take into account that the gas industry employs thousands of people in Spain at the construction, gas production, installation, fixing, pipelines supervision, inspection and maintenance phases.

If we look at the direct employment rates, the amount of people employed by the businesses in the gas industry has increased year after year, with a total of 6516 people employed in 2011.

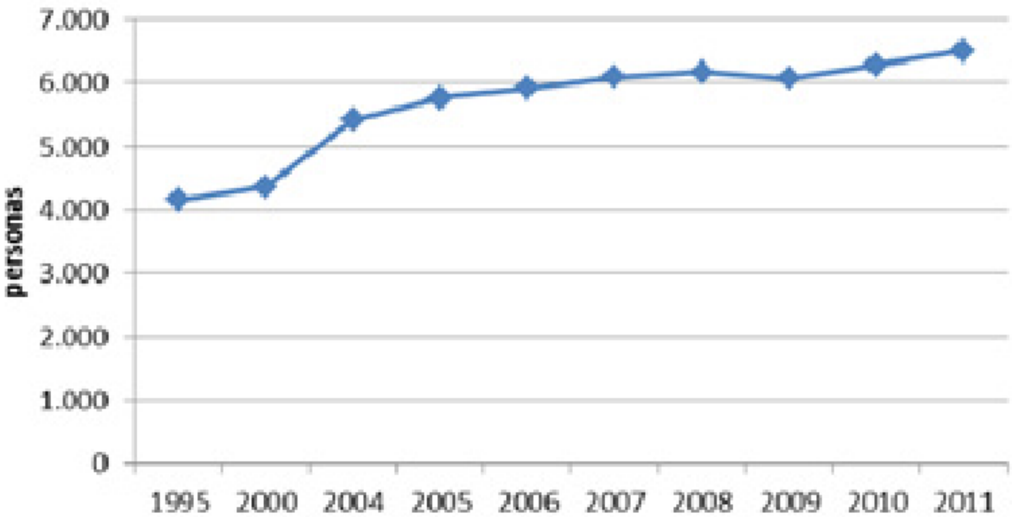

Figure 9. Direct employment of number of people in the Spanish gas sector since 1995

Source: Sedigas, 2012.

Table 44. Existing gas pipelines in Spain.

Linking	Gas pipeline name	Capacity Gm³/yr	In service since	Km underwater
Algeria – Spain (via Marocco)	Pedro Duran Farell –PDFG- (ex-GME Maghreb-Europe)	13	1997 & 2004	45
Algeria - Spain	Medgaz	8-10	March 2011	210

At France, gas import dependence is close to 100%. French natural gas imports are relatively well diversified with significant imports from Algeria, the Netherlands, Norway and the Russian Federation. LNG has traditionally been sourced from Algeria, but a growing proportion now comes from other sources including Qatar. Entry capacities to the French gas network were 260 mcm/d at the end of 2010 – with 77% of this for gas pipelines and 23% for LNG terminals. France has numerous cross - border gas pipelines, with a total import capacity of 187.5 mcm/d. Also, there are three LNG port terminals in France – one at Fos Cavaou near Marseilles, another nearby at Fos Tonkin, and one at Montoir - de - Bretagne on the Atlantic coast.

Many oil tanker routes pass along the West Mediterranean Pilot Area. However, no data was able to be gathered on the most profitable routes and their socioeconomic data.

Among submarine cables at the West Mediterranean Area, the following table gathers their names, start year and lengths.

Table 30. Existing submarine cables at the PERSEUS West Mediterranean Pilot Area.

Name	Year	Length (km)	Involved Companies	Company size (nº employees)	Cost (M€)
Algeria-Spain	2013	500			
ALPAL-2	2002	312		Pirelli Submarine Telecom Systems Italia = 1000-5000.Rest >10000.	17.6
Ariane 2	1995	2269	AT&T, Belgacom, Cypress Telecommunications Authority, France Telecom, OTE, Verizon	Cypress Telecommunications Authority = 51-200. Rest >10000	70
Atlas Offshore	2007	1634	Maroc Telecom	> 10000	26
BalaLink	2001	274	IslaLink	1000-5000	30
BARSAV	1996	773	Telecom Italia, Telefónica	>10000	39
I-ME-WE	2010	1320	Bharti Airtel, Etisalat, France Telecom, Ogero , PTCL , STC , Tata Communications, Telecom Egypt, Telecom Italia Sparkle		
Med Cable	2005	1215	Med Cable		
SEA-ME-WE-4	2005	18800	Algerie Telecom, BSCCL, Bharti Airtel, CAT Telecom, Du, France Telecom, Pakistan Telecommunication Company Limited, STC, SLT, Tata Communications , Telecom Egypt, Telecom Italia Sparkle , Telekom Malaysia, Tunisie Telecom, Verizon		500
Tamares Telecom	2012	3123	Tamares Telecom	201-500	
TE North	2011	2983	Telecom Egypt	> 10000	150

East Mediterranean

Pipelines

The only existing gas pipeline in Greece is the Interconnector Turkey-Greece (ITG) which also falls within the PERSEUS East Mediterranean Pilot Area.

Table 48. Existing gas pipeline at the PERSEUS East Mediterranean Pilot Area.

Linking	Gas pipeline name	Capacity (Gm^3/yr)	In service since	Underwater Km
Turkey - Greece	ITG	11	2007	17

However, there is also the prospective of constructing another gas pipeline, named as Interconnector Turkey-Greece-Italy (ITGI) whose offshore section is estimated that would cost €500 million. This development will close the ITG connection with Italy and its surplus to Bulgaria and is thought that will benefit in the followings:

- Diversify supply routes for Italy and Europe
- Enhance supply security in Southern East Europe (through Greece and Bulgaria) and in other European countries (through Italy).
- Implement solidarity mechanisms in Eastern Europe in case of supply interruption thanks to the connection to the multiple gas import routes Italy has and to the wide storage capacity towards these markets.

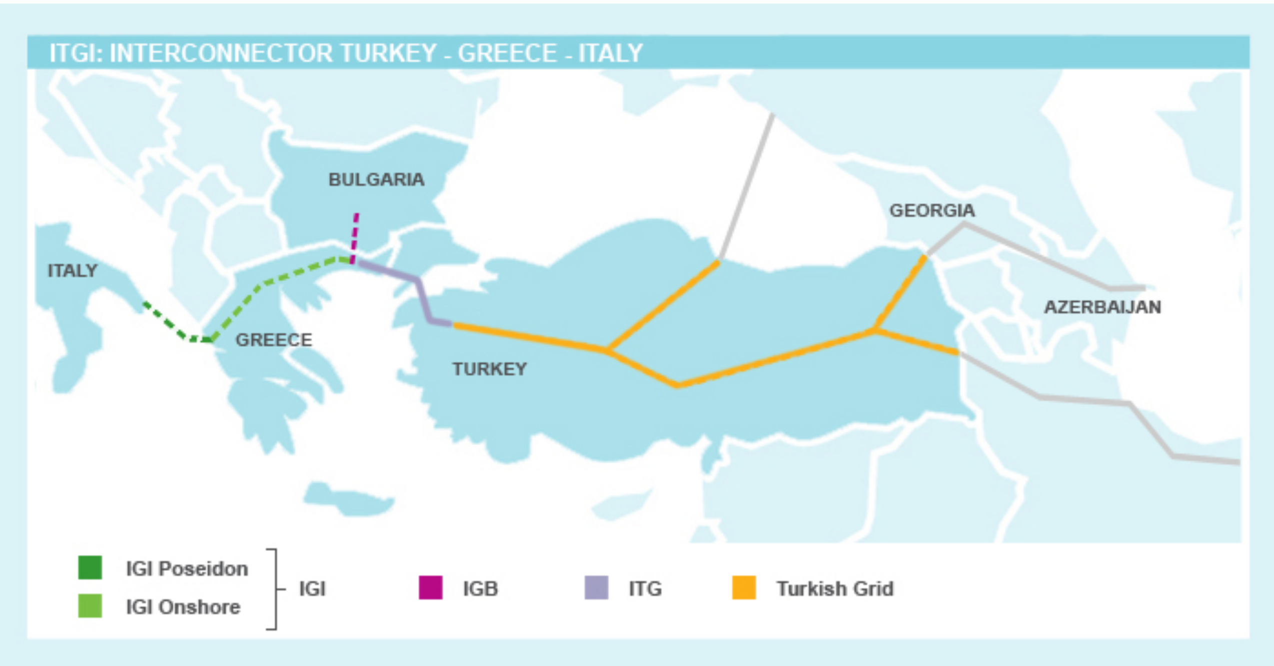

Figure 10. Map of the location routes of the ITGI.

Source: http://www.edison.it/en/company/gas-infrastructures/itgi.shtml

Many marine oil tanker routes pass through the East Mediterranean Pilot Area. The Aegean Sea might represent an extreme example of a marine safety risk area where an undesirable event may occur. The risk of an accident occurrence is even more aggravated by the existence of several other conditions, such as high maritime traffic density, transportation of large quantities of crude oil and refined products through the region (high transport density of vessels from and to the Black Sea passing narrow straits that are formed by over 1600 islands dispersed all over the Aegean), narrow and congested straits through which ships enter and exit (Giziakis et al., 2013).

