Pressures in the SES open waters in socio-economic terms

Gap Analysis on data and knowledge

Deliverable Nr. 1.2

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This deliverable presents the results of the economic and social analysis of the human activities which are exerting pressures on open waters of the Mediterranean and the Black Sea. Analysis has been done using existing available data on main marine activities occurring in open waters such as fisheries, maritime transport, submarine cable and pipeline operations and marine hydrocarbon extraction. A similar study has been made for the coastal area.

This work completes the identification of human pressures and their impacts on open waters carried out in parallel, both being preliminary to the design of programmes of measures to achieve or maintain a good environmental status (GES). Methods have been adapted from guidance issued for the MSFD implementation. The work presents the first economic and social analysis of this kind carried out at regional and sub-regional levels. It also attempts to assess 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 coastal water were distinguished as far as possible from those impacting open waters, beyond 200m depth. This approach is in coherence with distinct ecosystems but raises difficulties, due to the lack of data and the fact that it undermines the spatial coherency between economic and social assessment and design of programme of measures, which must be enforced in areas under given jurisdictional responsibilities. 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.

Scope

The objective of this first deliverable of the Task 1.2 (Analysis of socio economic activities in open sea) is to assess of the environmental impact of human activities, using the open sea, at sub-regional levels in the SES. It is built on existing data, where available, and highlights the gaps in terms of data and knowledge. This assessment complements the analysis carried out by nature scientists in Task 1.1 (Analysis of pressures and processes and their impact on the ecosystems). Methods and, to some extent, data are identical to the assessment of human activities in coastal areas performed within Task 2.2 (Analysis of socio-economic activities in the coastal seas). Following the DPSIR model, it provides an overview of the socio economic drivers (D) exerting pressures (P) on the open sea ecosystems whose knowledge is required to prepare the responses (R) aiming to reduce the impacts (I) to an acceptable level. More specifically, this work is in coherence with the economic and social analysis to be carried out in the MSFD initial assessment (by 2012). This preliminary and basin wide economic and social analysis will be followed by the Deliverable 1.4 which will focus on the four Pilot Cases of the Work Package 6 (Adaptive policies and scenarios). These assessments will be part of the contextual background needed for the preparation of future programme of measures and policies aiming to achieve or maintain a Good Environmental Status at Pilot Cases and Basin levels.

1 INTRODUCTION

1.1 The PERSEUS and MSFD contexts

This deliverable is the first one of the Task 1.2 (Analysis of socio economic activities in open sea), which is included in Work Package 1 (Pressures and Impacts at basin and sub-basin scale) of the PERSEUS project. The relevance of this deliverable is easily justified by referring to the call in response of which the PERSEUS project has been proposed: OCEAN.2011-3: Assessing and predicting the combined effects of natural and human-made pressures in the Mediterranean and the Black Sea in view of their better governance. The call states that one of the main overall objectives of the project is to promote sustainable well-coordinated research efforts in order to characterize patterns of pressure in environmental and socio-economic terms on the Mediterranean and the Black Sea, the Southern European Seas (SES). Characterization of pressures is the general objective of work packages of the PERSEUS project, respectively the WP1 for the open sea and WP2 for the coastal areas. Task 1.2 contributes directly to assess the pressures on the SES waters in socio-economic terms. The call provides also indications on the approach to be followed mentioning that "the project shall provide a scientific rationale for a basin-wide promotion of the principles and objectives put forward in the Marine Strategy Framework Directive (MSFD)". The principles of the MSFD are given in the Directive recitals and specifically in n° 8): "By applying an ecosystem-based approach to the management of human activities while enabling a sustainable use of marine goods and services, priority should be given to achieving or maintaining good environmental status…"

References to the "ecosystem-based approach to the management of human activities" and "sustainable use" clearly indicate the need to consider the economic and social aspects in interaction with the environmental concerns.

The MSFD makes several references (COWI, 2010) to the economic and social aspects. It is stipulated in the Directive recital n° 24 that: "As a first step in the preparation of programmes of measures, Member States across a marine region or sub-region should undertake an analysis of the features or characteristics of, and pressures and impacts on, their marine waters, identifying the predominant pressures and impacts on those waters, and an economic and social analysis of their use and of the cost of degradation of the marine environment". This requirement is detailed in Article 8 of the Directive. Article 5 states that Member States (MS) have to report their initial assessment to the Commission before the 15th of July 2012. In fact some MS were late in the delivery of their report to the Commission and some are still not publicly available at the date of completion of this deliverable.

The MSFD defines waters as marine waters, including the seabed and subsoil, under the MS´s national jurisdictions. However, MS shall, when implementing their obligations under this Directive, take due account of the fact that marine waters covered by their sovereignty or jurisdiction form an integral part of the marine regions such as the Mediterranean Sea and the Baltic Sea. Article 5 details the marine sub-regions to be considered for the Mediterranean Sea: (b) in the Mediterranean Sea: (i) the Western Mediterranean Sea; (ii) the Adriatic Sea; (iii) the Ionian Sea and the Central Mediterranean Sea; (iv) the Aegean-Levantine Sea.

It is worthwhile to note that the Directive makes multiple mentions to the need to consider the regional dimension and the relations with third countries sharing these regions: "Third countries with waters in the same marine region or sub-region as a Member State should be invited to participate in the process laid down in this Directive, thereby facilitating achievement of good environmental status in the marine region or sub-region concerned". This concern is obviously one of the main reasons of the call OCEAN.2011-3 and by consequence of the PERSEUS project, in order to concretize contributions of the scientific research community to this overall objective.

These reminders of the PERSEUS and MSFD contexts are here to justify the objective of the work underlying this deliverable:

- To make 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;
- Carried out at basin scale of the Mediterranean and Black seas, including as far as possible waters beyond the EU regulation,
- Following a methodology in coherence with the one used for the MS initial assessment, results being presented at sub regional scale for the Mediterranean Sea
- Using existing data and in particular the MS initial assessments, when available
- Be complementary of the work done under the T1.1. (Analysis of pressures and processes and their impact on the ecosystems) and so be focused on the open waters.

1.2 Focusing on the open waters, an ecosystem evidence

A similar work has been made in the framework of the WP2 for the Task 2.2, focused on the coastal areas instead of the open water. In coherence with the European Nature Information System, the PERSEUS DoW has defined the coastal area as the continental shelf, i.e. the marine area from a depth of 0 to 200 m. The reasons of this distinction between the coastal areas and the open sea, unusual in economic and social analysis which normally tends to consider territorial boundaries of human activities and ignore natural habitat limits, lies in the PRESEUS work plan. In its "New knowledge pressure impact process" cluster, the PERSEUS work plan has made an ecologically sound distinction between open sea and coastal areas, thus between WP1 and WP2. Moreover, it has been reasonably wished to foster interdisciplinary cooperation between nature and human sciences by putting tasks devoted to nature and human sciences under the same WP.

1.3 In contradiction with the jurisdictional responsibility

This ecological distinction raises difficulties when replicated in the economic and social domains. In substance, it has been seen above that the initial economic and social analysis has no reason by itself to contribute to the achievement of the good environmental status. The turnover of fisheries in a given area says nothing of the sustainability of the exploited fish stocks. However, if it is proven by nature sciences that stocks are overexploited, it will be useful to know the socio economic background of the fisheries in order to limit this overexploitation, by limiting overcapacities, restricting some fishing methods or the establishment of fishery restricted areas. In other words, the economic and social analysis is a preliminary step providing a useful context for implementation of programme of measures aiming to solve environmental issues. It is an evidence to say that programmes of measures can only be implemented in areas by authorities having jurisdictional rights on such area. This explains, if needed, why the MSFD Initial assessment is requested to be made in areas under the MS jurisdiction. Therefore, introducing ecological limits in the economic and social assessment weakens the links between this assessment and its ultimate objective, the preparation of the programme of measures.

As a consequence, data and statistics required to elaborate economic and social assessments are generally collected by authorities in a perspective of management of human activities within a given territory. For example, the European Commission has implemented the NUTS classification (Nomenclature of territorial units for statistics), a hierarchical system for dividing up the economic territory of the EU for the collection, development and harmonisation of EU regional statistics. So, existing economic and social data are generally not based on ecological areas, even for marine activities. At the same time, collection of original socio economic data by on field survey was completely beyond the capacity of this task, considering the number of activities and the geographical scope. Most states in these regions have poor statistics on marine activities, beyond the mandatory ones requested by United Nation Statistic Division, only because their collection is expensive and resource demanding.

However, since PERSEUS is a research project committed to explore innovative tools and approaches it is not out of place to experiment new ideas. Regarding innovation, the economic and social assessment of the use of the Mediterranean or Black Sea waters at basin scale has never been attempted to date, as shown in the deliverable D6.8 (Inventory and critical assessment of current economic valuation studies on marine good and services). Segregation between coastal areas and open water has made this first attempt more challenging.

Practically, it has been decided to perform the two works (D1.2 and D2.2) in parallel, following the same methodology and to focus on a gap analysis, in order to prepare argumentation at the attention of riparian states to increase their effort on data collection regarding activities impacting marine ecosystems.

1.4 Deliverable content

The report is divided into five chapters. After the Introduction, Chapter 2 presents the main concepts and specially the DPSIR approach, details the spatial aspects to be considered, specially the issues raised by the distinction between open waters and coastal areas and defines the scope of the economic and social analysis of the drivers and pressures impacting the marine waters. The following Chapter 3 provides views on the data used to perform the socioeconomic assessment and introduces the data gap analysis. Chapter 4 presents the results by marine activities as far as possible at sub-regional levels. Finally Chapter 5 presents the conclusions of the study in terms of findings and next steps.

2 METHODOLOGY

2.1 Main concepts

The evident increase in pressure on natural marine resources (Ban and Alder, 2008; Halpern et al., 2008; Stelzenmüller et al., 2010) and the demand for marine ecological services are often too high and the Community needs to reduce its impact on marine waters regardless of where the effects occur. Furthermore, the marine environment is a precious heritage that must be protected, preserved and, where practicable, restored with the ultimate aim of maintaining biodiversity and providing diverse and dynamic oceans and seas which are clean, healthy and productive (MSFD, 2008/56/EC).

It is within this basis that the Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 emerged, establishing a framework for community action in the field of marine environmental policy. This Directive, also known as the Marine Strategy Framework Directive (hereafter MSFD), establishes a framework within which MS shall take the necessary measures to achieve or maintain Good Environmental Status (GES) in the marine environment by the year 2020 at the latest. GES is defined by the MSFD as "the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive" (MSFD, 2008 -Article 3).

In 2009, in order to assist the development of criteria and methodological standards for GES and address issues of their application by EU MS, a Working Group (WG) was established with the aim of initiating the development of a common understanding of the meaning of the MSFD's normative definitions in the context of making an initial assessment, determining GES and establishing environmental targets. In December 2011, this WG wrote a final document entitled "Common Implementation Strategy activities for the MSFD: Finalization of common understanding document on Good Environmental Status" where it was established that GES means: (a) the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas that are clean, healthy and productive within their intrinsic conditions, and (b) the use of the marine environment at a level that is suitable, thus safeguarding the potential for uses and activities by current and future generations.

In order to attain this GES some deadlines have been established: an initial assessment, to be completed by 15 July 2012 of the current environmental status of the waters concerned and the environmental impact of human activities thereon; a determination, to be established by 15 July 2012 of GES for the waters concerned; establishment, by 15 July 2012, of a series of environmental targets and associated indicators; establishment and implementation, by 15 July 2014 of a monitoring programme for ongoing assessment and regular updating of targets; development, by 2015 at the latest, of a programme of measures designed to achieve or maintain GES; and entry into operation of the programme by 2016 at the latest.