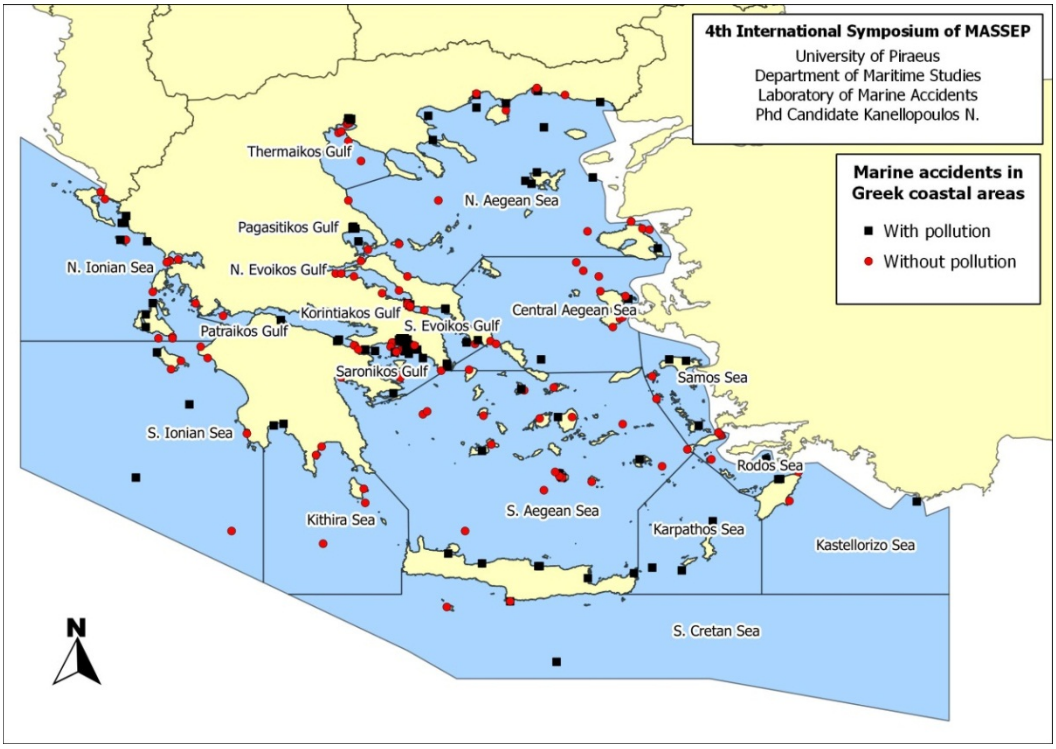

Figure 11. Marine accidents in the Greek Coastal Areas that occurred from 2001 to 2011
Source: Giziakis et al., 2013.

Table 31. Existing submarine cables at the PERSEUS East Mediterranean Pilot Area.

Name	Year	Length (km)	Involved Companies	Company size (nº employees)	Cost (M€
APHRODITE-2	1994	876	AT&T, Belgacom, British Telecom, Cyprus Telecommunicat ions Authority , France Telecom, OTE, Sprint, Verizon	> 10,000	30
Ariane 2	1995	2269			
ITUR	1996	3466	Telecom Italia	> 10,000	
MedNautilus	2001	5729	Telecom Italia Sparkle	> 10,000	
MINERVA	2007	3970	Telecom Italia Sparkle	> 10,000	
Turkey Marmara-Aegean Sea Fiber Optic System (TURMEOS-1)	2011	211			

Black Sea

Only one gas pipeline exists at the moment at the Black Sea since 2004, named ad “Blue Stream” and which connects Russia and Turkey directly through an underwater offshore pipeline of 396 km long. It is considered yet one of the deepest pipelines in the world. It is laid in depths as low as 2.2 km which exceeds the average depths of well-known subsea pipelines.

Table 32. Existing submarine gas pipeline at the PERSEUS Pilot Area at the Black Sea.

Linking	Gas pipeline name	Capacity (Gm^3/yr)	In service since	Underwater Km
Russia–Turkey	Blue Stream	15	2004	396

The Blue Stream gas pipeline cost was of US$3.2 billion, including US$1.7 billion for its submarine segment. The construction costs are passed on to gas consumers, as has been the case with Blue Stream in Turkey. Amongst other values, the Blue Stream pipeline aim was to bring gas from the Caspian area to Europe.

Another gas pipeline is prospected, for 2015, for the Black Sea Regions named as “South Stream” and which foresees laying pipeline subsea pipeline directly from Russia to Bulgaria. The South Stream project is seen as a rival to the projected Nabucco pipeline and there are doubts about the feasibility of South Stream project, since it may cost twice as much as Nabucco, which was initially expected to cost €12–15billion.

Figure 12. Map of the projected "South Stream" pipeline through the Black Sea.

Source: http://iberorusa.com/es/blog/2012/01/27/la-construccion-de-south-stream-comenzara-en-diciembre/

No submarine oil pipelines exist at the Black Sea. However the region is intensively being used and routed by many oil tankers. The Turkish Straits are one of the world's most difficult waterways to navigate due to its sinuous geography. With 50,000 vessels, including 5,500 oil tankers, passing through the straits annually it is also one of the world's busiest chokepoints. Shipping oil by tankers through the Black Sea costs 20 cents per barrel, which makes a total of about €2.5 billion passing through the straits annually.

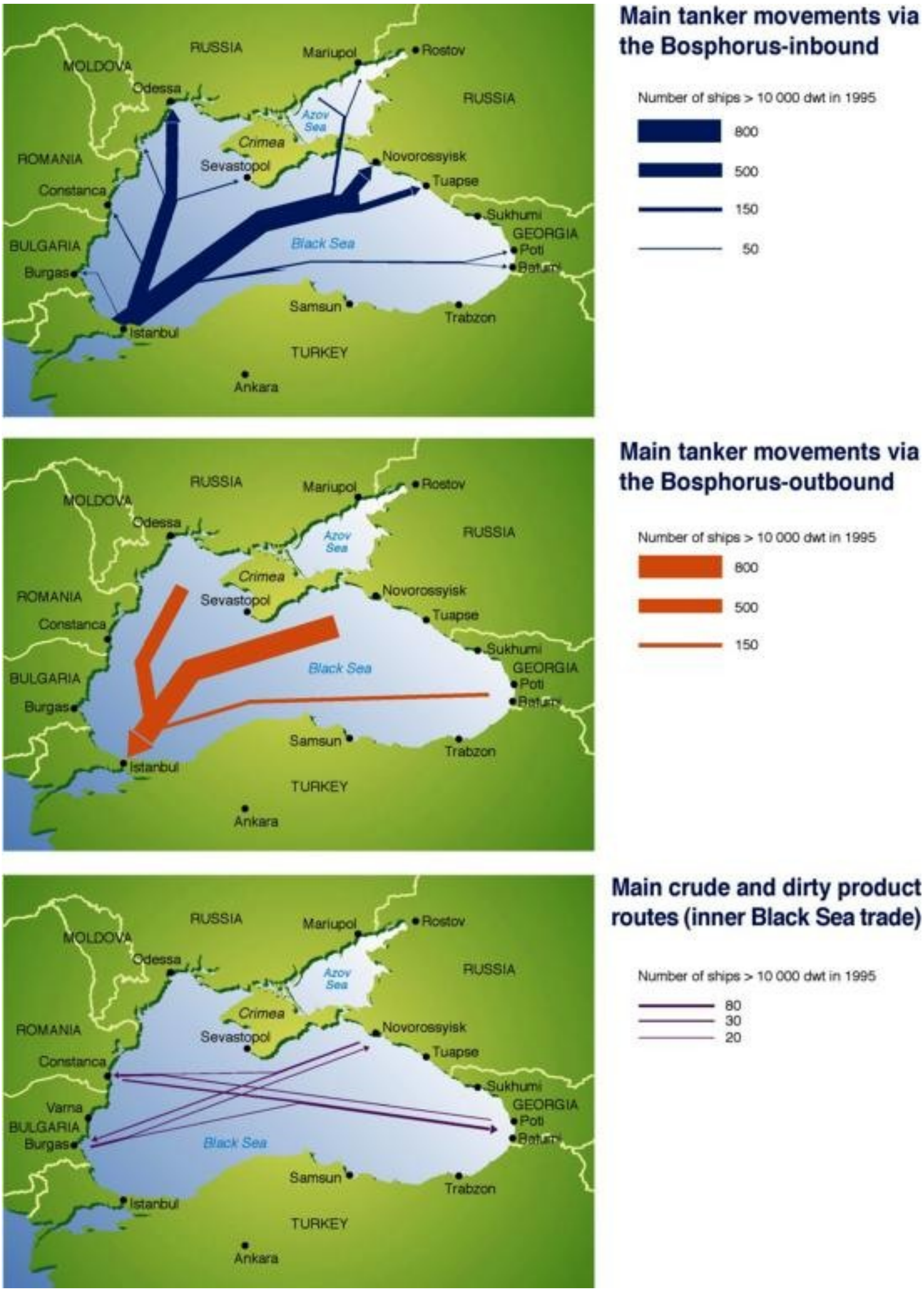

Figure 13. Main tanker routes through the Black Sea and the Bosphorous.

Source: From GIWA Black Sea Graphics. Available at: http://www.grida.no/graphicslib/collection/giwa-black-sea-graphics.

Submarine cables

Various submarine cables pass through the Black Sea as shown at the following Figure.

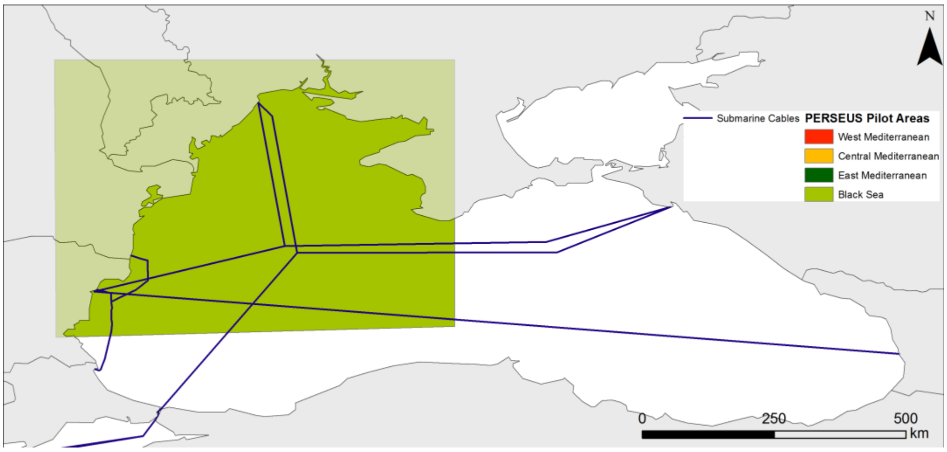

Figure 14. Submarine cables at the PERSEUS Pilot Areas at the Black Sea.
Source: Gathered from www.submarinecablesmap.com.

Table 33. Submarine cables at the PERSEUS Pilot Areas at the Black Sea.
Source: Gathered from www.submarinecablesmap.com.