A methodological approach to assess the current environmental status of the waters concerned and the environmental impact of human activities would be through the DPSIR (Drivers–Pressures–State–Impact–Response) framework, which has developed as a systems-based approach which captures key relationships between society and the environment, and is regarded as an approach for structuring and communicating policy-relevant research about the environment. In essence, after being developed from an OECD approach which aimed to link pressures (created by human demands of the system) with the state changes and impacts, the systemic DPSIR framework encompasses Drivers, which are the key demands by society and which create Pressures. Furthermore it recognizes that State changes and Impacts require a Response by society. Fundamental to the DPSIR framework is the definition of the boundary of the system it describes, the demarcation of which depends on the particular issue of interest and its conceptualization (Atkins et al., 2011; Svarstad et al., 2008) (Figure 1).

On the same hand, the DPSWR (Driver-Pressure-State-Welfare-Response) conceptual model is a useful starting point for analysing coupled social and ecological systems, as shown in Figure 1.

DPSWR framework encompasses drivers, which are largely economic and socio-political (e.g. industrial or agricultural development, trade, regulations, subsidies, etc.) and often reflect the way benefits are derived from ecosystem goods and services. Pressures are the ways these drivers burden the environment (e.g. agricultural run-off of nutrients, pollution discharges, bottom trawling, introduction of alien species etc.). State change is a measure (or proxy) of the consequences of pressures on species or ecosystems. Welfare is a measure of changes (the “costs”) to human welfare as a result of state changes. Response is the way society attempts to reduce impact or compensate for it.

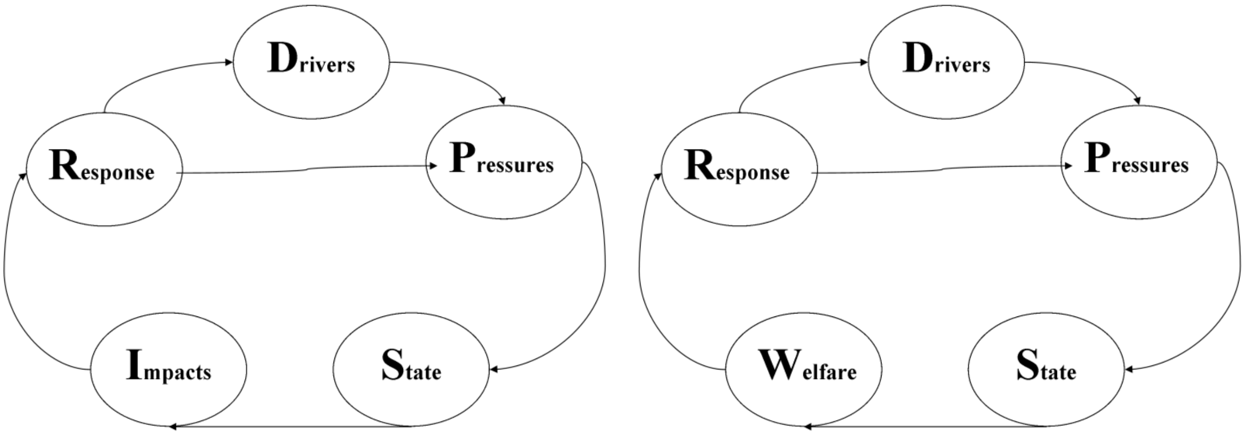

Figure 1. DPSIR and DPSWR diagrams.

On the same hand, effectively reducing cumulative impacts on marine ecosystems requires co-evolution between science, policy and practice (Österblom et al., 2010). Furthermore, the development and implementation of the MSFD should be aimed at the conservation of the marine ecosystems (Borja et al., 2011). Such an approach should include protected areas and should address all human activities that have an impact on the marine environment, throughout an integrated ecosystem-based approach (EBA). The EBA has an holistic view on the management and protection of marine ecosystems, focusing upon ensuring the sustainable use of the seas, and providing safe, clean, healthy and productive marine waters (Browman et al., 2004; Jennings, 2005; Borja et al., 2008). Understanding the EBA conceptually and how it is to be implemented practically is, therefore, critical for marine managers (Farmer et al., 2012).

Currently, the concepts of the Ecosystem Based Approach (EBA) and Ecosystem-based management (EBM) are often not fully differentiated, which may be viewed as a reflection of the absence of a clearly defined framework for implementation (Sardá et al., 2011).

Furthermore, many definitions for the Ecosystem-based management (EBM) exist (see Box 2. of Farmer et al., 2012). However, EBM is defined by ICES (2003), as the comprehensive integrated management of human activities based upon the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of goods and services and maintenance of ecosystem integrity (Borja et al., 2011). Its adaptive management recognizes that long-term management decisions based upon conceptual modelling or knowledge of only a limited part of the system is unwise due to high levels of scientific uncertainty in natural systems (Holling, 1978; Mee, 2005). Therefore, taking a flexible and pragmatic approach to marine management is necessary and the correct way since it actually treats a system as a management 'experiment', adapting management policies and goals based upon knowledge gained (Farmer et al., 2012).

Furthermore, oceans ecosystems have been recognized for long as one of the most important natural resources (Costanza, 1999), as they provide an array of ecosystem services that directly or indirectly translate into economic services and values to humans (Figure 2) (Eggert and Olsson, 2009; Granek et al., 2010; Hanley et al., 2003; MEA, 2003; Remoundou et al., 2009). The utilisation of this goods and services approach has the capacity to play a fundamental role in the ecosystem-approach (MEA, 2003; Beaumont et al., 2007), as the EBM of marine ecosystems requires integrating the pressures and demands of society, economy and environment (Granek et al., 2010).

The Millennium Ecosystem Assessment (MA) establishes a conceptual framework for documenting, analysing and understanding the effects of environmental change on ecosystems and human well-being. It views ecosystems through the lens of the services that they provide to society, how these services in turn benefit humanity and how human actions alter ecosystems and the services they provide (Carpenter et al., 2009). Figure 2 presents the MA approach to ecosystem services.

The MEA classifies ecosystem services in four types: provisioning, regulating, supporting and cultural services. For marine ecosystems, provisioning services include: food (inshore or offshore fisheries, algae, aquaculture and wild sources); fibre and fuel (referring to vegetation in coastal systems); water supply (industrial or domestic uses); medicines and others (chemicals and species with medical applications); the provisioning of energy (renewable); raw materials (salt); and the provisioning of transport and navigation. Regulating services are: biological regulation (regulation of pest outsets); freshwater storage and retention in coastal systems; hydrological balance; atmospheric & climate regulation due to ocean air interchange and coastal vegetation; human disease control; waste processing or bioremediation of waste; natural hazard protection and erosion control. Cultural services include: cultural and amenity benefits; leisure and recreation; aesthetic benefits; education and research knowledge; future unknown or speculative values (option values); feel good or warm glows (related to the welfare associated with the conservation of marine environments); cognitive values (those related to the existence or bequest values); and cultural heritage and identity values. And finally, provisioning services include: biologically mediated habitat (the potential of habitats to provide biological assets); nutrient cycling and fertility; and physical habitat for species.

Figure 2. Conceptual Framework of the Millennium Ecosystem Assessment (MA, 2003)

The concept of ecosystem services has shifted our paradigm of how nature matters to human societies. Instead of viewing the preservation of nature as something for which we have to sacrifice our well-being, we now perceive the environment as natural capital, one of society's important assets (Liu et al., 2010). Society needs to start acknowledging the value of natural capital (Daily et al., 2009) and Ecosystem Services Valuation (ESV) could be the approach to tackle such a challenge. ESV is the process of assessing the contributions of ecosystem services to sustainable scale, fair distribution, and efficient allocation (Liu et al., 2010). However, challenges still remain for the ESV as ESV research has to become more problem-driven rather than tool-driven. Ultimately the success of ESV will be judged on how well it facilitates real-world decision making and the conservation of natural capital (Liu et al., 2010).

ESV methods can be either monetary or non-monetary. Nevertheless, the economic approach of measuring benefits has limitations. First, data on the benefits of ecosystem services to specific groups (versus society as a whole) may be lacking. Second, many ecosystem services cannot be easily reduced to monetary values. Disputes among groups may require extensive dialogue and explicit discussion of trade-offs that will likely be multifaceted rather than measured in a common currency (Granek et al., 2010).

Recently, The Economics of Ecosystem Services and biodiversity (TEEB) has mainstreamed the economic approach to ecosystem services. The TEEB initiative is rooted on the MA and post-MA assessments and scientific publications to establish an updated framework for ecosystem services assessments.

Non-monetary indicators of ecosystem benefits can be useful in some situations and may be less expensive and take less time to apply. Such approaches may be better suited to address spiritual, cultural, or aesthetic values that are quite difficult to capture in monetary terms. Extensive in-person interviews, quantitative surveys, and other analyses by social scientists can generate evidence about deeply held beliefs of individuals and groups and the benefits they derive from ecosystems.

Few ES assessment analyses of the use of waters have been applied so far, and, when performed, they have mostly looked at assessing the ecosystem services affected by certain marine uses such as fisheries, offshore renewable energy, tourism and conservation measures. Furthermore, opposition is growing from coastal residents and marine user groups who fear substantial impacts of human pressures on marine ecosystems (Halpern et al., 2008) and, thus, onto the services these ecosystems provide. We need to quantify explicitly the impacts of sectors onto the marine ecosystems as well as onto other sectors, in order to be able to assess the possible affections, trade-offs and costs which may occur in a near future if the use of our waters is increased.

The non-legally binding document written by the working group on Economic and Social Assessment, entitled as "Economic and Social analysis for the initial assessment for the Marine Strategy Framework Directive: a guidance document", describes three approaches to the analysis of the cost of degradation. These approaches are: the Ecosystem Services Approach; the Thematic Approach; and the Cost-based Approach. The document further explains what valuation methods could be applicable for each of the approaches and provides guidance on which of the approaches to follow and when. As such, the Ecosystem Services Approach may set your ambition, the Thematic Approach may provide a useful example of how to present your own framework, and the Cost-based Approach may appear to be useful when resources are scarce. The analysis of the cost of degradation can usefully constitute a basis for later analyses in the Directive, for example as a base for the cost-benefit analyses of measures (Art. 13 MSFD) and/or as a foundation for the discussion of potential exemptions (Art. 14 MSFD).

2.2 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 level 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, distinction between coastal sea and open sea and their relationships with the marine waters under the jurisdiction of the states. Moreover reporting format of pressures is necessarily influenced by the fact that most of the publically available socio economic data are generally collected at the levels of national administrative territorial units. Finally this study should prepare the work to be done in the WP6 sub regional Pilot Cases, which should also be considered.

2.2.1 Mediterranean sub regions

We choose to present the joint initial analysis of pressures and processes and their impacts on the ecosystems at the intermediate scale of large sub-regions for the Mediterranean Sea and of the sea as a whole for the Black Sea. These are the first tasks both of WP1 (Pressures and Impacts at basin and Sub basin scale) dealing with the open sea and WP2 (Pressures and impacts at coastal level). In order to be compatible with the deliverables resulting from these tasks, the same intermediate scale has been adopted for the reporting of the pressures in socio economic terms.

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:

- 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 (Figure 3).

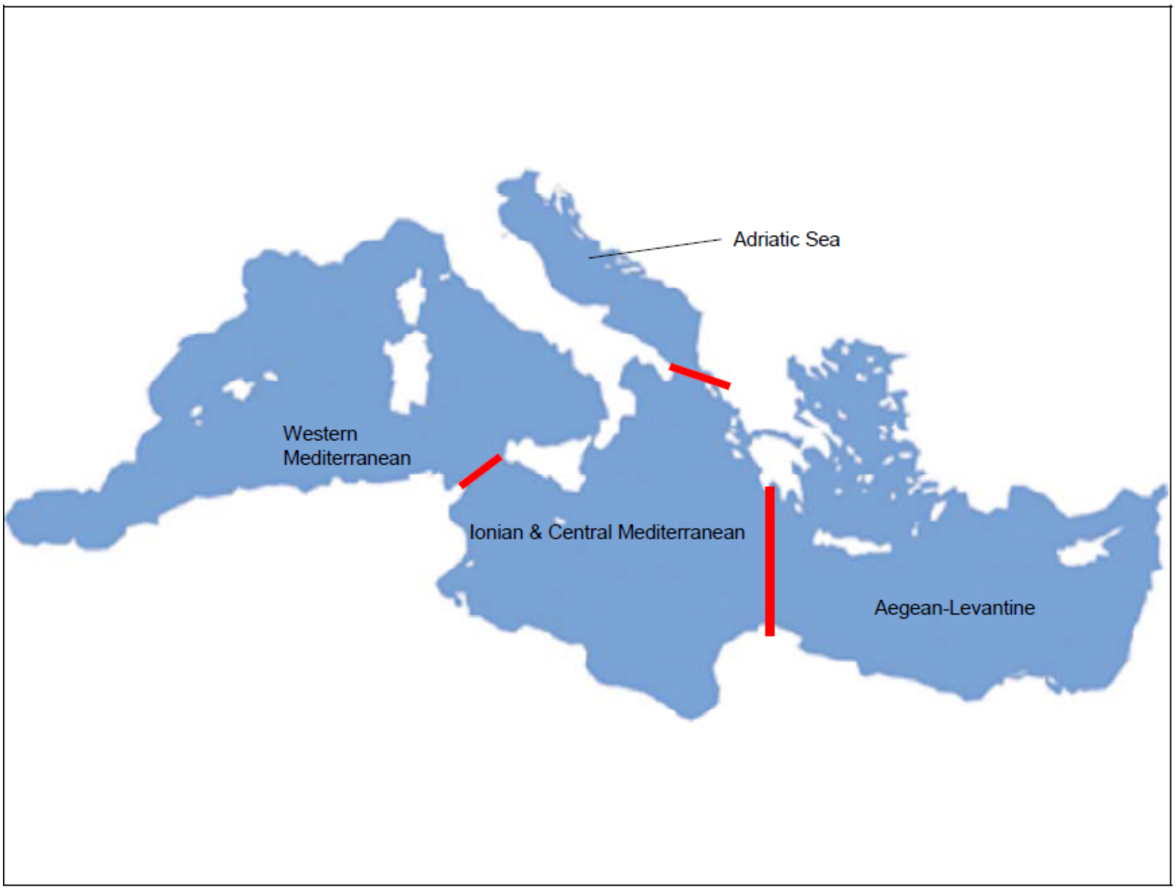

Figure 3. MSFD and MAP Mediterranean sub-regions. Source: UNEP/MAP, 2011.

The correspondences between PERSEUS sub-regions, MSFD sub-regions and coastal states (Member and Non EU Members) can be summarized in Table 1.

Table 1. Definition of the PERSEUS sub-regions. * indicates Countries owning to multiples sub-regions (including outside Mediterranean Sea and Black Sea)

PERSEUS sub regions	MSFD and RSC sub regions	Member States	Third Countries (non-EU Members)
West Mediterranean	Western Mediterranean	Spain*, France* Italy*	Monaco, Tunisia*, Algeria, Morocco*
Central Mediterranean	Adriatic Sea	Italy*, Slovenia	Croatia, Bosnia-Herzegovina, Montenegro, Albania

PERSEUS sub regions	MSFD and RSC sub regions	Member States	Third Countries (non-EU Members)
	The Ionian Sea and the Central Mediterranean Sea	Greece*, Italy*, Malta	Libya*, Tunisia*
East Mediterranean	Aegean-Levantine Sea	Greece*, Cyprus	Turkey*, Syria, Lebanon, Israel, Palestinian territories, Egypt*, Libya*
Black Sea	Black Sea	Bulgaria, Romania	Ukraine, Russia, Georgia, Turkey*

2.2.2 Coastal and open waters

Distinction between coastal and open waters is embedded in the PERSEUS cluster "New Knowledge" which comprises two interactive work packages dealing with pressures and impacts, WP1 at basin and sub-basin scales and WP2 for coastal 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. This contradiction has already been presented in the introduction section.

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) where EEZ have been established. 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.

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.

A pragmatic examination of the marine activities shows that most of them are mainly impacting coastal areas (see Table 2).

Practically, it has been decided that most of the assessments will be presented in the D2.2 deliverable dealing with coastal waters, the open sea deliverable (D1.2) being mostly devoted to qualitative considerations about the impacts of some marine activities in open sea.

Table 2. 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	
Port operations	All	
Maritime transport	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)

2.2.3 The WP6 Pilot Cases

This assessment should also serve to 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 socio economic context in which these policies will be implemented. For example, Article 8(c) of the MSFD provides an economic and social analysis of the use of the water and 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.

Within the PERSEUS workflow, this knowledge is supplied from the results displayed by this deliverable. In consequence, the socio economic assessments are reported taking into account as far as possible the Pilot Cases.

The four pilot cases concern areas in each PERSEUS sub-regions are illustrated in Figure 4.

Figure 4. The four WP6 Pilot Cases.

2.3 Scope of the Analysis

Article 2 of the MSFD defines its spatial scope as: "all marine waters as defined in Article 3(1), and [...] the trans-boundary effects on the quality of the marine environment of third States in the same marine region or sub region". Referring to its content, the MSFD does not restrict MS to analysing specific economic sectors and uses of the marine environment. Though Annex III of the Marine Directive provides an indicative list of pressures and impacts, MS will have to carry out an analysis of "the predominant (our emphasis) pressures and impacts, including the human activity" [Article 8(1)b].

The scope of the socio economic analysis of pressures on the open waters in the present report follows accordingly the results of the preliminary analysis of issues at risk of non-achievement of GES in SES (see Deliverable D6.2) by focussing on the following marine sectors, in coherence with Table 2

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

Fisheries constitute a predominant market sector 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 a non-issue to continue.

A consistent, economic and social analysis of the use 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 scope of the cost-of-degradation analysis is to provide a first quantitative assessment of the gap between present status and GES for marine environments in SES. 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. 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.

3 DATA

3.1 Data sources

Data on marine water uses and economic sectors are scattered in a variety of sources: EU publications, official statistical compendia of MS, ad hoc databases within specific International Agencies and Conventions, private sector associations, marine NGOs, etc. GW 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.

[1] www.eea.europa.eu

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

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.

3.2 Progress of the National Initial assessment of Member States

3.2.1 Case of Greece

Data on the socio economic profile of marine sectors and uses in the Aegean, Ionian and Adriatic Seas can be found in the recent 'initial assessment report' of Greece submitted to the EU as part of its national reporting obligations. The report was made available in September 2012 on the website for public deliberation set up by the Greek Ministry of Environment and Climatic Change (see http://marinestrategy.opengov.gr/). Section 4.3 of the Greek initial assessment report contains information on the economic and social analysis of Greek territorial waters (Aegean Sea, Ionian / Adriatic Sea). The approach of Water National Accounts was chosen in order to assess the economic significance of the following sectors:

- Fisheries
- Aquaculture
- Secondary treatment and trade of marine food
- Tourism
- Ports

Parameter used included value of production, value added and employment. The importance of the above Greek marine market sectors was estimated at €6.9 billion or 3.84 % of GDP. The report estimates also the importance of Greek non-market marine uses and benefits applying qualitative indices and proxy measures. The following non-market uses were assessed:

- Recreation
- Education and research
- Oil abstraction
- Carbon sequestration

The cost of degradation due to the exertion of the above pressures during 2008-2012 is calculated in terms of production value in the range 0.83% to 1.29% of GDP. In terms of value added the cost of degradation ranges between 0.12% and 0.21% of GDP.

3.3 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)

3.4 Gap analysis on data

The MSFD requires that MS maintain or achieve GES in their waters. It requires an Initial assessment of the current environmental state (Article 8.1), a determination of what GES means for each country (Article 9) and the establishment of targets and indicators designed to show whether GES is being achieved (Article10) (EU, 2010). Gap analysis is essential to determining the last requirement. Within PERSEUS, there are two essential aspects to the gap analysis: (1) establishing indicators that reflect the GES and can be feasibly measured and compared over countries in the two basins[3]; (2) identifying missing data and information needed to assess gaps between GES targets and the current state in individual countries and over the two basins in a comprehensive and comparable manner; and (3) projecting over time and space future patterns of gaps with reference to difference scenarios (e.g. Business as Usual vs. policy change).

The gap analysis must be informed by quantitative (and possibly qualitative) spatial-temporal descriptions of state variables such as ecosystem functions and ecosystem services. Collaboration between natural and social scientists is essential since the interaction between anthropogenic pressure and changing states and the feedback among them is fundamental to the inter-temporal assessment. Moreover, indicators of environmental status can be measured using a variety of metrics (e.g. ecological, physical and socio-economical). For example, water quality can be assessed in terms of its chemical composition, turbidity or by its relation to human activities such as recreation, fishing or shipping. Thus, the overall quality assessment may be skewed depending on the indicators chosen. For example, despite turbid water generally indicates high primary productivity and/or suspension and is considered less desirable than clearer waters by ecologists and recreational users, they may or may not have negative implications for fishermen, and are irrelevant for the shipping industry. However, turbidity is caused by a combination of natural process and human activities which will probably need to be the targeted for modification in order to achieve the GES. Incorporating all of these factors in the gap analysis is essential to achieving an understanding of the meaning of GES and deviations from it.

In order to achieve PERSEUS goal of integrating the economic and other human aspects with the natural element in an assessment that facilitates basin-wide and sector-wide comparisons, the gap analysis must also need to address information needs. County reporting tends to be inconsistent (mostly missing data) and even

[3] This is somewhat different that the requirement of the MSFD since region-wide comparison is not an explicit objective.

when variables are comprehensively reported, ensuring that they are comparable may be challenging and time consuming. Addressing these information issues is essential if PERSEUS is to achieve the dual goals of identifying current gaps as well as scenarios for change.

4 RESULTS

4.1 Fisheries

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

4.1.1 Introduction

a) 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 Black Sea, Western Mediterranean, Aegean-Levantine Sea, Adriatic Sea and Ionian Sea and Central Mediterranean, 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.

b) 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.)

Pelagic fishes:

- 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)

All fisheries statistics unless otherwise stated are for coastal areas. Coastal water fishing activities includes all other species caught for commercial, industrial, recreational and subsistence purposes.

4.1.2 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 by sub-regions (Western Mediterranean Sea (WMed), Adriatic Sea (AdS), Ionian Sea and the Central Mediterranean Sea (CentMed) and Aegean-Levantine Sea (AegSea)). However, because data is only available on a National basis, the statistics presented here are according to National fleet. When possible, future projections are provided.

a) Black Sea

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 during 1996-2008 (Shlyakhov and Daskalov, 2008). Anchovy and sprat account for the bulk of the catch and in 2008 these two species alone formed over 90% of the total annual catch of 370000 tons. The remaining catch for 2001-2008 consisted of commercially less important fishes such as the Mediterranean horse mackerel (6600 -15300 tons), whiting (7300-11100 tons), Atlantic bonito (5000-20000 tons) and molluscs. Researchers consider that the important commercial stocks are shared between the coastal countries.

During the past 50 years fisheries have been one of the drivers of environmental changes in the Black Sea ecosystems. Simultaneously they have been radically affected by changes caused by other factors, such as the introduction of invasive species. The past few decades can be divided into three main periods (Eremeev and Zuyev, 2007):

- Fishery development, 1970-1988: a gradual catch increase with total landings, reaching a maximum of almost 800 000 tons;
- Fishery crash, 1989-1991: a drastic catch decrease over three years down to 200000 tons, the lowest point since the 1970s. The decrease was observed in all stocks, but particularly in anchovy and other small pelagic fish with landings reaching levels of approximately 100000 tons, which is comparable only to those preceding the development period;
- Fishery recovery, 1992- 2004: partial growth of fish landings.

More recent data shows that this recovery period was interrupted in 2005 with landings shrinking to about 270 000 tons, followed by a subsequent growth in 2006-2007. The total mean annual catch of Black Sea fisheries was at a level of around 400000 tons over the period 1992-2010, varying annually from 270 000 to 530 000 tons.