Name	Year	Length (km)	Involved Companies	Company size (nº employees)	Cost (M€)
BSFOCS	2001	1300	Armentel, AT&T, BTC, Cypress Telecommunications Authority, DTAG, HT, KDDI, OTE, Rostelecom, Telecom Slovenia, Ukrtelecom	Cypress Telecommunications Authority, DTAG, HT, KDDI, OTE: 50-500. Armentel, BTC: = 5000-1000 AT&T, Rostelecom, Telecom Slovenia, Ukrtelecom >10,000.	51
Caucasus Cable System	2008	1374	Caucasus Online	500-1000	76
Italian-Turkish-Ukrainian-Russian (ITUR)	1996	3466	Telecom Italia	>10,000	
Karadeniz Fiber Optik Sistemi (KAFOS)	1997	504	BTC, Turk Telecom	BTC = 5000-10,000 Turk Telecom >10,000	
MEDTURK	2004		Turk Telecom	> 10,000	

Also, at the Black Sea, there is the intention to build two new fiber-optic submarine cable route which would be named as Poti-Constantsa (with a branch to Odessa) and Poti-Istanbul (see Figure 28). The Poti-Constantsa route would have an estimated length of 1200km and its costs are estimated to be around 22 M€. While the Poti-Istanbul route´s estimated length is 1059km and its cost is estimated to be of 20 M€. The maximum term of construction is of 2 years and its construction turnover term is of 6-7years.

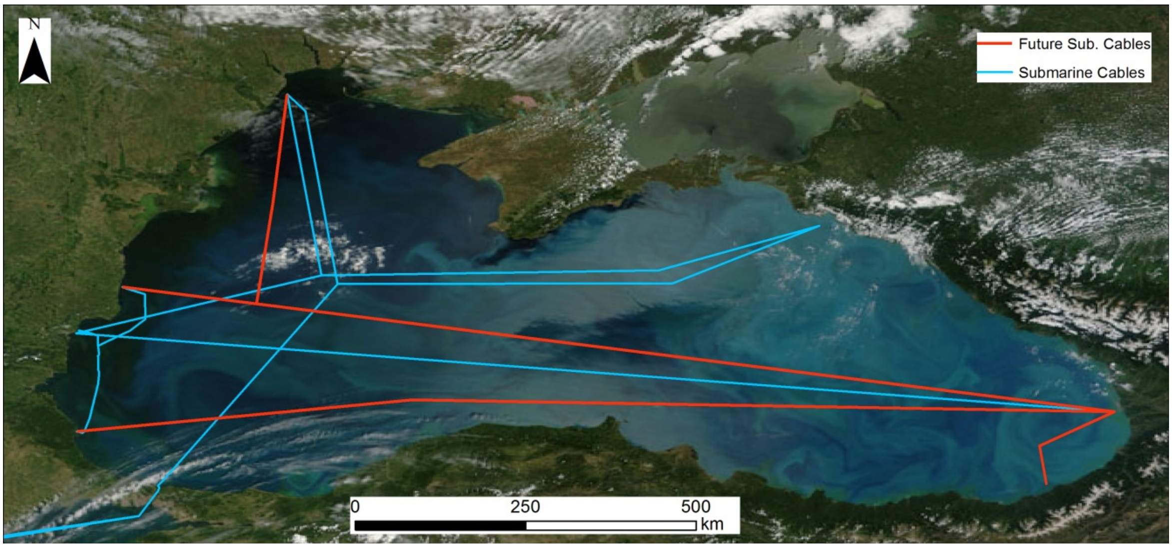

Figure 15. Current and Future submarine cables at the PERSEUS Pilot Areas at the Black Sea.
Source: Authorship: Marta Pascual, BC3.

4.3.3 Gap Analysis

When analysing the Gaps in socioeconomic terms for the submarine cables and pipelines, as anthropogenic stressor, we observe that not many information is publicly available and, when available, averages for the entire Mediterranean or Black Sea are being offered.

Among the most important data acquaintance gaps we found that not much information is available for the production value of oil-tanker vessels or LNG terminals. On the same hand, for the economic value, some information was available in terms of the turnover values, whilst information was not easily obtained for gross value added, transit charges or even the investments being made. For the social value of submarine cables and pipelines, at the Mediterranean and the Black Sea, labour costs, employment rates, or number of direct and indirect jobs was seldom found. Furthermore, for certain aspects, such as oil-tanker routes, even locating these routes seemed quite hard.

While this information is key in assessing possible impacts to various sectors, it is often the most difficult to obtain. Few people are willing to disclose information regarding personal income, profit margins and expenses for the sake of economic assessments. Information for social assessments often involves both time consuming qualitative and quantitative data collection regarding stakeholders, their activities and their communities. Yet detailed information is needed in order for the Council to make better decisions to balance impacts and meet requirements.

Thus, we can conclude saying that more effort should be put into making statistics on the costs/benefits and value indicators of these marine uses in order to put into value their activities and determine if they could be impacted or not if some other use happens to occur in the area.

On the other hand, if we look not only to the costs and benefits of submarine cables and pipelines for the socio economics but also for the environment, most costs, related to the environmental degradation attached to submarine cables and pipelines, rely on the installation, maintenance and decommissioning phases as they may result in benthic disturbance (in a limited extent). Furthermore, prior to the cable or pipeline installation phase, the selected route is usually cleared so that they are installed in a debris-free zone. All these phases are usually followed by a brief overview of seabed recovery after disturbance (ICPC-UNEP –WCMC, 2009).

Thus, knowing the cost of this environmental degradation, in terms of loses or restoration costs should also be determined and further studies should be encouraged for their better measure.

4.3.4 Future Trend Analysis

Oil and Gas pipelines

As stated in the context section 4.5.1, the scenario of oil and gas pipelines ought to increase in the near future regarding the high dependency of the European Union on hydrocarbons. Mediterranean countries currently import half of their oil and gas requirements, and continue to depend on these imports to cover growing domestic demand. The infrastructure for both oil and gas (ranging from pipelines to liquefied natural gas (LNG) terminals, and from oil tankers to oil export terminals) is significantly expanding across the region. The largest shares of the future LNG terminals additions to capacity concern Italy (+16 bcm), Spain (+13.6 bcm), Portugal (+5 bcm) and France (+4.5 bcm) (The LNG Industry in 2011, GIIGNL, 2011).

The Statistical Review of World Energy, BP (2011) and Cedigaz report stated that the area covered by Algeria, Egypt, Libya, Morocco, Tunisia and Turkey along with 5 other south-eastern Mediterranean countries (Israel, Jordan, Lebanon, Palestine and Syria) has almost 5% of the world's proven oil reserves (about 6,145 M tons) and nearly 5% of the world's proven gas reserves (about 8,500 bcm), accounting for most of the hydrocarbon reserves of the overall Mediterranean region. Most of these reserves are located in three North African countries: Libya, Algeria and Egypt (Figure 29).

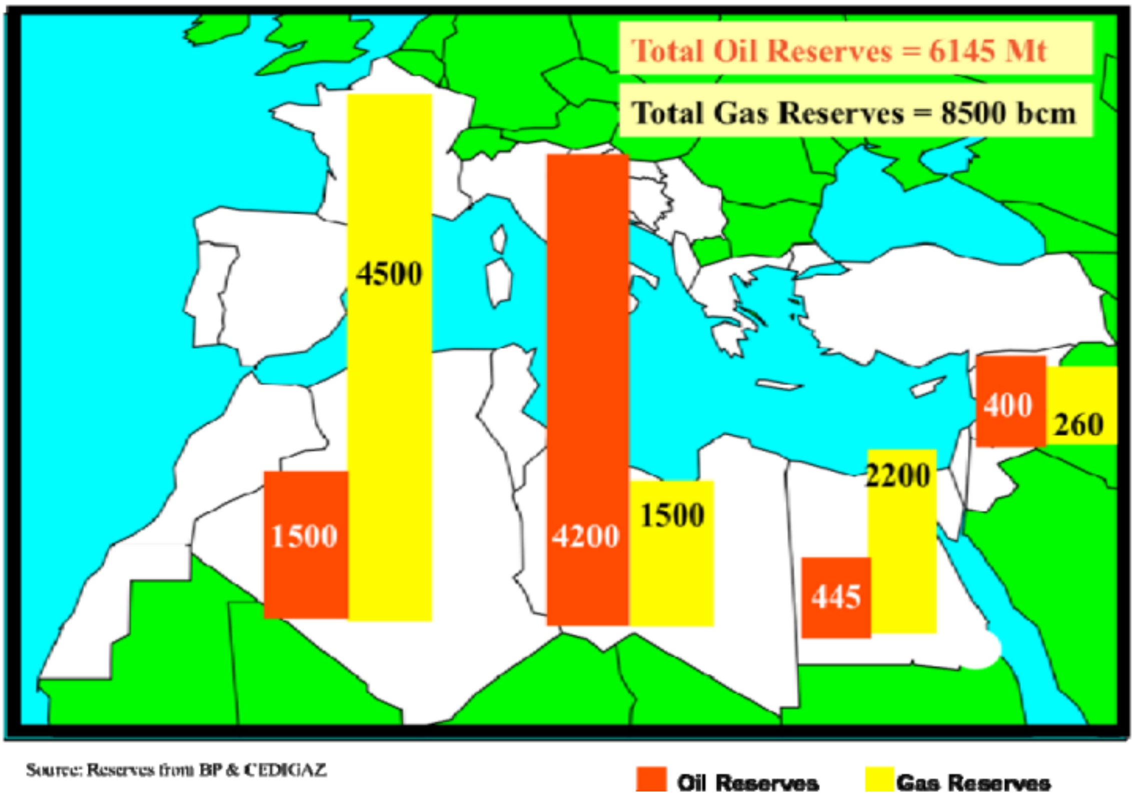

Figure 16. Oil and gas reserves in the Mediterranean.
Source: MEDPRO Technical Report No. 18/October 2012, based on data from BP and Cedigaz.

These areas account for 31% of the Mediterranean region's overall energy demand, a level set to rise to 47% by 2030 according to the MEDPRO (Prospective Analysis for the Mediterranean Region) Energy Reference Scenario, growing by an average annual rate of 3.3% between 2009 and 2030. However, if oil demand is likely to increase – particularly because of an expanding transportation sector – natural gas is set to overtake oil as the dominant fuel by 2030 in the MEDPRO Energy Reference Scenario. In fact, natural gas is expected to rise significantly in the primary energy mix over the next two decades, reaching 38% of the Mediterranean energy demand by 2030.

Considering that the overall potential for oil and gas exports is projected to rise, it is possible to realize the great prospects within the Mediterranean region for energy cooperation between oil- and gas-producing countries on the one hand and oil- and gas-consuming countries on the other.

Among the Mediterranean and Black Sea countries the followings should be highlighted if the future trend analysis of oil and gas pipelines in these regions is to be made.

Turkey: Turkey is increasingly at the crossroads of the world's energy trade. A web of pipelines already crosses Turkey, carrying hydrocarbons along east–west and north–south energy corridors. Indeed, because of tanker traffic through the Bosporus and

Dardanelles Straits, Turkey has become an important north–south transit route for oil.

Traffic through the Straits has grown as the crude production and exports of Azerbaijan and Kazakhstan have risen. Moreover, the Baku–Tbilisi–Ceyhan (BTC) oil and Baku–Tbilisi–Erzurum natural gas pipelines make Turkey an important east–west route as well. Other pipelines already operative include the Kirkuk–Ceyhan oil pipeline and the Blue Stream gas pipeline. A terminal located in Ceyhan – on Turkey's Mediterranean coast – allows the country to export oil from Iraqi and Caspian sources: the first route extends from northern Iraq via a pipeline from Kirkuk and the second route from Azerbaijan via the BTC pipeline.

Egypt: Egypt plays a strategic role in the scenario for regional energy transit, notably because of three important structures: the Suez Canal, the Suez–Mediterranean (SUMED) oil pipeline and the Arab Gas Pipeline. The Suez Canal is increasingly significant for LNG trade. In 2010, about 30 bcm of LNG from Qatar crossed the Canal for the EU market. This represented more than a third of total European LNG imports. For the UK and Belgium, LNG from Qatar crossing the Suez Canal represents about 80% of these countries' LNG imports.

Algeria: Algeria is a major oil and gas exporter in the region and has a well-established system of infrastructure. Algeria is also looking forward to solidifying its standing as a regional transit hub for West African gas and its access to the Mediterranean and European markets. This aspiration explains the planned Trans-Saharan Pipeline, a proposed 4,128-km-long gas pipeline from Nigeria to Algeria with an annual capacity of 30 bcm/yr.

Communications cables

The International Cable Protection Committee (ICPC) determined the "New routes, new technologies, new players and evolving challenges", which was designed to capture the remarkable advances of the submarine cable industry and its future challenges in the face of an increasing human presence offshore. Other key outcomes of the 2013 Plenary were:

•The representation of many new members from different parts of the industry, reflecting the ICPC's drive to open up membership to the entire Submarine Cable Industry.

•Inclusion of new Government members, reflecting the growing importance of Government-Private partnerships to help resolve the new challenges for the critical infrastructure network of submarine cables.

•Reminder of the need for education around the fact that almost all transoceanic communications are now carried on submarine cables.

•The expected growth of offshore renewable energies and the need to share an increasingly crowded seabed.

Maritime activities have a cross-border dimension. National decisions have an impact on adjacent countries. Thus, trans-boundary problems might arise from the localizing of new pipelines or cables. Countries sharing a common marine space in the same basin should find ways to cooperate and promote common approaches to avoid or tackle potential cross-border impacts such as those at the TRACECA EU project, which promoted the development of regional transport links initiatives, promoting, thus, the regional economy on the whole.

4.4 Marine hydrocarbon (oil and gas) extraction

Prepared by D. Sauzade, Plan Bleu

4.4.1 Introduction

General context

According the EU Offshore Authorities Group (EU OAG, 2013), offshore oil and gas production constitutes an important indigenous energy source of hydrocarbons in Europe. In 2011, offshore production in the continental shelves of different EU member states corresponded to almost 11% for oil and 26% for natural gas of the Gross Petroleum Products Consumption.

As shown in Figure 17, major offshore installations in the Mediterranean Sea are concentrated in the Adriatic, in the gulf of Gabes and in the Libyan Sea. In the Black sea, production is mostly located in the North West part.

Production in the Mediterranean WP6 Pilot cases areas is concentrated in Adriatic for Italy, but other areas are potentially promising as offshore of Western Mediterranean (Catalonia and France) or North West of the Black Sea.

The future development of the offshore oil and gas production in European waters of the Mediterranean and in the Black sea is now mostly conditioned by evolution of the energy price and environmental considerations.

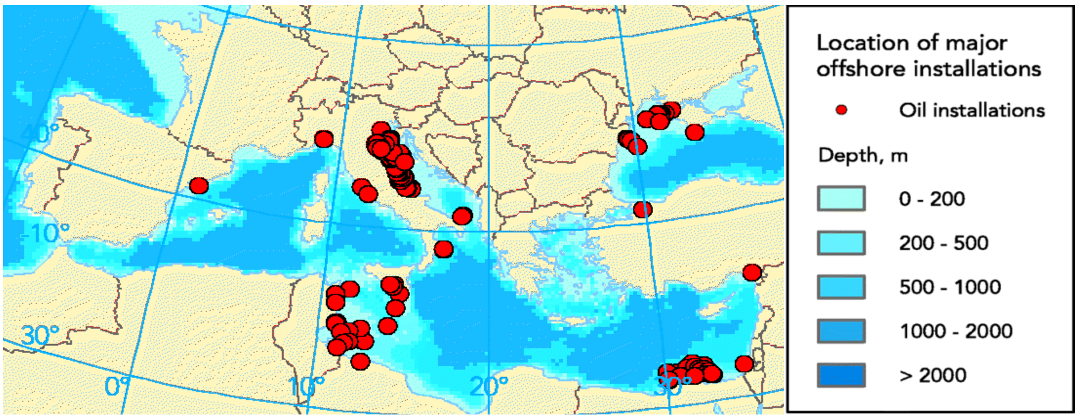

Figure 17. Major offshore installations in Mediterranean and Black Sea (2003)

Source EEA, Locations of major offshore installations, 2003.

Activity description

The oil and gas activities include offshore exploration and extraction of oil and gas at sea. The offshore activities comprise different phases linked to exploration of gas and oil reservoirs: i) the exploration phase to probe the position and the geological characteristics of wells, ii) the installation of the production platform iii) the production phase to extract oil and gas and iv) the decommissioning phase when the commercial life of the well is finished (E & P Forum / UNEP, 1997).

Offshore activities are supported by services activities, such as supply of offshore platforms (various materials, food), personnel transport, security of platforms, anti-pollution but also towing, installation and maintenance of platforms. In this study, these support activities are not taken into account in the calculation of turnover and value added, but they could have been included in the employment data issued by some sources. Some riparian countries of the Pilot cases are also hosting offshore related activities as management, consultancy, research & development, classification or construction and repair of offshore fleet units which are not generally taking place in the Pilot case waters. They are mentioned in the text but not quantified in the activity indicators.

4.4.2 Sector and socio-economic analysis per Pilot Case

Methods, data and assumptions

Data on offshore production in the Mediterranean and in the Black sea are scarce. One reason is due to the fact that oil and gas offshore production is not an economic sector by itself, but a subsector of the oil and gas production in general. The produced commodities (crude oil, natural gas) are identical to those produced on land, the only difference being on the means of exploration and production. Moreover, the PERSEUS Pilot cases are not by far large offshore producing regions, and are not significant in the world production. Data scarcity is developed in the gap analysis for this sector.

The used data and the developed assumptions to address the Pilot Case economic and social analysis for this sector are presented here.

Production figures

- Crude oil and gas production are segregated. Oil and gas productions (generally in barrels per day) have both been converted in TOE (tons of oil equivalent) to be aggregatable.
- 2011 as selected as the reference year, considering available data.
- For Italy, National statistical data (DG RME, 2013) provides a detailed overview of the Italian offshore production.
- National productions (offshore and onshore aggregated) of oil and gas are given by Eurostat.
- Clarkson Research Services provide offshore oil production figures (quantities, number of fields, platforms…) regarding some countries. The December 2010 issue has been used.
- When offshore production figures were not available, assumption was made that approx. 50% of the primary production of crude oil or natural gas is produced offshore. This assumption was employed by the EU Offshore Authorities group to present the offshore oil and gas production in Europe by countries.

Economic analysis

Value of the production

It has been considered that all identified productions have been sold at the average price of the OPEC Reference Basket (ORB) value for the reference year (2011): US$ 107.46 for one barrel or 787.83 for one ton.

Conversion US$ / € has been made using the yearly average conversion rate: one US$ for € 0.78. So, one TOE was valued at € 614.51

Added value

Offshore and onshore productions are generally aggregated in macro-economic statistics and few studies specific to offshore are currently available. None have been found regarding specifically Mediterranean or Black Sea countries. Thus it has been used figures for the UK Offshore industry. According (Pugh, D., 2008), the average added value/ production value ratio is 69%.

Regarding indirect value added, it was found in the study "Economic Impact of the Maritime Industries in Europe" (Policy Research Corporation, 2001), which focused on the economic analysis of the traditional maritime sectors in 15 Member States and Norway (cited in Policy Research Corporation, 2008) that for every euro direct added value, € 0.59 indirect added value was realised after correction for double counting and cross-border effects. However by convention, indirect added value has not been taken into account in this analysis.

Social analysis

Similarly, specific studies on the employment induced by the oil and gas offshore industry within Mediterranean or Black Sea countries have not been found freely available. Figures transferred from the UK offshore industry has been used, (UK Offshore industry, 2013) considering for Mediterranean countries that each TOE generate the same ratio of employment as the one of the UK industry. Considering the large difference in national importance between the UK offshore industry and the one of the Mediterranean and Black sea countries under study, this assumption probably under estimate the direct employment but also overestimate the indirect employment. Thus it provides an order de magnitude on the whole.

In 2012, the UK oil and gas production was about 100,000 kTOE. The same year, exploration for and extraction of oil and gas from the UK continental shelf accounts for around 440,000 employments, comprising:

- Direct: 32,000 directly employed by oil and gas companies and their major contractors (ratio: 0.32 employment/TOE)
- Indirect: 207,000 within the wider supply chain (ratio: 2.07)
- Induced: 100,000 jobs supported by the economic activity induced by employees' spending, plus 100,000 jobs in the exports business, or 200,000 (ratio: 2.00).