The fluctuations in catch were accompanied by a major change in the species composition from the 1960-70s to the end of the 1980s. A gradual reduction of large-sized, food-valuable fishes such as turbot, bluefish, mackerel, Atlantic bonito, sturgeons and shad has occurred since the 1960s. They have been replaced by several small-sized species such as anchovy, sprat, whiting, horse mackerel and others (GFCM, 2012).

Sector analysis

Landings

The Food and Agriculture Organization of the United Nations (FAO) defines the Black Sea fishing subarea (Subarea 37.4), as consisting of the Sea of Marmara (Division 37.4.1), Black Sea proper (Division 37.4.2), and the Sea of Azov (Division 37.4.3). While the three basins form a common fishing subarea, it is misleading for scientific analysis to mix fauna of the Sea of Marmara with the Black Sea, as the species found in the Sea of Marmara are not found in the Black Sea proper.

The Black Sea is surrounded by six countries: Bulgaria, Georgia, Romania, Russia, Ukraine and Turkey. The Sea of Azov is shared between the Russian Federation and Ukraine, while the living resources of the Sea of Marmara are exploited by Turkey.

At this stage of the analysis, it has been considered that all the catches in the Black Sea are coastal ones. Therefore, results are presented in D2.2 where coastal pressures are analysed.

b) Western Mediterranean Sea

The Western Mediterranean Sea is surrounded by Algeria, France, Monaco, Morocco, Spain and Tunisia. Data for the Italian fleet is included in the following section on the Adriatic Sea.

In the Western Mediterranean Sea, coastal waters are the primary source where open sea waters contribute10 132 000 tons of landings.

Sector Analysis

Table 3. Landing statistics for the Western Mediterranean Sea.

	Open sea
	2010
Landings (1000t)	10 132

Source: FAO STAT, 2012 Notes: Fishing areas in the Balearic, Gulf of Lion and Sardinia. Data is for Algeria, France, Morocco, Spain and Tunisia. No data is available for Monaco. Open sea data includes Algeria (Blue and Red Shrimp, European Hake and Norway Lobster), France (European Hake and Norway Lobster), Morocco (European Hake and Norway Lobster), Spain (Blue and Red Shrimp, European Hake, Giant Red Shrimp, and Norway Lobster), and Tunisia (Blue and Red Shrimp, European Hake, and Norway Lobster).

Fleet capacity statistics aggregate coastal areas and open sea.

Table 4. Sector statistics for the Western Mediterranean Sea.

	Spain	France	Algeria	Morocco	Tunisia
	2010	**2010**	**2008**	**2008**	**2008**
Fleet					
Vessels (nr)	n.a.	6100	4441	3358	11 326
GT (1000)	n.a.	163.9	n.a.	n.a.	n.a.
kW (1000)	n.a.	885.1	330	140	n.a.
Effort					
Days at sea (1000)	n.a.	507.1	n.a.	n.a.	n.a.

Source: EC, 2012; Sacchi, 2011. Note : no date available for Monaco

Economic Analysis

Economic analysis aggregates coastal areas and open sea.

Table 5. Economic statistics for the Western Mediterranean Sea (Million Euros).

	Spain	France	Algeria	Morocco	Tunisia
	2010	**2010**	**2008**	**2008**	**2008**
Landings value	n.a.	924.3	n.a.	n.a.	n.a.
Gross value added [a]	752.6	502.7	418.8	16.2	115.1
Gross profit	120.7	116.5	n.a.	n.a.	n.a.
Net profit excluding subsidies	-11.8	38.9	n.a.	n.a.	n.a.

Source: EC, 2012; Sacchi, 2011. Note : no date avalable for Monaco
Notes: a, Values for Algeria and Morocco are converted from US Dollars based on January 2013 rates.

Social Analysis

Economic analysis aggregates coastal areas and open sea.

Table 6. Social statistics for the Western Mediterranean Sea.

	Spain	France	Algeria	Morocco	Tunisia
	2010	**2010**	**2008**	**2008**	**2008**
Total employed	38 045	10 871	39 000	16 250	49 000
Full Time Equivalent (FTE)	33 678	8410	n.a.	n.a.	n.a.

Source: EC, 2012; Sacchi, 2011. Note : no date available for Monaco

c) Adriatic Sea

In the following section, data on fishing activities in the Adriatic Sea focus on fishing activities of Italy and Slovenia as they are main fleets active in the Adriatic. Little information was found for Croatia, Bosnia-Herzegovina, Montenegro and Albania. 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. But whereas Italian and Slovenian landings show an overall decreasing trend, Croatian landings are increasing. 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 Adriatic Sea open sea waters provided about 4 270 000 tons in landings.

Table 7. Landing statistics for the Adriatic Sea.

	Open sea
	2010
Landings (1000t)	4 27

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

Regarding the fleets capacity, data is only available for the Italian and Slovenian total fleet. This data also extends beyond the Adriatic Sea. In 2011, 14 715 vessels were registered in Italy and 186 in Slovenia, see Table 8. 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 8. Sector statistics for the Adriatic Sea.

	Italy	Slovenia	Albania	Croatia	Montenegro
	2011	2011	2008	2008	2008
Fleet					
Vessels (nr)	14 715	186	269	3 823	218
GT (1000)	185	1.0	n.a.	n.a.	n.a.
kW (1000)	1 236.5	10.9	60	580	14
Effort [a]					
Days at sea (1000)	166.7	7.7	n.a.	n.a.	n.a.

Source: FAO STAT, 2012; EC 2012; Sacchi, 2011.
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 9 (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 9. Economic statistics for the Adriatic Sea (Million Euros).

	Italy	Slovenia	Albania	Croatia	Montenegro
	2010	2010	2008	2008	2008
Landings value [a]	1,115	2	n.a.	n.a.	n.a.
Gross value added [b]	653	0.46	10.55	320.5	4.5
Gross profit [c]	335	-0.8	n.a.	n.a.	n.a.
Net profit excluding subsidies [d]	114	-1.1	n.a.	n.a.	n.a.

Source: EC, 2012; Sacchi, 2011.

Notes: a: Data for landings value in 2011 is only available for Slovenia; b: Data for gross value added is not available for Slovenia for 2008 and 2009. Values for Albania, Croatia and Montenegro are converted from US Dollars based on January 2013 rates; c: Data for gross profit is not available for Slovenia for 2008 and 2009; d: Data for net profit excluding subsidies is not available for Slovenia for 2008 and 2009.

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 10 below provides the combined statistics for the Italian and Slovenian fleets.

Social statistics aggregate coastal areas and open sea.

Table 10. Social statistics for the Adriatic Sea.

	Italy	Slovenia	Albania	Croatia	Montenegro
	2010	2010	2008	2008	2008
Total employed	28 982	116	990	15 000	510
Full Time Equivalent	22 002	82	n.a.	n.a.	n.a.

(FTE)					

Source: EC, 2012; Sacchi, 2011.

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).

d) Ionian Sea and the Central Mediterranean

Italy (Sicily), Albania, Egypt, Greece, Libya, Malta and Tunisia all border the Ionian Sea and Central Mediterranean.

Data on the Italian fleet is included in the previous section on the Adriatic Sea, while Fleet data for Egypt, Greece and Libya are covered in the following section on the Aegean-Levantine Sea. Information for the Tunisian fleet is provided in the section on the Western Mediterranean.

In 2010 landing statistics for the Ionian ~~Adriatic Sea~~ show that 10 384 000 tons were provided by open sea waters.

Table 11 Landing statistics for the Ionian and Central Mediterranean ~~Adriatic Sea~~

	Open sea
	2010
Landings (1000t)	10 384

Source: FAO STAT, 2012

Notes: Fishing areas includes the Ionian Sea. Open sea includes data for Albania (European Hake), Greece (European Hake and Norway Lobster), Italy (European Hake and Norway Lobster) Malta (Blue and Red Shrimp, European Hake, and Norway Lobster) and Tunisia (Blue and Red Shrimp, European Hake, Norway Lobster). No data for Libya and Egypt..

e) Aegean-Levantine Sea

The Aegean-Levantine Sea area is bordered by Greece, Turkey, Cyprus, Syria, Lebanon, Israel, Palestinian Territories, Egypt, and Libya. In this report, data on fishing activities in the Aegean Sea focuses on Greek fisheries. For the Levanine area data on Cyprus is in focus.

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'.

The Cypriot fleet fishes primarily in the Mediterranean Sea. Its fleet has decreased significantly in recent years. Limited data is available for Cyprus after 2010, although some information is provided up to 2012, and reported in the 'The 2012 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 4 600 000 tons fisheries landings came from open sea waters.

Table 12. Landing statistics for the Aegean-Levantine Sea.

	Open sea
	2010
Landings (1000 tonne)	4 600

Source: FAO STAT, 2012

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

Fleet capacity aggregate coastal area and open sea.

Table 13. Sector statistics for the Aegean-Levantine Sea.

	Greece	Cyprus	Egypt (Med)	Lebanon	Libya	Palestinian Territory	Israel	Syria	Turkey (Med)
	2008	**2010**	**2008**	**2008**	**2008**	**2008**	**2008**	**2008**	**2008**
Landings (1000t)									
Fleet									
Vessels (nr)	17 657	1768	3124	2660	5029	717	438	1213	7992
GT (1000)	84.4	4.7	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
kW (1000)	506.1	45.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Effort									
Days at sea (1000)	2721.4	75.6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Sources: FAO, 2012; EC, 2011; EC, 2012; Sacchi, 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.

The Cypriot fleet obtained the highest value of landings from bogue (1.66 million Euros), followed by surmullet and parrotfish. Similarly, bogue also makes the most common species landed in terms of volume by the Cypriot fleet, although this is followed by albacore and picarels.

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 Euros (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 14. Economic statistics for the Aegean-Levantine Sea (Million Euros).

	Greece	Cyprus	Egypt (Med)	Lebanon	Libya	Palestinian Territory	Israel	Syria	Turkey (Med)
	2008	2010	2008	2008	2008	2008	2008	2008	2008
Landings value	544	10.2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Gross value added	n.a.	-5.7	270.5	n.a.	104.6	n.a.	12.7	184.9	16.2
Economic profit	n.a.	-7.12	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Source: EC, 2011; EC, 2012; Sacchi, 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 15. Social statistics for the Aegean-Levantine Sea.

	Greece	Cyprus	Egypt (Med)	Lebanon	Libya	Palestinian Territory	Israel	Syria	Turkey (Med)
	2008	2010	2008	2008	2008	2008	2008	2008	2008
Total employed	23 862	1 421	18 000	8 500	7 700	3 300	1 500	4 000	19 000
Full time equivalents	n.a.	910.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Source: EC, 2011; EC, 2012; Sacchi, 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).

Total fisheries employment in Cyprus was 1421 and 910 FTEs in 2010. This suggests an increase in employment of 43% and FTEs by 10% between 2008 and 2010 (EC, 2012).

4.1.3 Links to environmental pressures

f) 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).

g) 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.

4.1.4 Gap analysis

Data issues remain a major challenge to assessing the fisheries sector in the Mediterranean and Black Seas, especially for open waters. The assessment conducted here suggests that data is predominantly available for European fleets, with less information available for non-European fleets.

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.

4.1.5 Inventory of data sources

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

Table 16. 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
Sacchi, 2011, Analysis of economic activities in the Mediterranean: Fishery and Aquaculture sectors	http://www.planbleu.org/publications/analyse_activites_econ_pecheEN.pdf

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

4.2 Maritime transport, Cruises

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4.2.1 Introduction

Content

This chapter aims at analysing the socio-economic impact of the maritime transport and ports of the Mediterranean and Black Seas and identifying and describing the pressures caused on the environment by these activities, with a specific focus on the open sea, defined as areas beyond the 200m bathy line.

This first section introduces the report, its structure and the data gathering process. Section two presents the importance of the shipping industry and provides information and data on several indicators related specifically to the maritime transport, namely the gross weight of goods handled in ports, the number of passengers embarked and disembarked, the number of vessels' calls. The results in this section are presented according to the four regions identified in PERSEUS. Section three analyses the main pressures on the marine ecosystems and terrestrial habitats derived from ships' activities. Finally, section four examines and discusses the limitations and weaknesses found doing this study and some conclusions are drawn.