Gulf of Lion/ Catalan Sea Pilot Case

By convention, this area contains parts of the Mediterranean coasts and waters of Spain (Levantine Balearic Area) and France (Mediterranean façade) included in the Western Mediterranean MSFD subregion.

Considering this area, there is only is a small production zone in Spain, mostly located in south of the Ebro delta. According Clarkson (2010) 6 fields are in production in Spain, a figure stable from 2006 to 2010, while the production slowly is decreasing. 2009 production of crude oil was estimated to 100 kTOE.

However exploration licences on large and deep to ultra-deep areas have been granted both in France and in Spain. In France, south of the Provencal coasts, Rhône Maritime, in the French EPZ, a very large exploration licence (25,000km^2) going as deep as 2600m was granted in 2002, renewed in 2006 for 125,00km^2 and dropped in 2012. This licence has triggered anger of ecologist movements, as it was located near the Pelagos cetacean sanctuary. Spain has recently granted a very large exploration licence in the slope of the gulf of Lion shelf named Nordeste. It should be noted that a large part of this licence is located in an area claimed both by the recent French (2012) and Spanish (2013) EEZs.

Sector analysis

Open sea

Production is deemed to be only coastal to date.

Economic analysis

Open sea

- Value: € 0

Social analysis

Coastal areas

Open sea

- Current permanent employment for open sea operations is probably nil (occasional explorations).

Projections

- Exploration activities in Member State waters are facing strong environmental opposition in these areas, due to their recognized ecological sensitivity, their seismic instability and their ultra-depth, making difficult implementation of control operations in case of problems. This opposition has been strengthened since the BP Deepwater Horizon accident in the Gulf of Mexico. Moreover, production in these areas would be very expensive. For these reasons, production would be probably delayed after 2030, if not dropped out.

Aegean Sea/ Saronikos Gulf

This area contains parts of the coasts and waters of Greece included in the Aegean sea MSFD subregion.

Offshore production in the area is very confidential. According Clarkson (2010), 3 fields are said to be in production in 2010, against 71 for Italy to give an idea. Exploration of is relatively recent and oil reserves has discovered in 1973 only at Prinos and South Kavala sites in Thasos offshore field, in the north of the Agean Sea. More promising discoveries are located in the Katakolo field in Western Peloponnese, outside the Pilot case area.

Discovery of proven reserve in the eastern part of the Mediterranean Sea in deep sea, offshore Israel, Malta and Cyprus made up hope of equivalent discoveries in the southern Aegean Sea. Exploration campaigns are on-going. Discoveries could have enormous political, geopolitical as well as economic consequences. Recent declarations of Greek Prime Minister (august 2013) substantiate the opinion that Greece has huge gas reserve, mainly offshore.

Nowadays greek production is mainly offshore, national production and other parameters have been shared equally between the Thasos (inside the area) and the Katakolo (outside the area) fields, in absence of more precise data.

Sector analysis

Open sea

Production is deemed to be only coastal to date.

Economic analysis

Open sea

- Value: € 0

Social analysis

Open sea

- Current permanent employment for the open sea operation is probably weak (exploration only).

Projections

If offshore reserves are proven, current financial situation of Greece will sweep off environmental opposition and exploitation will start as soon as possible. However, Greece has ratified the Prevention and Emergency Protocol, 2002 associated to the Barcelona convention in 2006. Moreover, the European Union has adopted recently (published 28 June 2013) a new Directive on the safety of offshore oil and gas operations which should provide some guaranties regarding deep sea operation safety.

Western Black Sea

Production

Shows of oil and gas have been observed on the shores of the Black Sea since antiquity, with the first commercial (onshore) production beginning in the 1850's in Romania. Romanian offshore fields are located in the central part of its continental shelf. On-going exploration campaigns show that the whole area could host huge gas reserve. Recent discoveries are located in a disputed zone between Romania and Bulgaria.

Sector analysis

Open sea

Production is deemed to be only coastal (<200m) to date. Moreover, the Romanian coastal shelf is very large.

Economic analysis

Open sea

- Value: € 0

Social analysis

Open sea

- Current permanent employment for the open sea operation is probably weak (exploration only).

Future trends

Most of the Black Sea, both the shelf and the deeper areas, is believed to be prospective for oil and gas. Indeed, numerous discoveries have been made on the shelf of Ukraine, Romania, and Bulgaria. Until recently, however, exploration beyond the shelf on the continental slope and in the deep sea has been sporadic and inconclusive. Among the reasons for this lack of interest are the facts that the littoral countries have traditionally been well supplied with reasonably priced oil and gas by major producers. Also, the lack of technology in the littoral countries and the low incentive conditions offered to private investors of the upstream petroleum industry have limited the scope of exploration for oil and gas in the Black Sea.

However, this context is changing, especially for the two EU countries. In Romania, future pipe line connecting the Ana and Doina fields to the shore will boost exploration and production in the area (Figure 18)

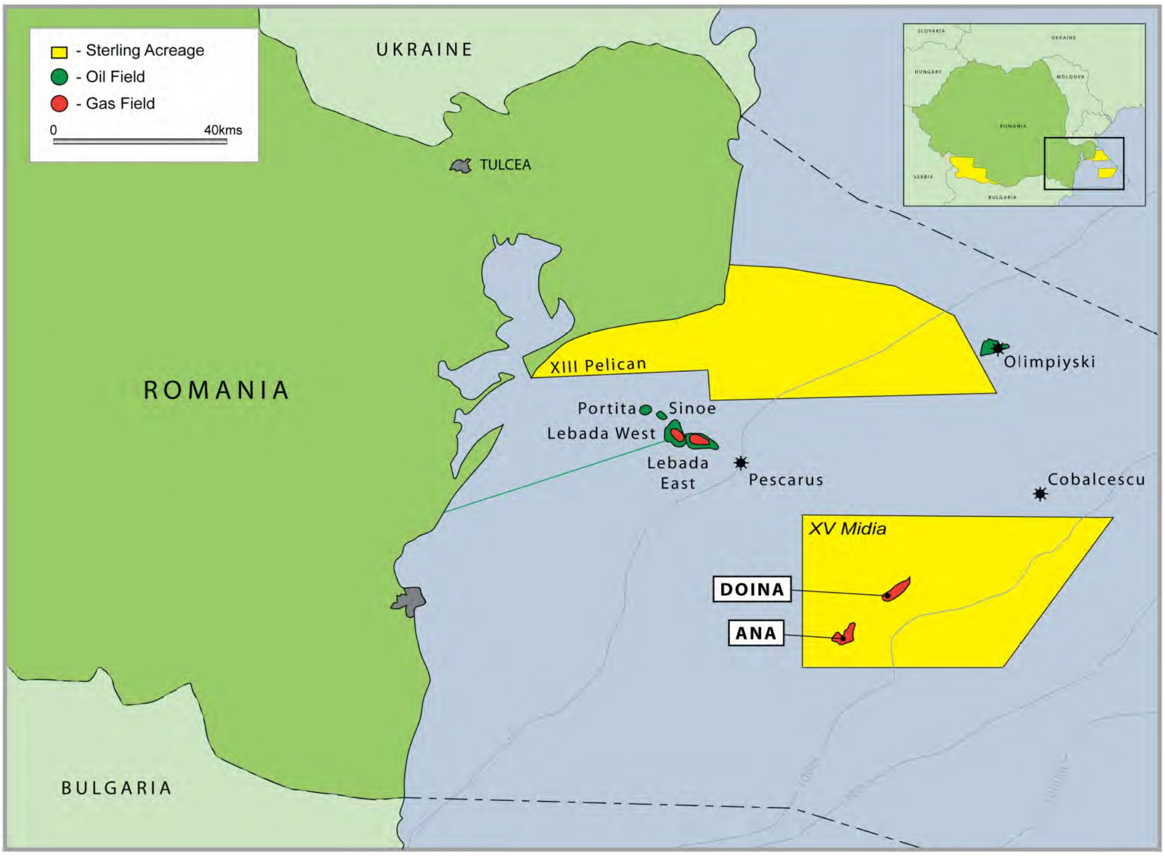

Figure 18. Map of the Romanian offshore production fields

Source : Sterling resources Company, Romania gas forum, 2011

4.4.3 Links to environmental pressures

General considerations

Oil and gas exploration and production operations have the potential for a variety of impact on the environment, depending upon the stage of the process, the nature and sensitivity of the surrounding environment, pollution prevention, mitigation and control techniques (Trabbucco, 2012).

Impact can be roughly classed into two categories; the first is related to ecosystem disturbance by the presence and operation of structures in the water column and on the bottom. The second is related to marine pollution due to oils spills, whether accidental or not.

With regards to the aquatic environment, the principal problems are linked to the presence of the offshore structures and then to waste streams. Presence implies disturbance by noises and vibrations of the marine fauna such as fish and marine mammals in the operating area, as well as possible invasions of exotic species carried by ships' ballast water assistance / support and oil (Kloff and Wicks, 2004).

As for the wastes, produced water consist mainly of water extracted from the reservoir, relatively warm, containing dissolved and dispersed oil, polycyclic aromatic hydrocarbons (PAHs), heavy metals, high salt concentrations, and no oxygen, sometimes even radioactive materials (Steiner, 2003; Wills, 2000; Patin, 1999). Volumes vary considerably throughout the life of a reservoir. Environmental impacts of offshore chronic pollution are not yet well known. However, the current research reveals the existence of cumulative and long-term impacts.

Regarding marine pollution, it should be noted that globally, only 9% of marine pollution from oil is attributable to offshore production, the majority of this pollution being from maritime traffic (68%) and onshore facilities (23%) (Lentz and Felleman, 2003). However, in regions where offshore oil production is intensive, as in the North Sea, the marine pollution by oil due to offshore production rises to 32%. Local environmental impacts can be significant depending on the intensity of the activity. In addition, marine pollution related to petroleum may originate from several sources and it can be chronic or acute and more or less toxic. A relatively small but sudden amount of oil can have fatal acute effects on all marine life, while larger quantities of oil discharged for long periods may have chronic and sub-lethal effect on the marine life.