Data

Most of the data presented in this report have been obtained from the Eurostat (Eurostat, 2012c), the body responsible to provide statistical information about the European Union (EU) and to promote the harmonisation of statistical methods across its MS. This means that it has not been possible to include data in this report from ports that do not belong to the EU, such as Western Asian and North African countries. Moreover there is no distinction between coastal and open sea activities.

Overview of the sector

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).

Major commodities transported by the maritime transport are classified into the following categories:

- **General cargo** includes a mix of cargoes and packaged items, such as forest products, heavy equipment, manufactured goods, machinery, furniture, steel, and food products, among others, that are handled in any other method different than containers, such as boxes, barrels, packages, and pallets.
- **Freight containers** are a reusable transport and storage unit for moving products and raw materials between locations or countries. There are

approximately seventeen million intermodal containers in the world; a large proportion of the world's long-distance freight generated by international trade is transported in shipping containers. Its capacity is measured in twenty-foot equivalent unit (TEUs).

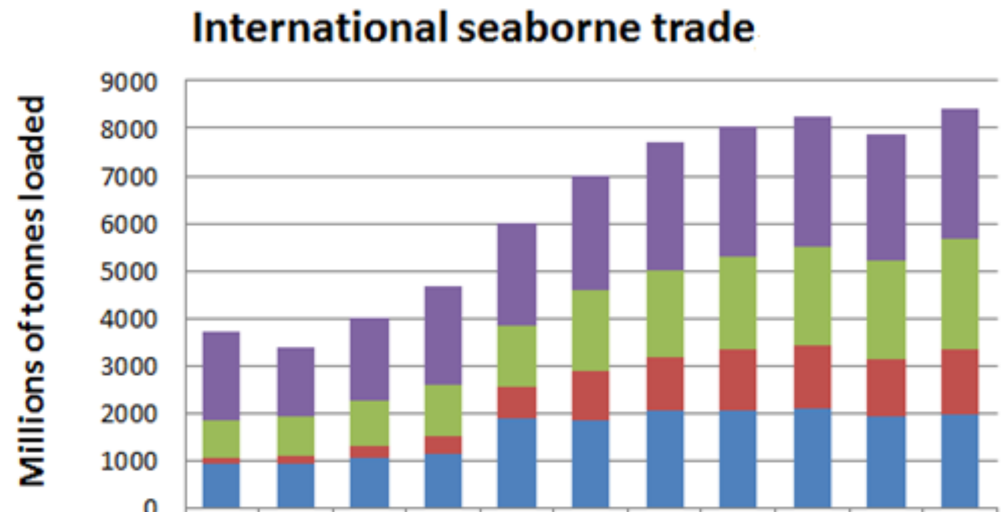
- **Liquid bulk traffic** is the transport of liquid and gaseous products in bulk by tankers. Liquids may be categorised as non-edible and dangerous such as chemicals, crude oil and petroleum products; and edibles and non-dangerous liquids such as cooking oil, fruit juices, milk, and wine.
- **Dry bulk cargo** is simply cargo that is transported unpacked in large quantities (British Shipping, 2012), including raw materials and manufactured products. The United Nations Conference on Trade and Development (UNCTAD) (United Nations, 2011) considers that the major dry bulk substances are iron ore, grain, coal, phosphates, and bauxite. However, this category also covers many other commodities, namely bulk minerals (e.g. sand & gravel), chemicals (e.g. fertilizer), dry edibles (e.g. flour or sugar), ferrous & non-ferrous metal ores, cement, gypsum, forest products and wood chips.
- **Ro-ro** stands for 'Roll-on/Roll-off' and it focuses on the transport of wheeled equipment for carrying cargo, such as automobiles, trucks, trailers or semi-trailers. Vehicles are driven on and off the ship on their own wheels, which allow the cargo to be efficiently 'rolled on' and 'rolled off'. Although ferries usually perform short journeys for a mix of passengers, cars and commercial vehicles, the term ro-ro is generally reserved for larger ocean-going vessels.
- **Cruise** passengers make sea journeys on cruise ships. A cruise ship is intended to provide passengers with a full tourist experience, calling at ports of cities with tourist attractions. Modern cruise ships are fully equipped with facilities for entertainment aboard such as theatres, cinemas, luxury dining halls, shopping malls and leisure facilities including swimming pools, gyms and even climbing walls (British Shipping, 2012). Ferries carry passengers, cargo and vehicles, operating usually on a regular return service.

4.2.2 Sector and socioeconomic analysis

This section presents facts and figures on the performance of the port sector and the maritime industry, classified into three levels: worldwide, European Union, and Mediterranean and Black Sea. Simultaneously, the Mediterranean and Black Sea are divided into four sub-regions according to PERSEUS project: West, Central and East Mediterranean and Black Sea. These data provide the reader with information on the current status of the sector and its trends year over year.

Worldwide

According to the United Nations Conference on Trade and Development (UNCTAD) (United Nations, 2011), due to the global financial crisis of late 2008, the year 2009 recorded the largest drop in the global seaborne trade since the 1930s, falling by nearly 5%. In 2009, international total goods loaded amounted to 7.8 billion tonnes, below the 8.2 billion tonnes recorded in 2008. In 2010, international shipping experienced a growth reaching an estimated 8.4 billion tonnes of goods loaded (see Figure 5).



	1980	1985	1990	1995	2000	2005	2006	2007	2008	2009	2010
Crude oil and products	1871	1459	1755	2049	2163	2422	2698	2747	2742	2642	2752
Five major bulks	796	857	968	1082	1288	1701	1836	1957	2059	2094	2333
Container	102	160	246	389	628	1020	1134	1264	1319	1201	1347
Other Dry	935	918	1039	1131	1905	1852	2032	2066	2109	1921	1976

Figure 5. International seaborne trade, selected years. Source: Adapted from United Nations, 2011.

As shown in Figure 5 this increase was particularly significant in the loading of dry bulks (with an increase of 11.4%) and containers (12.1%). The trade of crude oil and products (representing the main liquid bulk components) accounted for about one third of the total tonnage loaded internationally in 2010. The five major bulks, namely iron ore, grain, coal, phosphates, and bauxite, were reported as the second type of cargo mostly traded with a share of 28% (United Nations, 2011).

European Union

The indicators on the maritime transport and ports activity in the European level are discussed under three major groups, namely gross weight of goods handled, passenger traffic and vessel traffic.

According to the European Commission Statistics (Eurostat, 2012a), in 2010, the total weight of goods handled in ports of the 22 European Union maritime MS was estimated at 3.6 billion tonnes, a rise of 5.7% compared with 2009 (see Figure 6). Although the overall port activity is still under the data recorded in 2007 and 2008, this demonstrates the progressive recovery of the European economy after the downturn experimented in 2009. In 2010, activity grew in most European countries, particularly in Poland (+32%), Estonia (+19.5%), Finland (+17.3%), Belgium (+12.2%), the Netherlands (+11.5%), Sweden (+11%) and Lithuania (+10.3). Only four countries documented negative trends of their port activity, namely Greece (-8.2%), Denmark (-3.9 %), Latvia (-2.3 %) and France (-0.6 %).

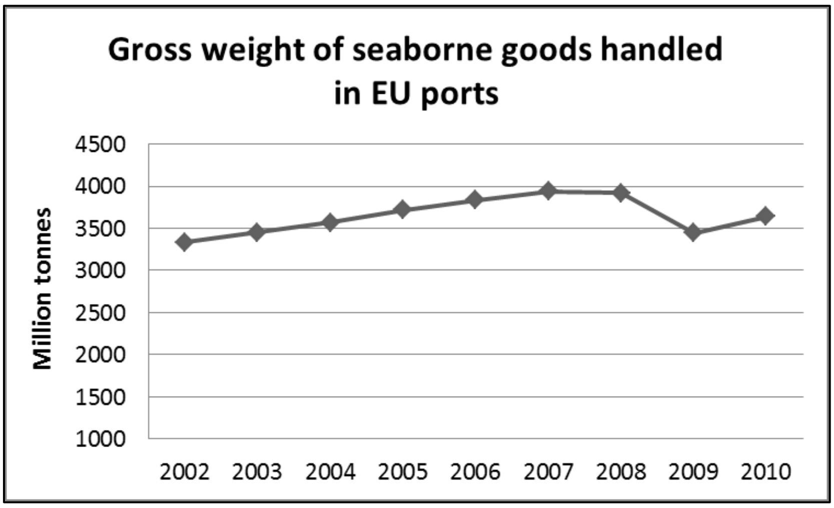


Figure 6. Gross weight of seaborne goods handled in EU ports (in million tonnes). Source: Eurostat, 2012a.

Three ports located on the North Sea coast, Rotterdam (the Netherlands), Antwerp (Belgium) and Hamburg (Germany), maintained their positions as the three largest EU ports in terms of both the gross weight of goods and the volume of containers handled. By countries, the Netherlands, with 539 million tonnes, emerged as the largest maritime freight transport country, handling almost a 15 % of the total tonnage handled in EU ports in 2010. It was followed by British ports with 14.1 % and Italian ports with 13.6 % (Eurostat, 2012a).

By type of goods, liquid bulk (which include petroleum products) accounted in 2010 for 41% of the total cargo handled, followed by dry bulk (23%) and containers (19%). Dutch ports handled the largest amount of liquid bulk in Europe (265 million tonnes) and Spain handled the largest volume of containers with 112 million tonnes (Eurostat, 2012a).

The number of passengers passing through EU ports in 2010 was estimated at 396 million people (including inwards movements plus outwards movements), decreasing a 2% compared to 2009, and falling year-by-year the total number of passengers since 2007 (see Figure 7).

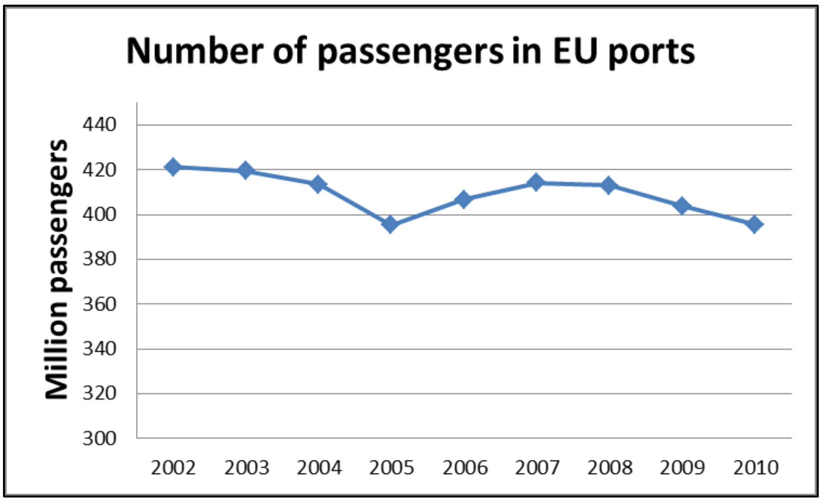


Figure 7. Number of passengers embarked and disembarked in EU ports. Source: Eurostat, 2012a

This continued drop may be explained with the rapid growth of low cost flights, the construction of new bridge connections and the resulting reduction in ferry lines. Italy (22%), Greece (21%) and Denmark (11%) are the three leading sea passenger transport countries in Europe. The Port of Dover (United Kingdom) remained as the largest passenger port in Europe, with more than 13 million passengers embarking and disembarking in 2010 despite the competition from the Channel Tunnel.

The European Commission Statistics (Eurostat, 2012a), also specifies that the number of vessels calling at European ports has increased by 4.4% in 2010, compared to 2009 levels. Italy became the country that recorded both the highest number of port calls and the largest gross tonnage of vessels, followed by Greece and Denmark in terms of highest number of port calls and United Kingdom and Spain in terms of gross tonnage of vessels. Concerning the type of vessels, the highest number of calls was made by vessels of general cargo followed by passenger vessels, liquid bulk vessels and container vessels.