Small oil spills typically occur during routine operations when oil is loaded and unloaded by tankers. This usually happens in ports, oil terminals such or offshore production platforms. The amount of oil spilled during operations on the terminals is three times greater than the total amount of oil spilled as a result of accidents involving oil tankers (ITOPF[4]). However, there are several examples of best practice globally regarding port management and control systems of tanker traffic, in which the problem can be reduced to very low levels through the use of advanced technology and careful management.

Accidental pollutions are often severe and can be caused by both tankers and offshore oil facilities. If a large spill occurs, pollution reaches almost immediately levels lethal to plants, fish, birds and mammals. The consequences are particularly disastrous if the oil spills happens on the coast and accumulates in sediments of shallow coastal areas. Accidents caused by large oil spills involving offshore oil installations can be caused by various factors. Well blowout or pipeline ruptures are the most common. A recent example for a catastrophic accident is the major explosion of *Deep Water Horizon* platform in the Gulf of Mexico in April 2010, having rejected three months between two and four million barrels of oil into the sea.

Policy context evolution in European waters and the Mediterranean Sea

The European Commission has considered that the scale and characteristics of recent offshore oil and gas accidents demand action. They expose the disparity between the increasing complexity of operations and the inadequacies in the current risk-management practices. In Europe, most oil and gas is produced offshore and the likelihood of a major accident in Union waters needs to be reduced. It has been considered that the existing regulatory framework and operating arrangements do not provide for the most effective emergency response to accidents wherever they

[4] The International Tanker Owners Pollution Federation (ITOPF) http://www.itopf.com/information-services/data-and-statistics/statistics

occur in Union waters, and the liabilities for clean-up and conventional damages are not fully clear.

In this context, the European Commission has proposed end 2011 a regulation of the European parliament and of the Council on safety of offshore oil and gas prospection, exploration and production activities[5]. On 28 June 2013, the European Union published a new Directive on the safety of offshore oil and gas operations in its Official Journal.

The objective of this Directive is to reduce as far as possible the occurrence of major accidents relating to offshore oil and gas operations and to limit their consequences, thus increasing the protection of the marine environment and coastal economies against pollution, establishing minimum conditions for safe offshore exploration and exploitation of oil and gas and limiting possible disruptions to Union indigenous energy production, and to improve the response mechanisms in case of an accident.

In September 2012, IUCN's Members Assembly has adopted a recommendation aimed at strictly regulating the development of offshore oil exploitation policies and projects in the Mediterranean. Through this motion, the World Conservation Congress asks the Mediterranean coastal States to regulate the development of offshore oil exploitation policies and projects in several ways including:

- to apply the precautionary principle to offshore development projects for remarkable and sensitive natural environments as well as protected areas;
- refuse to allow gas, oil or any other kind of exploration or exploitation permits for areas near natural sites which have national or international importance should any impacts be identified; and
- reinforce prior scientific studies on the study of coastal and marine environments.

Main pressures caused by the offshore hydrocarbon extraction

The main pressures considered are those listed in the Table 2 of the MSFD.

By order of importance:

- Oil spills: Contamination by hazardous substance, here oil, impacting marine life. This impact could local in case of operational oil spill or relatively large in case of accidental oil spill. Impacted ecosystem components are Seabirds, fishes (including exploited) shellfishes (including exploited), marine mammals, benthic fauna
- Operational waste: systematic introduction of solid and liquid wastes, specially produced waters, with a local impact
- Physical disturbance of marine life due to noise, especially during the seismic surveys required by the exploration phase.
- Biological disturbance due to potential introduction of introduction of non-indigenous species and translocation caused by associated shipping operations.

[5] Ref. COM/2011/0688 final - 2011/0309 (COD)

Main risks to be considered for each Pilot Cases

Within the tasks T1.1 and T2.1, respectively Analysis of pressures and process and their impact on the ecosystems, respectively in open sea areas and in coastal waters, main risks of non-achievement or maintenance of GES have been identified for the Mediterranean sub regions and the Black Sea. Specific risks for each WP6 Pilot cases have been also selected and presented in paragraph 2.4, Environmental risks analysis. For offshore oil and gas activities, these risks are presented in

Table 34. Potential risks induced or exacerbated by offshore extraction activities

WP6 Pilot cases	Coastal areas	Open Sea
Gulf of Lyon / Balearic Sea	Chemical Pollution (D8, D9), Marine litters (D10)	Physical damages and losses of habitats (D6)
Aegean Sea/Saronikos Gulf	Marine litters (D10)	Physical damages and losses of habitats (D6)
Western Black Sea	Chemical Pollution (D8, D9), Marine litters (D10)	

Gulf of Lyon / Balearic Sea

As seen in the above analysis, offshore extractions activities are nowadays minor compared to other Mediterranean areas. Excepted in the Ebro delta fields, contribution of these activities to increase risk regarding Chemical pollution and Marine litters is negligible.

In open sea, exploration permits have been granted by Spain. However, regarding uncertainties before to installations of production wells, risk of physical damages and losses of habitats will be negligible for long. Moreover these wells would probably not be drilled in the continental shelf slope and canyons, where are located ecosystem hot spots for this area.

Aegean Sea/Saronikos Gulf

Offshore extractions activities are nowadays minor compared to other Mediterranean areas. Excepted in the Thasos offshore fields, contribution of these activities to increase risk regarding Marine litters is negligible.

It has been seen that expectations are high to discover large gas fields in the Aegean Sea deep waters. If it becomes true in the coming years, these fields will be exploited and a great attention should be paid to the impact on the deep sea habitats, as there are biodiversity hotspots on seamounts in this area.

Western Black Sea

While less important than the Adriatic, western Black sea hosts a significant offshore activity, contribution to the chemical pollution of the area, especially in the production field areas. This pressure will probably increase in the future, if some of the offshore extension projects are concretized.

To a lesser extent, offshore production also contributes to the generation of marine litters. It is hoped that stricter regulation will limit these risks in the future.

4.4.4 Gap Analysis

Oil and gas activities are very strategic. They are the subject of plethoric factual information, aggregated in multiple business intelligence surveys at various scales, mostly made by specialized private companies who are generally selling at high price their production to professionals of the sector (typically 1000 € to 2 000 € for a country report or a regional map). Except for specialised reviews on offshore activities, reports are usually not setting apart offshore activities from onshore ones, as they produce the same commodities (crude oil and natural gas). Published scientific publications are generally dealing with issues upstream production, as geological studies, or downstream, as impact of activities or intelligence surveys on the energy resources or needs in the region. For these reasons, this part of the deliverable has been built on few available references, from which data have extrapolated by the authors in view to provide orders of magnitude and some general perspectives. These references have been presented in the methodology and data section of the analysis.

Except some field specific data, available data does not separate coastal areas activities from those in open sea, here defined as beyond the 200m bathyline. It can be considered that most of the oil and gas extraction in the PERSEUS Pilot cases is nowadays in the coastal area. However projections show that these activities could be developed in open sea in the next decades (W Black Sea, Aegean)

5 RESULTS OF THE COST OF DEGRADATION

5.1 Introduction, methodological considerations

In the context of PERSUES four Pilot Cases are examined, namely: the Balearic Sea and Gulf of Lyon; the Northern Adriatic Sea; the Aegean Sea/Saronikos Gulf and the Western Black Sea.

These areas are presented in section The WP6 Pilot Cases2.3.2, in terms of geographic features, in particular their surface, which has been used in some cases to assess the cost of degradation per Pilot case, as a proportion of the Cost of degradation assessed in similar areas, generally in the framework of the MSFD economic and social assessment (ESA) carried out by Member States.

General methods to assess cost of degradation are presented in the Guidance document elaborated by an ad hoc working group at European level.

Three approaches were suggested in the WG ESA guideline to undertake the Cost of Degradation of marine waters:

- The Ecosystem Service Approach
- The Thematic Approach
- The Cost-based Approach

Each of these approaches is briefly presented and analysed in terms of strengths and limitation.

The Ecosystem Service Approach

Definition of "Cost of Degradation": The cost of degradation is associated to the value of (lost) ecosystem services, calculated as the potential difference between Good Environmental Status and a "Business As Usual" (BAU) Scenario.

Objectives: Capture the potential difference between the reference condition (attaining GES scenario) and the scenario that may originate in the absence of policy, by identifying and inventorying the ecosystem services and associated benefits that might be lost if the marine environment is negatively affected.

The Ecosystem Service Approach involves 4 main steps:

I. Defining GES for each component of the marine environment

II. Assessing the environmental status in a BAU Scenario

- Projections: forecast of drivers and pressures or simple extensions of historic trends in the state of the environment.

III. Describing in a qualitative and, if possible, quantitative manner, the difference between GES and the environmental status under the BAU Scenario (environmental degradation).

IV. Describing consequences of environmental degradation to human welfare in a qualitative, quantitative or monetary manner.

Strengths:

- Very detailed and exhaustive.
- It considers both qualitative and quantitative data.

Limitations to the Ecosystem Service Approach:

- Dealing with uncertainty: two or more future scenarios need to be assessed (e.g. the "BAU Scenario" and the "GES - MSFD scenario"), as well as monetary valuation of all ecosystem goods and services.
- Indicators able to compare different scenarios should be established.
- Risk of double counting when estimating the costs of losing ecosystem services.
- Dealing with reality: a significant amount of resources (time and data) are needed for a quantified and monetized assessment of the full cost of degradation.
- Taking into account the former aspects, a qualitative assessment might be the result of adopting this approach.

The Thematic Approach

Definition of "Cost of Degradation": The socio-economic impacts of current environmental degradation with regard to the reference situation.

Objectives:

- Providing a comparison between the current costs of implementing measures aiming to protect the marine environment and prevent its degradation, and the costs of implementing such measures in a reference –GES- situation.
- Assessing the current cost of degradation, reflecting the present costs, expenses and losses of benefits related to the anthropogenic degradation of the marine environment.
- Assessing the financing structure for the protection of the marine environments, that is, providing an overview of the economic actors that are involved in the implementation of these measures.
- Providing useful qualitative and quantitative information characterizing the benefits of implemented measures.

The Thematic Approach involves 4 main steps:

I. Defining degradation themes (e.g. chemical compounds, marine litter, oil spills, microbial pathogens, eutrophication, invasive species, degradation of natural resources etc.).

II. Defining the reference condition, where GES targets are achieved.

III. Describing in a qualitative and, if possible, quantitative manner, the difference between the reference condition (GES) and the present environmental status for all themes.

IV. Describing consequences of environmental degradation of marine environments to human welfare in a qualitative, quantitative or monetary manner. It may include 4 types of costs:

- Expenditures on current measures for environmental protection and prevention
- Mitigation costs: expenses for avoiding impacts linked to the loss of ecosystem services.
- Transaction costs: linked to monitoring and dissemination.
- Opportunity costs: loss of benefits of activities suffering from environmental degradation or lack of biodiversity resources.

Strengths:

- It considers both qualitative and quantitative data.
- Since no BAU Scenario to be forecast, this approach results less contentious from the analytical perspective.

Limitations to the Thematic Approach:

- The reference situation (GES) needs to be determined and explained for each cost type and degradation theme.
- Limitations on data availability, leading to an assessment rather qualitative.

The Cost-based Approach

Definition of "Cost of Degradation": Cost of avoiding today's environmental degradation, according to relevant legislation put in place for the protection of the marine environment.

Objectives: This approach assesses the current cost of degradation, and quantifies the present costs, expenses and loss of benefits related to the anthropogenic degradation of the marine environment.

The Cost-based Approach involves 4 main steps:

I. Identifying current legislation intended to improve the status of the marine environment. This step involves the following tasks:

- Considering all individual measures that have been put in place and have a significant effect upon the marine environment.
- Considering whether measures are on land or sea; whether they are paid by public or private sectors; and the time scale they are paid over.

II. Assessing the costs of this legislation to the public and private sectors.

- E.g. costs to public sector: subsidies, personnel costs, carrying out measures for land-based activities, etc.

III. Assessing the proportion of this legislation that can be justified on the basis on its effect on the marine environment.

IV. Adding together costs attributable to protecting the marine environment from the review of the different legislation

Strengths:

- It refers to the present situation, consequently data and information might be available.

- It delivers useful information for assessing benefits of measures currently put in place.
- There is no need for developing neither a reference condition nor future scenario.
- It provides with an overview of the financing structure for the protection of the marine environment by detailing which are the economic sectors implementing measures (and assuming costs).
- It can also consider measures resulting from concerns in areas other than marine environments (i.e. agricultural sectors, wastewater treatment plants, etc.) but having an effect on them.

Limitations to the Cost-based Approach:

- This approach considers only quantitative data on already implemented measures for preventing marine degradation.
- It does not include a reference condition (since it does not aim to present benefits of improving marine environmental status or achieving GES).
- Cost of total degradation is not quantified, since current measures are not able to prevent total degradation of marine environments.
- The inventory of land-based measures might be challenging: to what extent do they need to be considered.

Analysis of the Cost of degradation assessment made by EU MS riparian of the PERSEUS Pilot cases shows diversity in the methods chosen by MS, some MS combining methods. Greece has used a simplified Ecosystem Service approach, as Slovenia which combined this method with a valuation of the current goods and services provided by marine ecosystems. Italy and Spain used the Cost based approach while France developed an original method combining the Cost based approach with the Thematic approach. This diversity shows the novelty of the subject and has made more difficult to assess the Cost of degradation in the PERSEUS Pilot Cases.

5.2 Cost of degradation per Pilot Case

The environmental risks affect a number of the ecosystem services of the marine areas, both final and intermediate. In order to provide detailed estimates of the cost of degradation for each Pilot Case, it would be necessary to have a plethora of quantitative information regarding:

(a) the ecosystem status

(b) the pressures and impacts affecting the provisioning (e.g. food, genetic resources, renewable resources and non-renewable resources, maritime transportation routes), the regulating (e.g. air quality regulation, climatic regulation, storm and flood protection, erosion control, water purification), the cultural (e.g. recreation and leisure, aesthetics, cultural heritage) and the supportive services (e.g. nutrient cycling, ecosystem stability and resilience, habitats, biodiversity) of the marine ecosystem

(c) the characteristics of the population affected (i.e. number of affected inhabitants, tourists, recreationists, etc.)
(d) the affected population's willingness to pay for measures aiming to protect the marine ecosystem (per impacted service) by means of methods capable of capturing both use and non-use values of these services.

Although in the context of PERSEUS existing data were gathered and synthesized and new knowledge was developed, there are still significant gaps in information relating mainly to the abovementioned issues (b) and (d). For instance, as proved during the process of constructing the *V-MESSES* database, the number of monetary estimates for specific marine ecosystem services is limited, if not absent, in Mediterranean and Black Sea regions. In addition, the disparity in the monetary estimates is quite large. For example, for the Mediterranean Sea, the economic value of marine ecosystem benefits ranges between 125 €(2012) per ha and year (Mangos et al. 2010) and 161,000 €(2012) per ha and year (Brenner et al. 2010). This is attributed to the different 'assets' valued and the different area of interest (e.g. an entire sea region vs. a coastal area) and it coincides with the conclusions drawn by TEEB (2010), i.e. that the monetary value of the potential use of all services of coastal ecosystems varies between 248 and 79,580 USD per ha per year (App. 3, Tables A3.1 & A3.3).

Bearing in mind the above remarks, the cost of degradation, at this stage, was based on the information provided from the MSFD Initial Assessment reports of the EU MS. More explicitly, first, the total national or regional cost of degradation of the marine environment from the MSFD Initial Assessment reports of the MS was scaled on a per square kilometre basis. Then, the cost of degradation attributed to each of the four Pilot Cases was estimated according to their geographic area (see section 2.3.2), taking into consideration the following activities:

- fisheries
- aquaculture
- maritime transport
- recreational activities and tourism (ferries, cruise ships)
- underwater pipelines and cables (power and communication)
- "offshore" industry (oil, renewable marine energy)

The methodology adopted follows a 'top-down' approach and it is not capable of providing a detailed breakdown of the cost of degradation per ecosystem service and activity because of the lack of appropriate input data. As a result, its ability towards selecting targeted measures is reduced. In addition, it may underestimate the cost of degradation related particularly to non-use values. On the other hand, the methodology is simple, transparent, straightforward and consistent with the approaches adopted by EU MS. Consequently, the estimates of the cost of degradation for each Pilot Case are comparable and at least as reliable and accurate as those of the MSFD Initial Assessment reports of the EU MS. It is finally noted that those issues will be addressed by means of a more detailed quantitative description and mapping of economic sectors that will be made in the Barcelona/Catalan coast, which is known to have adequate information and data in both environmental and socio-economic issues related to pressures from human activities.

5.2.1 Balearic Sea and Gulf of Lyon

Based on economic data published by the Spanish General Office of Analysis, Forecasting and Coordination, Department of Agriculture, Food and Environment, the cost of degradation was estimated at 139.99 million Euros and 83.10 million Euros for the years 2009 and 2010, respectively (i.e. 111.5 million Euros per year, on average), through investments attributed to the protection of the eastern provinces of Spain - Balearic Sea marine sub-region. In addition to that cost, the Autonomous Communities of Catalonia, Valencia and Balearic Islands spent, on average, around 256.5 million Euros per year, in 2009-2011 (i.e. Catalonia: 65 million Euros; Valencia: 125 million Euros; and Balearic Islands: 67 million Euros) for the protection of the marine environment (details are provided in deliverable D2.2).

The French Mediterranean coast comprises the Gulf of Lion and the Cộte d'Azur. The Gulf of Lion is broad and shallow and reaches, in the south, from the border with Spain to Toulon, in the west. The Cộte d'Azur is narrow and drops steeply to depths of 2000 meters and more (Lambeck and Bard, 2000). Bearing in mind the characteristics of this area and the fact that the economic figures which are available from the French Initial Assessment report (Mediterranean region) refer mainly to marine activities in coastal waters, the cost of degradation for the Gulf of Lyon was considered equal to the estimates provided for the French Mediterranean region. Based on this assumption, the cost of degradation is around 748 million Euros per year (details are provided in deliverable D2.2).

5.2.2 Aegean Sea/Saronikos Gulf

According to the Greek report, the cost of degradation was considered to be equal to the Present Value of lost Gross Value Added in specific sectors. Using the results of the basic scenario (i.e. a discount rate of 2.38%), the total cost of degradation of the Greek marine territory is around 557.5 million Euros. The total exclusive economic zone of Greece is 504,452 square kilometers (de Vivero, unknown). The area covered by the Aegean Sea and the Saronikos Gulf is 217,600 square kilometers. Based on these figures, the total cost of degradation for the policy case is around 240.5 million Euros in Net Present Value terms.

5.2.3 Western Black Sea

The Romanian Initial Assessment employs a cost based approach, which includes monetary values of measures related to the coastal zone and the marine area in four main fields:

1) Investments in wastewater treatment facilities and construction of sewerage systems under the Urban Wastewater Treatment Directive. The total investment for rehabilitation of wastewater treatment plants sums up to € 24 million, while

the extension and upgrade of the sewerage system along the coast is estimated at about € 50 million.

2) Nutrient abatement costs in the Romanian part of the Danube basin. The estimates for achieving reduction in nutrient loads until 2015 according to a baseline scenario (12% decrease in nitrogen and 20% in phosphorus compared to the level of 2005-06) are the staggering € 46,700 million or about one third of Romania's GDP in 2011.
3) The annual costs for removing algae from the beaches during the summer season are in the range of € 0.5-0.6 million.
4) The total costs for protection and rehabilitation of the southern part of the coast are estimated at € 40.3 million.

The total cost of degradation of the Romanian zone adds up to around € 115 million, not taking into account the nutrient abatement costs part of the Danube Basin Management Plan.

As far as Bulgaria is concerned, according to the Initial Assessment report that was recently released, the potential damages to fisheries and the tourism sector, in permanent damage to the marine environment, range between € 0.575-0.890 and 39 -58 million, respectively. The cost of degradation was calculated as the net present value of lost production value in the two sectors under a baseline scenario with a discount rate of 2.53%. This cost of degradation is used as a preliminary assessment of the cost of degradation of the specific policy case.