Mediterranean and Black Sea

Figure 8 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.

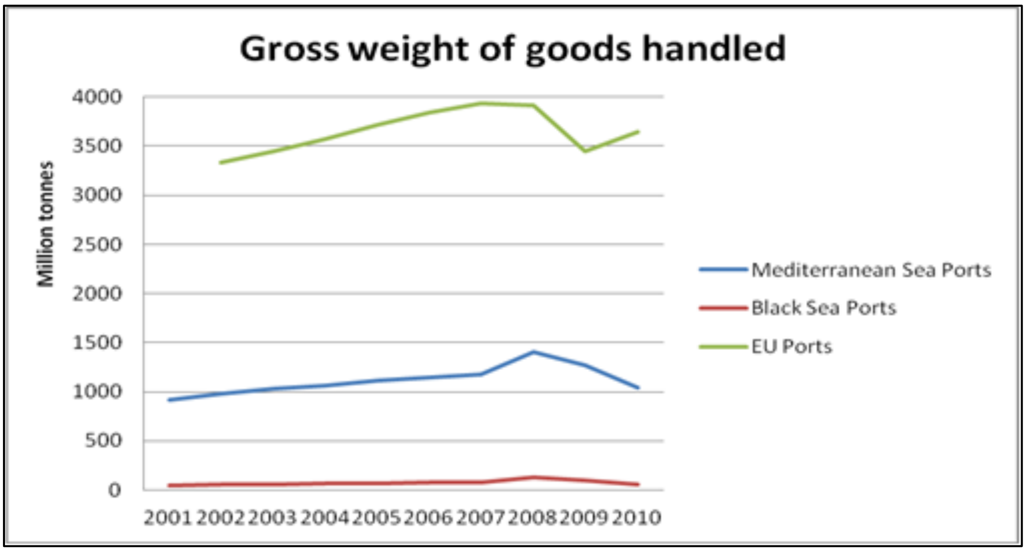


Figure 8. Gross weight of goods handled in Mediterranean, Black Sea and EU ports from 2001 to 2010. Source: Eurostat, 2012b.

According to the figure, 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 Figure 8) 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 8, 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.

In the PERSEUS project, it was agreed to divide the Mediterranean Sea in three regions for a deeper study. Therefore, the results are presented accordingly: West, Central and East Mediterranean and the Black Sea. In each sub-region the traffic statistics are presented in terms of gross weight, liquid bulk, dry bulk, containers, ro/ro, general cargo, passengers and number of vessels.

It was no possible to distinguish the marine traffic in coastal areas from the one in open sea.

West Mediterranean

The West Mediterranean sub-region comprises of the coastal MS of Spain and France and the non-EU members of Monaco, Tunisia, Algeria, and Morocco. The statistics of this region for EU ports are provided in Table 17.

Table 17. 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 given in Table 17 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.

Central Mediterranean

The Central Mediterranean includes Italy, Slovenia and Malta and the non-EU countries of Croatia, Bosnia- Herzegovina, Montenegro, and Albania, and the North African countries of Egypt, Libya, and Tunisia. Table 18 provides the performance of this area for EU countries:

Table 18. Traffic statistics of the Central Mediterranean sub-region (Italy, Slovenia and Malta)

Central Med	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Gross weight	473006	490837	513351	527596	553055	567443	588531	577497	512119	539015
Liquid bulk	203586	203303	207542	202005	217922	217254	219072	214067	190021	198152
Dry bulk	88196	85150	91757	96268	109653	114009	113039	115568	112424	77489
Containers	6378	7267	8121	8226	8175	8266	9103	8604	7811	9199
Ro-ro	23699	27149	31019	32745	33337	34336	42616	38999	30893	53630
General cargo	20407	24376	26880	26371	27221	30732	32158	41681	22411	32698
Passengers	16867	25241	26472	28811	29320	30419	32464	34226	33892	33226
Vessels	527578	511204	519089	524985	630388	677691	659527	683686	681949	738997

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 previous table provides the results of the shipping sector of the Central Mediterranean countries of Italy, Slovenia, Malta and Croatia. This area is clearly the one with the higher port's and shipping commercial activities in the whole Mediterranean Sea, with a total amount of 539 million tonnes of gross weight.

There are several reasons that contribute to explain why this region has the most intense maritime traffic in the Mediterranean: the first is that it includes two emerging countries that have had the highest growth in the gross weight of goods handled from 2001 to 2010, which are Slovenia (+59.5%) and Croatia (+27.7%) (Eurostat, 2012e). The second reason is that Malta is the only one maritime country in the Mediterranean that has not seen its port operations decrease as a result of the global economic crisis. On the contrary, it increased by 0.1% (Eurostat, 2012e). The third reason is that Italy, with a long shipping tradition, is the country that handles the highest amount of gross weight of goods in the Mediterranean Sea, around 494 million tonnes in 2010, and representing 47% of the seaborne trade of the Mediterranean (Eurostat, 2012e) and 13.6% in the overall EU ports (Eurostat, 2012f).

In addition, Italy is, by large, the country that handles the largest quantity of liquid bulk, almost a 50% of all Mediterranean Sea liquid bulk traffic and a 13% of the whole EU ports in 2010, followed by Spain and France (Eurostat, 2012g). In general, small countries have faced the highest growth in trading liquid bulk from 2001 to 2010, such as Malta (+63.3%) or Slovenia (+46.5%), both included in this sub-region.

Concerning the ro-ro traffic, in these countries there has been an overall increase of 126.3% since 2001, from 23 to 53 million tonnes. Italy is again the Mediterranean country that handles the highest amount of ro-ro cargo, with an impressive increase of a 121.5% since 2001 until 2010 and a 74.2% in the last year (2009-10). All Mediterranean Sea ports experienced an increase in the ro-ro cargo traffic, except Croatian ports that reduced it by -4.6% (Eurostat, 2012g).

Italy is again the country with major general cargo activity, representing 60% of non-containerised cargo traffic for the whole Mediterranean countries (Eurostat, 2012g). However, in this category most ports have not recovered from the global downturn of 2008 because their levels of activity in 2010 are below from the recorded in 2001. Only Italy and Slovenia register higher levels than 2001.

In general, there has been a drop in the trade of dry bulk products in the Mediterranean sea compared with 2001, being the largest decrease in Malta (-46.7%), Cyprus (-27.9%), and Italy (-24.5%) (Eurostat, 2012g). The overall decrease of the dry bulk traffic in EU ports is about -14%.

Although it is not mentioned in the table, Italy is the highest country dealing with cruise passengers; 60% of EU Mediterranean cruise passengers departed or arrived in Italy, 27% in Spain and 8% in Greece in 2009. The major cruise port is the Port of Barcelona, followed by the two Italian ports of Napoli and Genova (Eurostat, 2012b).

Italy remained as the country with more vessels calling at its ports, with a share of 38% out of the total Mediterranean and Black Sea ports, followed by Greece (36%) and Croatia (14.4%). Malta had the highest growth (+656.3%) in terms of number of vessels, evolving from 3,045 vessels in 2003 to 23,030 vessels in 2010 (Eurostat, 2012d).

East Mediterranean

The East Mediterranean sub-region only includes two EU coastal countries: Greece and Cyprus. The other countries included in this geographical area are Turkey, Syria, Lebanon, Israel, and Palestinian territories. However, the statistics displayed in Table 19 are only for the EU countries of the East Mediterranean:

Table 19. Traffic statistics of the East Mediterranean sub-region (Greece and Cyprus)

East Med	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Gross weight	122171	154912	169792	164729	158555	167101	171816	160460	142238	131341
Liquid bulk	34634	40373	39613	39075	39504	43370	43309	48688	46740	44592
Dry bulk	24591	26054	28868	29786	30341	29229	30174	28416	23897	22584
Containers	1395	1907	2162	2192	2093	2121	1713	1247	1355	1465
Ro-ro	7078	12984	23379	19278	16270	17054	18341	17674	16126	11323
General cargo	6874	7253	6253	6256	6393	6158	6204	6135	4752	4596
Passengers	50149	101549	103047	96991	86262	90630	92597	91251	88447	84100
Vessels	194362	336584	374689	465799	475063	498396	522609	492924	482644	491841

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 in Table 19 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).

The gross weight of goods entering the Mediterranean ports is greater than the gross weight of goods exiting them, since there are a percentage of imports of 66% (Eurostat, 2012e). Cyprus, located in the East Mediterranean, is the country with higher imports, with 87% of its products being brought in. This makes sense because it is a small and an island country.

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 although Cyprus faced the largest drop in the number of vessels (from 4,691 vessels reported in 2002 to 2,741 reported in 2010) (Eurostat, 2012d), the number of vessels in the East Mediterranean region has increased the most compared to the rest of the regions, by 153.1% since 2001. This rise was caused by the Greek increase in the number of vessels, a 151.6% in the period 2001-10 (Eurostat, 2012d).

Black Sea

In the Black Sea there are two EU countries, Bulgaria and Romania. The rest of the counties that border this sea are Ukraine, Russia, Georgia, and Turkey.

Table 20. Traffic statistics of the Black Sea sub-region (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 Figure 8Figure 8. **Gross weight of goods handled in Mediterranean, Black Sea and EU ports from 2001 to 2010. Source: Eurostat, 2012b.**). 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).

4.2.3 Links to environmental pressures

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 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.

Other physical disturbance (noise and marine litter)

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).

4.2.4 Gap analysis

The research conducted for this review shows significant gaps in the data available for the Mediterranean and Black seas shipping. The first limitation comes from the fact that the available data does allows to differentiate shipping in coastal area from the one in open sea.

Secondly, industry data are available for the EU regions in terms of tonnes of cargo, vessels and passenger traffic. However, as mentioned previously, the analysis showed that unfortunately no open data are available for North African and Asian countries since most of the data presented in this report have been obtained from the Eurostat (Eurostat, 2012c),which provides statistical information at a European Union (EU) level.

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.

The results of the industry, economic and social indicators introduced in section three 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 chapter, 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.

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, in section four the major environmental impacts of the shipping are 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.

4.3 Submarine cable and pipeline operations

Prepared by Marta Pascual (BC3) & Didier Sauzade (Plan Bleu).

4.3.1 Introduction

a) Context

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 percent 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.

b) Activity Description

Oil and Gas Pipelines:

International trade and sea transport of hydrocarbons represent a vital link in the chain of oil and oil services, since the centers of production of oil and gas are generally far from the centers of consumption. The distances are very important and international transportation of crude oil is mainly done by sea. Hydrocarbons can be liquid or gaseous, hazardous and likely to be polluted and polluting. These characteristics give importance to their transport characteristics. Indeed, it should be transported in special containers: oil tankers ("tankers") and pipelines for crude oil, and pipelines for natural gas. To distinguish the transportation of oil from other shipping, we have mainly focused on the transport of oil through shipping. However, some specific infrastructure maritime transport of oil from pipelines will also be identified even thought their socio-economics will not be considered to avoid double counting.

Submarine cables:

Economic activities related to submarine cables are considered separately from transport activities (although it is a kind of transportation including information and power). They include the installation and operation of:

- Telecommunication submarine cables
- Electricity submarine cables

4.3.2 Sector and socioeconomic analysis for the Mediterranean

a) General

Oil and Gas Pipelines:

The Mediterranean region is a transit zone of more than 22% of the trade of oil in the world, which makes its potential impacts and risks at sea to be increased. About 336 millions of tons of oil are transported across the Mediterranean Sea most of which is transported mainly by tankers and partly due to some international pipelines However, if compared to the ship-transport, the transport of oil through pipelines crossing the Mediterranean can be considered as marginal.

In addition, also crossing the Mediterranean Sea, over 105 billion m^3 gas are exchanged through some of the major international gas pipelines. In 2010, those pipelines carried approximately 41 billion m^3 of gas.