5.2.4 Results on cost of degradation and gap analysis

The cost of degradation for the four policy cases is summarized in the following table (Table 35). As mentioned, the estimates were based on existing information gathered by the Initial Assessment reports of the Member States after appropriate scaling. The estimates will be updated as new data becomes available.

Table 35. Cost of degradation for the PERSEUS policy cases

Policy case	**Cost of degradation** (millions of EURO)
Balearic Sea and Gulf of Lyon	1,116*
Aegean Sea/Saronikos Gulf	240**
Western Black Sea	155 - 175**

*Note: *Annual estimates; **Total estimates*

Data issues remain a major challenge to assessing the cost of degradation for the pilot cases. The lack of information is attributed to not having:

(a) detailed surveys regarding the connection between the ecosystem status, the pressures and impacts and the ecosystem services of the open sea;
(b) valuation studies and data-points regarding the main environmental risks and the services affected in each Pilot Case.

In order to cope with these issues, first, a detailed analysis of the ecosystem status and of the pressures and impacts affecting the ecosystem services of the marine areas would be necessary, considering both the final (e.g. food provisioning, raw materials and energy, recreation, maritime transport) and intermediate services (e.g. habitat, climate regulation, eutrophication mitigation, and resilience). As mentioned by UNEP (2006), there are gaps in both knowledge and data relating to marine and coastal ecosystems and, thus, long-term and large-scale ecological processes are generally poorly understood. Furthermore, it is argued that existing biodiversity indicators do not adequately reflect many important aspects of biodiversity, and so far, there is no agreement, towards a complete set of indicators. This stands especially for deep-sea values. For example, there is a lack of understanding of the oceanic nitrogen cycle that makes predicting the impacts of anthropogenic N inputs very difficult. In addition, anthropogenic pressures on marine ecosystems derived from land-based activities, namely the effects of large cities, ports, coastal development, pollution from industry and their interference with hydrology, nutrient and organic matter enrichment, biological disturbance or contamination effects in the pilot cases should be considered. Except some specific data, available information does not detail the interconnections between ecosystem status, pressures and impacts and ecosystem services, neither separates coastal areas activities from those in open sea, here defined as beyond the 200m bathyline.

Regarding market and non-market valuation studies, the *V-MESSES* database contains, so far, over 100 value estimates for four categories and 20 subcategories of marine services extending to regions of SES. Thus, the database enables, so far, the estimation of the aggregated value of all ecosystem services, as well as the economic value of: (a) provision of food, raw materials and genetic resources/medicine; (b) gas and climate regulation, erosion control, bioremediation of waste and water purification; (c) recreation and leisure, aesthetics, cultural heritage, spiritual values and science and education; (d) primary production, biochemical cycling, ecosystem stability, habitats and biodiversity.

Nevertheless, it should be noted that there are gaps of information that need to be filled. For instance, the Black Sea and the Central Mediterranean areas appear to have monetary estimates relating only to cultural values. Focusing on specific countries, Italy and Bulgaria have estimates only for cultural services, while no such data are available for France. Furthermore, not all ecosystem categories are covered with respect to the services offered within the area of interest. For example, there are limited or even no records for specific provisioning services. In addition, there is limited information focusing on open waters. About 47% of the studies reviewed are related to both marine and coastal ecosystems, 19% are limited to coastal ecosystems and only around 9% refer solely to marine waters (all in Western Mediterranean, i.e. Spain).

In addition to availability of data or credible information, the selection and implementation of values is another restriction, since several conditions should be met in order to conduct effective and efficient value transfers (e.g. similar characteristics in terms of the environmental good or service valued, similar population sizes and characteristics in the study and policy sites, similar distributions of property rights, etc.). Finally, besides those issues, there are additional difficulties in applying value transfers in the context of marine and coastal ecosystem services, e.g. care must be taken not to use values derived in the context of incremental changes to value the ecosystem as a whole, not to add estimates of individual components of value when benefits from ecosystems are non-complementary to avoid overestimation of total economic value, etc.

6 CONCLUSIONS

Following the DPSIR model, this study provides an overview of the socio economic drivers (D) exerting pressures (P) on the coastal areas ecosystems whose knowledge is required to prepare the responses (R) aiming to reduce the impacts (I) to an acceptable level. More specifically, the objective of this deliverable D1.4 of the Task 1.2 (Analysis of socio economic activities in open sea areas) is to assess in socioeconomic terms the environmental impact of human activities using the marine areas, at the scale of the PERSEUS WP6 (Adaptive policies and scenarios) Pilot Cases, where will be implemented and tested the Adaptive Policy Frame Work (APF) Tool Box. This Tool Box is a kind of Decision support system for the construction of adaptive policies aiming to achieve or maintain the Good Environmental Status at Pilot Cases and Basin levels. Its logic follows a policy cycle in five steps, each steps calling for tools and knowledge base. The economic and social assessment (ESA) presented in this deliverable is an important part of the knowledge required to build policies, in the same way as the ESA included in Initial assessment is needed for further steps of the MSFD implementation by EU Member States (MS).

In this context, the following PERSEUS Pilot Cases have been examined, namely:

- the Balearic Sea and Gulf of Lyon (abbr. W. Med)
- the Aegean Sea/Saronikos Gulf (abbr. Aegean)
- the Western Black Sea (abbr. W. Black Sea)

This study on the PERSEUS Pilot cases has been preceded by the D1.2, which was focused on the four subregions of PERSEUS.

A similar work (D2.3) has been made in the framework of the Task 2.2, focused on the coastal, here defined as waters including the seabed and subsoil within the 200m bathyline. This approach is in coherence with distinct ecosystems studied within the PERSEUS project but raised difficulties in practice due to the lack of data as well as in theory as it undermines the spatial coherency between the economic and social assessment and the design of programme of measures, which must take place in areas under given jurisdictional responsibilities. However, it has been considered as innovative to make a focus on the open seas.

As for the D1.2, this analysis has been focused on the following main sectors: i) fisheries, ii) maritime transport and ports, iii) submarine cable and pipeline operations, and vi) marine hydrocarbon (oil and gas) extraction.

The distinction between coastal areas and open seas proved to be more difficult than expected.

- For fisheries, distinction between coastal areas and open seas has been made on the basis of species known to be mostly fished in high sea, such as some pelagic Bluefin tuna and swordfish and some demersal fishes (Hake, Norway lobster, Blue and red shrimp and Giant red shrimp). It should be noted that these species being absent of the Fish stat records in the W. Black Sea Pilot Case, all landings are deemed to be coastal.

- For Maritime transport, it turned out difficult to segregate open sea from coastal area operations and it has been considered that all the maritime transport was taking place in open sea.
- Regarding submarine pipelines and cables, it was also difficult to segregate open sea from coastal area operations. In general for practical and then economic reasons, submarines pipes lines and electrical cables are nowadays rather installed in straights or coastal seas whereas data cables are laid in open seas. However, some submarine pipe lines have been installed in open seas and this trend will increase in the coming years.
- In the Mediterranean and Black Seas, offshore marine hydrocarbon operations take place mostly in coastal areas. However there are several projects of installation in open seas, and even in deep areas.

To give a complete picture of the maritime stressors on the coastal marine environment In consequence, it has been chosen to focus this deliverable on open sea activities, as for the D 1.2, and to present in the D2.3 activities both in the coastal and open seas.

For all these sectors an economic and social analysis of the use of waters and an assessment of the Cost of degradation has been attempted. Effort has been undertaken to quantify as fully as possible the parameters describing the socio-economic importance of the sectors examined but wherever this is not possible - within the time and resource constraints of the present research - analysis takes a more qualitative aspect. Parameters studied include production means, production values, and employment.

The statistical data used for these assessments were collected from various sources, mainly Eurostat, as the Pilot Cases areas are surrounded by EU MS only and the Initial Assessments of the MS, when available. However, it is striking to note that professional data bases have also been used, as FAO fish stat for the fisheries or reports of private intelligence services for Offshore oil and gas.

Cost of Degradation assessment has mostly based on Initial Assessments of the MS and economic values extracted from the V-MESSE data base developed in the Frame Work of the PERSEUS D6.8.

The gap analysis has shown that a significant part of required data to perform these assessments are missing or not publicly available, especially those needed to assess value added and employment wages as well as cost of degradation. Impacts on the marine ecosystems have been characterized in qualitative terms. For some sectors, it has been attempted to make projection, for the next decade in a qualitative way.

The results obtained in the socioeconomic analysis are summarized in the Table 36, which makes possible a rough comparison between Pilot Cases.

Table 36 Synthetic overlook of the main drivers in the WP6 Pilot Cases including open sea domain

Drivers/Activities (unit) in the Pilot case areas (beyond 200m depth)	**W. Med**	**Aegean**	**W. Black Sea**
Fisheries, open sea (Landings, T % total catches)	7750 7%	4517 7%	- -%
Maritime Transports			
Gross Weight (1000T /y)	376	131	61
Passengers (million/y)	27	84	0.001
Nb. Of Vessels (1000)	123	492	5
Submarine cables / pipelines (Nb. of landings)[1]	0/11	1/6	1/8
Offshore in deep waters (oil and gas production, kTOE/y)	0	0	0

[1] Existing and in project

Open sea fisheries are more important in the W. Med than in the Aegean Pilot Case, both being in the same proportion of the total landings. Note that this indicator shows the importance of fisheries for the local economy but says nothing of the stocks exploitation. Maritime transport is described through three indicators, transported gross weight, number of transported passengers and number of vessels using the pilot case ports. Again W. Med and N. Adriatic are relatively close for the goods, but with much more vessels in N. Adriatic, which reflects an intense cabotage in the area, Aegean is characterized by a number of very important number of passengers, which reflects the importance of the maritime passengers traffic between the islands in the Aegean Sea, W. Black sea is far behind. In all Pilot cases, the number of submarine pipelines is low, by contrast with the numbers of telecommunication cables landings, especially in W. Med and W. Black Sea. Offshore production is currently nil in the open sea domain. However Aegean may reveal important potentialities for further deep exploitations.

If we also consider the very distinct morphological characters of the Pilot Cases, we can say that the WP6 pilot cases PERSEUS are diverse allowing thus to test efficiently the PERSEUS Adaptive Policy Framework during the next phase of the PERSEUS project.

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