Table 21. Gas transport at the Mediterranean Sea (El Andaloussi, El Habib, 2011; BP, 2011)

Characteristics	Figures	Reference year
Number of the gas pipelines	5 (+2 projets)	2011
Undewater gas pipelines (Km)	943 km (+502 km projets)	2011
Trade volume of gas transported through the Mediterranean Sea	105 millions m^3	2010
Trade volume of gas transported via pipelines from the Mediterranean Sea.	41 millions m^3	2010

Submarine cables:

We have considered a cable as being from the Mediterranean if the cable is tied to one or more Mediterranean countries or if it ties two destinations under the condition that the cables run through the Mediterranean. Therefore, the Mediterranean parts of long-distance worldwide cables will also be taken into consideration. In the context of the socio-economic activities related to submarine cables, this study takes into account:

- - The installation, operation and maintenance of electrical cables
- - The installation of telecommunications cables

Due to lack of data, we are not able to calculate the costs of operation and maintenance of telecommunication cables or even the turnover generated by the rental units of the frequency telecommunication cables. Furthermore, due to reasons of no data availability, the evaluation of jobs related to the electrical cables in the Mediterranean could also not be performed.

Telecommunications cables

Since the appearance of the first telecommunication submarine cable of optic fiber in the 1980s, submarine cables have become the primary pathways of telecommunication, even more important than satellites. The dimensions of a submarine telecommunication cable are 28-50 mm in diameter with a weight of less than 10 kg / m. Figure 9 shows the number and lengths of submarine telecommunication cables which have been settled in the Mediterranean through time. The graph rises particularly rapidly between 1988 and 2002, due to the development of optic fiber cables.

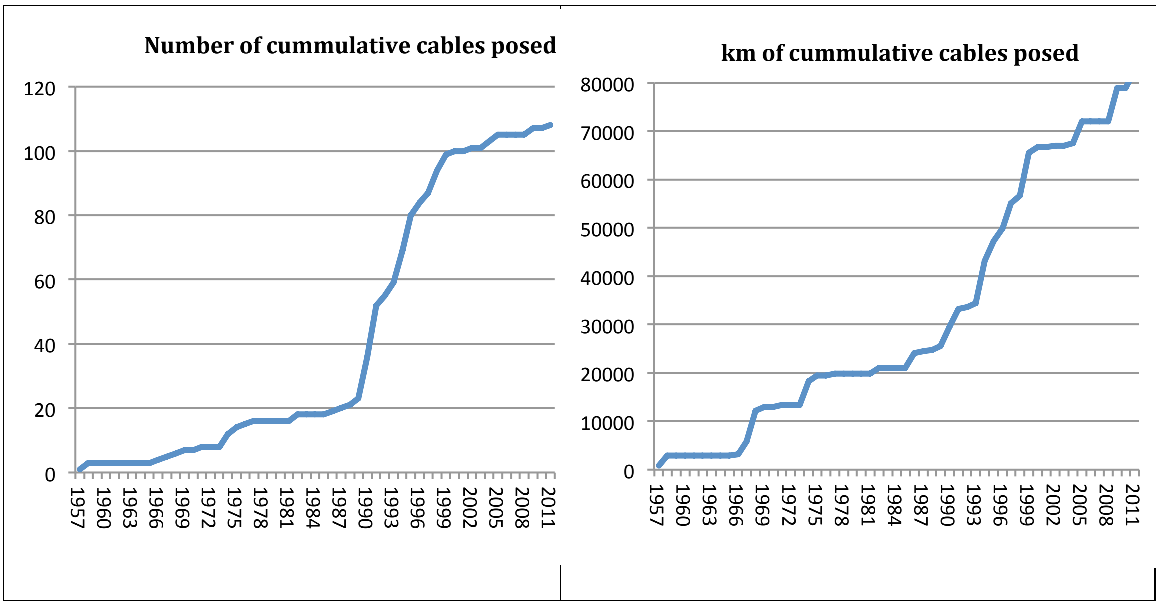


Figure 9. Cumulative number of km of submarine telecommunication cables posed in the Mediterranean, 1957-2011 (ICPC, 2010; Telecom Egypt, 2011).

Nowadays cables carry more than 95% of transmissions of telephone, fax, internet and e-mail and television programs (Drew and Hopper, 2009). A very detailed study on the evolution of submarine cables in the world was established by the ICPC in cooperation with UNEP-WCMC (UNEP-WCMW and ICPC, 2009).

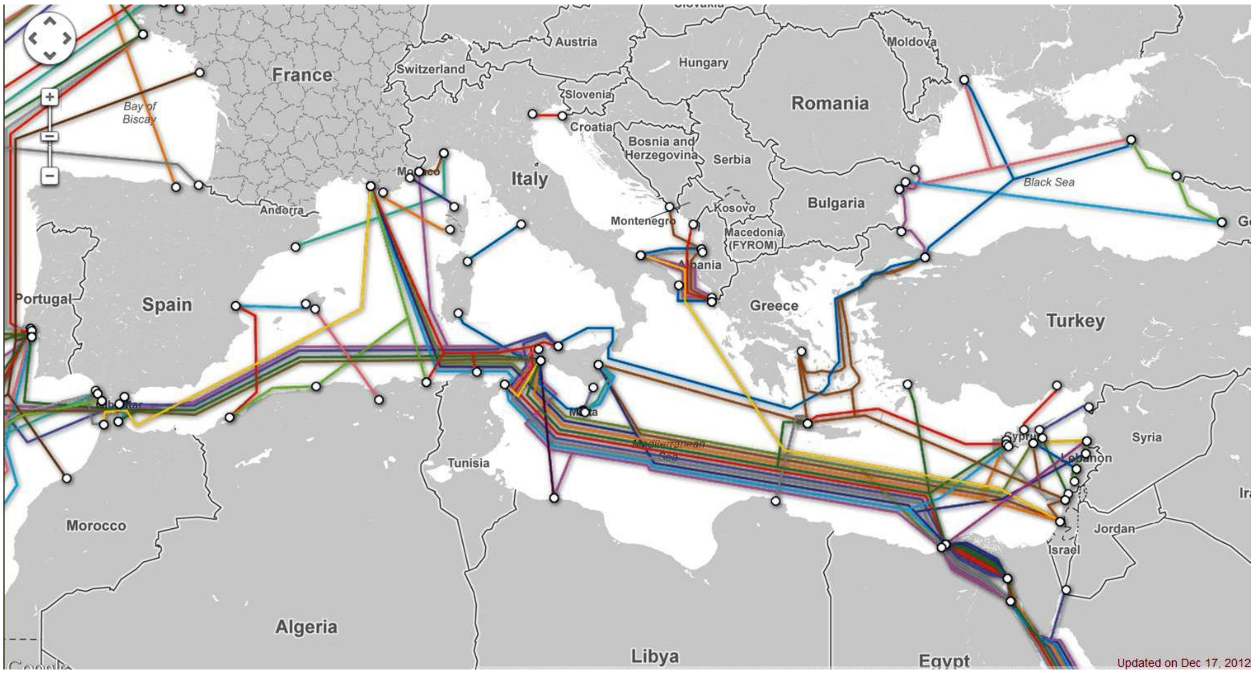


Figure 10. Submarine cables map taken from TeleGeography (Available at: http://www.submarinecablemap.com/; accessed 07/01/2013).

From those cables we must highlight:

- The FLAG Europe-Asia (FEA) cable of 28,000 km length which goes from Porthcurno (UK) to Miura (Japan) stopping at Estepona (Spain) and then crossing all the Mediterranean Sea, The Red Sea, The Indic Ocean and the Sea of China
- The Atlas Offshore cable (transferring 320 gigabits) which goes from Asilah (Marocco) to Marseile (France)
- The SEA-ME-WE 4 cable (transferring 1280 gigabits) which goes from Marseille (France) to Asia (through all the Mediterranean, red and Indic Ocean).
- The I-ME-WE cable (transferring 3840 gigabits) which goes from Marseille (France) to Mumbai (India) through all the Mediterranean, Red Sea and Indic Ocean.

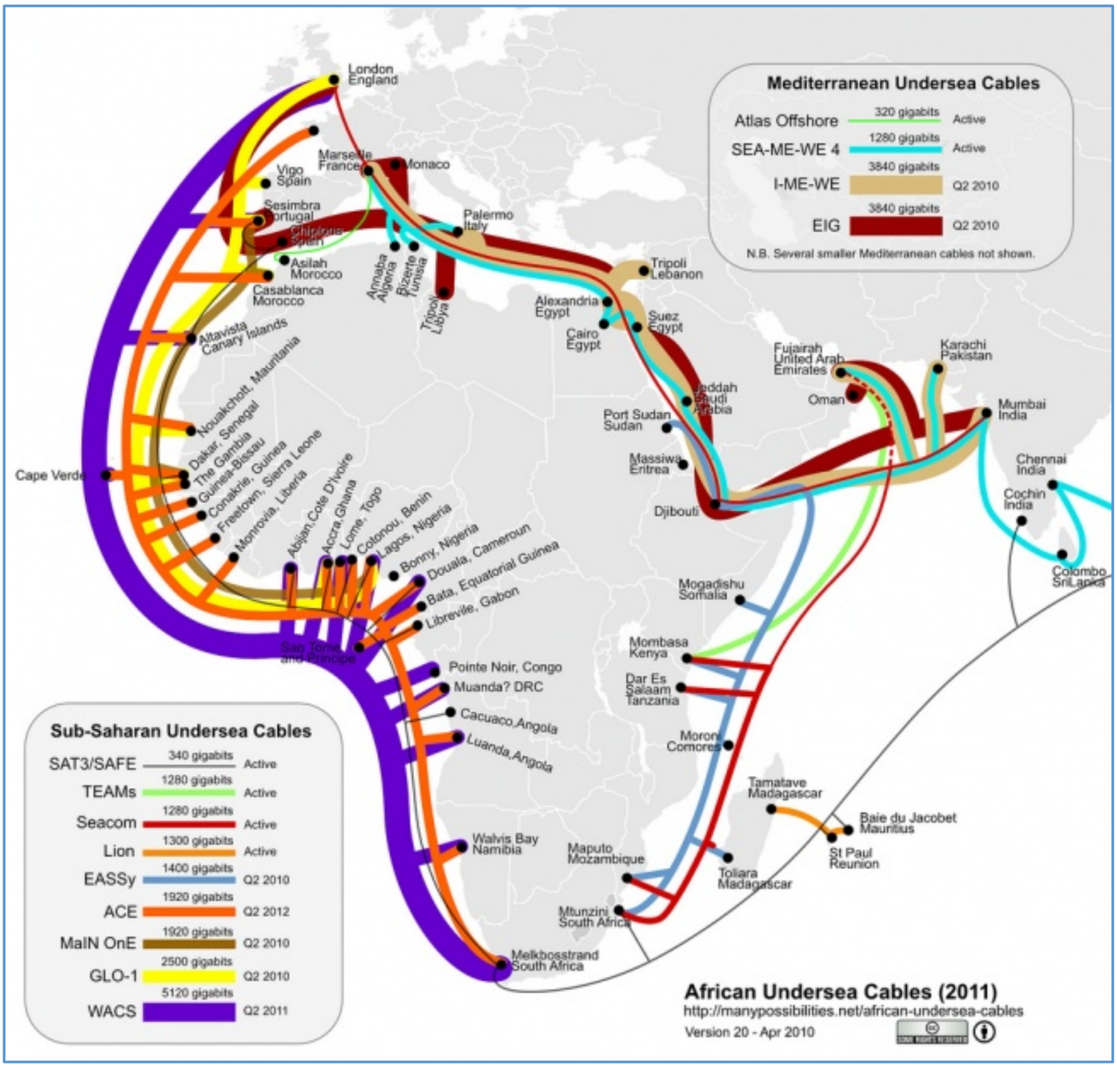


Figure 11. Mediterranean and African Undersea Cables (info from http://wikitel.info/wiki/Cable_submarino).

Electrical cables

Regarding electrical submarine cables, three are settled in the Mediterranean at the moment, but several projects are underway. The dimensions of an electric cable are significantly greater than those of a telecommunications cable. An underwater electric cable reaches a diameter of about 235 mm and a weight of 100 kg / m.

The total length of electrical and telecommunication cables along the bottoms of the Mediterranean is about 82 845 km, including the 202 km of 29 telecommunication cables which are settled also outside of the Mediterranean. However, several ongoing projects could rise up this total cable length to over 88 000 km in a very few years. There are seven cable ships operating in the Mediterranean (with usual ports in the Mediterranean) at the moment (see Table 22). However, there are several other cable ships in the world that operate globally and can also appear in the Mediterranean.

Table 22. Cable ships with their usual port in the Mediterranean, 2010 (ICPC, 2010).

	Name	Main Port	Registration Country	Operator/Owner	Capacity
1	Raymond Croze	La Seyne sur Mer, France	Kerguelen	France Telecom Marine	1300 tonnes
2	René Descartes	La Seyne sur Mer, France	Kerguelen	France Telecom Marine	5800 tonnes
3	Certamen	Catania, Italy	Italy	Elettra Tlc S.p.A.	1200 tonnes
4	Pertinacia	Naples, Italy	Italy	Elettra Tlc S.p.A.	6000 tonnes
5	Teliri	Catania, Italy	Italy	Elettra Tlc S.p.A.	2500 tonnes
6	Giulio Verne	Castellamare Di Stabia, Naples, Italy	Italy	Pirelli	8000 tonnes
7	Teneo	Valencia,Spain	Spain	Tyco Telecommunications	1000 tonnes

These are some of the names of the submarine cables which we can find at the Mediterranean: ALETAR; ALPAL-2; Aphrodite 2; BERYTAR; Bezeq International Optical System; CADMOS; CIOS (cable system); Columbus II; Columbus III; Eastern Mediterranean Optical System 1; Europe India Gateway; GO-1; I-ME-WE; KINYRAS; LEV (cable system); MedNautilus; MENA (cable system); Minerva (cable system); Pentaskhinos; SEA-ME-WE 3; SEA-ME-WE 4; TE North; TEFKROS; UGARIT.

b) Socio-economic data

Oil and Gas Pipelines:

In 2010, the turnover of gas transportation via pipeline in the Mediterranean Sea was approximately €1 billion, excluding €100 million from transit charges levied by third countries through which the pipelines pass.

However, there is an important lack of data according to the number of jobs related to oil transportation activities which cannot yet be estimated. Since most oil present in the Mediterranean region is located on the ground and the majority of oil transport is carried by tankers, the socio-economic impacts associated with oil in the Mediterranean Sea are estimated to be marginal.

Table 23. Turnover and added value of the gas transmission pipelines in the Mediterranean Sea, 2010 (Communications with El Habib El Andaloussi, 2011; BP 2011; Factor value based on Pugh, 2008).

Turnover gas transmission via pipelines	€1 billion + €100 million from transit charges
Added value of gas transportation via pipeline	€700 millions + €100 million from transit charges

Submarine cables:

Observing the investment costs related to submarine cables, we see a very large difference in cost between telecommunication cables and electrical cables as the average investment cost per kilometer is a little more than 40000 € for telecommunication cables and about € 2 million for electric cables.

Table 24. Estimates of investment costs of cables through the Mediterranean, 2011 (MED-IMP, 2010; ICPC, 2010; UCTE, 2008).

Telecomunication cables	Investment cost of telecommunication cables located in the Mediterranean	3,2 billion € (whose 1,2 billion € out of service)
	Cost of investment projects of telecommunication cables located in the Mediterranean	272 million €
	Average annual investment cost (installation of telecommunication cables)	61,2 million €
Electrical cables	Investment cost of electrical cables located in the Mediterranean	674 million €
	Cost of investment projects of electrical cables located in the Mediterranean	4,7 billion €
	Average annual investment cost (installation of electrical cables))	700,000 €
	Average annual investment cost for the next 10 years (laying cables)	200 – 500 million €
Cable Ships	Direct jobs on seven ships in the Mediterranean	460

Regarding jobs related to the installation and operation of submarine cables, an estimate of the order of magnitude is currently not possible. Indeed, the available data on economic activities cables are aggregated at both corporate and national levels. Given that the cost structures and labor of submarine cables differ significantly from those of terrestrial cables, it is not possible to use aggregate data to estimate an order of magnitude for cables submarines. However, 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.

c) Geographical distribution

Oil and Gas Pipelines:

In the Mediterranean, the oil production is concentrated in the South of the Mediterranean, while the load centers are located in the countries of the northern shore of the sea. This structure is also reflected in transport patterns of hydrocarbons. Indeed, the exchange of intra-Mediterranean hydrocarbons are mainly in the South-North direction, which makes the Mediterranean Sea almost an obligatory passage by sea between the centers of production and consumption centers.

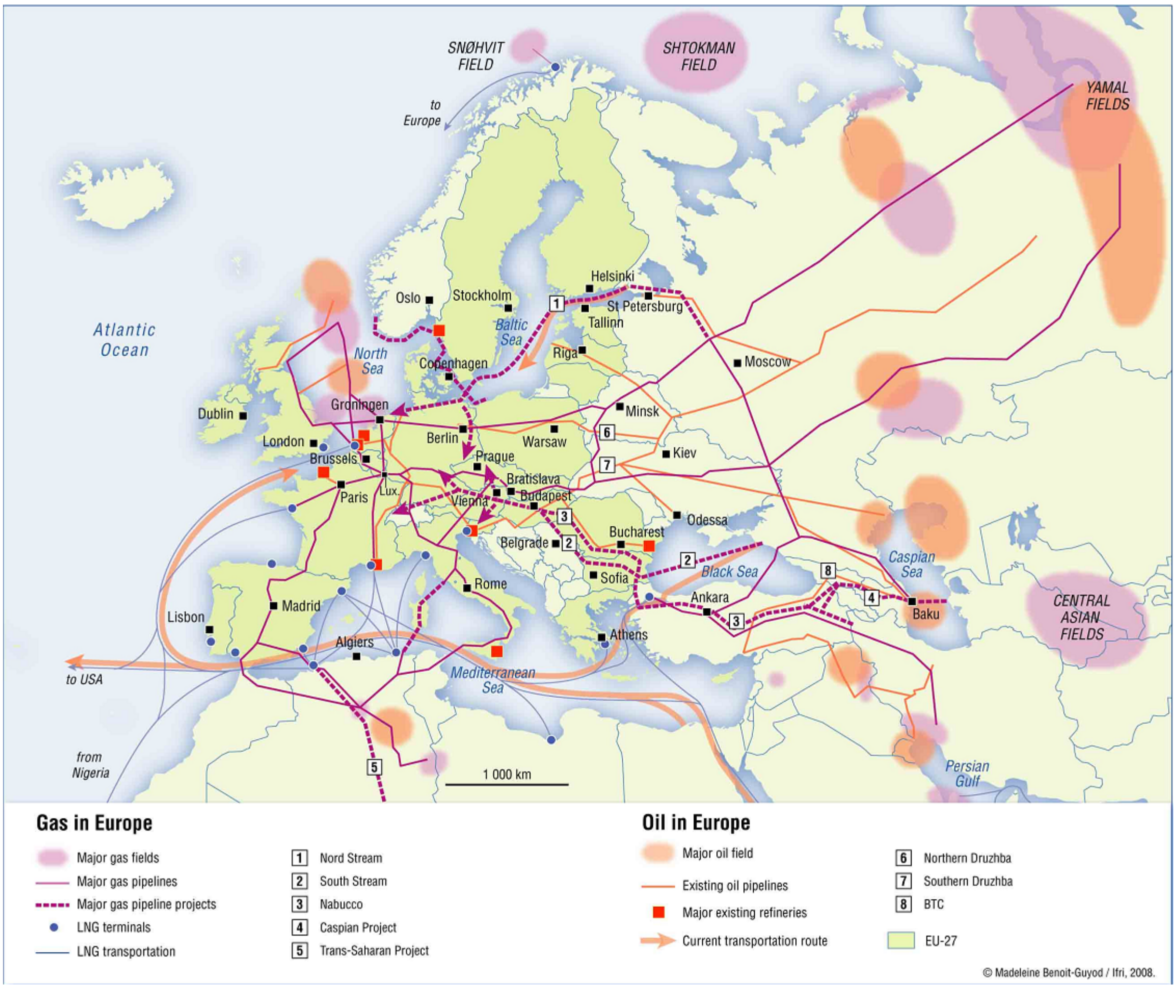


Figure 12. Oil and Gas transport in Europe (Nies, 2011).

Table 25. Gas pipelines at the Mediterranean (Eurogas; EGM; Cedigaz).

Linking	Gas pipeline name	Capacity Gm³/yr	In service since	Km underwater
Algeria – Italy (via Tunis)	Enrico Mattei –EMG (ex-Transmed)	27	1983 &1994	155
Algeria – Spain (via Marocco)	Pedro Duran Farell –PDFG- (ex-GME Maghreb-Europe)	13	1997 & 2004	45
Libia - Italy	Greenstream	8	2004	516
Turkey - Greece	ITG	11	2007	17
Algeria - Spain	Medgaz	8-10	March 2011	210
Greece - Italy	IGI	8-10	Planned 2011	217
Algeria - Italy (Sardinia)	Galsi	8-10	Planned 2011	285

In order to trade oil internationally, exchange of hydrocarbons in the Mediterranean are dominated by exchanges between the Mediterranean countries (22%), followed by trades with Russia (15%) and the Middle East (14%).

Submarine cables:

See figure of cables geographical distribution above at Figure 10.

d) Future trends

Oil and Gas Pipelines:

Faced with the growing demand for energy in the Mediterranean countries, exports and total imports, from or to the Mediterranean countries, will continue to grow and increase between 20-25% by traded volume in 2025. Therefore, the Mediterranean Sea will continue to play the role of a transit region for nearly a quarter of world trade for oil, with ever-increasing the potential risks of impacts to sea.

Submarine cables:

In the Mediterranean region, several projects of lying electrical and telecommunications submarine cables have been announced or are already under construction, with an investment cost of approximately € 270 million for telecommunication cables and approximately € 4.7 billion for electric cables.

Regarding the installation of telecommunication cables, recent years have shown a clear trend towards the installation of long-distance cables which are managed by consortia of national telecommunications companies. Indeed, it seems that the market for "small" telecommunication cables (less than 500 km) is relatively saturated leading to those companies to rely on the replacement of existing cables as work. Therefore, the trend for future years would mainly be the placement of international long distance cables or the replacement of obsolete or irreparable cables.

What it is for sure is that the market for submarine cables is booming and, in recent years, the cumulative length of submarine cables in the Mediterranean could reach eight times its current length. These prospects are based on the MEDRING (Mediterranean electricity ring = loop electrical Mediterranean) draft, an initiative that emerged in the 2000s, which has grown considerably in the last three years. The project's objective is to link Europe and the countries of the southern Mediterranean with electrical interconnections to ensure energy security in the region. This is to allow the exchange of electricity between the countries of the southern Mediterranean, which have significant potential energy and electricity demand with relatively small countries of the European Union that they are characterized by significant energy demand and energy resources much less abundant. According to the European Commission, the electrical loop is particularly essential for developing the potential of solar and wind energy in the region. In addition, the potential development of offshore wind energy will require underwater cables that carry electricity produced at sea to land.

4.3.3 Sector and socioeconomic analysis for the Black Sea

a) General

Oil and Gas Pipelines:

The Black Sea region is a contested neighborhood and the subject of intense debate. This reflects the changing dynamics of the region, its complex realities, the interests of outsiders and the region's relations with the rest of the world. Its strategic position, linking north to south and east to west, as well as its oil, gas, transport and trade routes are all important reasons for its increasing relevance (BSC).

In 1995 it was created by the EU the Interstate Oil and Gas Transportation to Europe (INOGATE), which is a regional structure which covers the energy transport in the Black Sea (BSC). It involves countries like: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkey, Turkmenistan, Ukraine, and Uzbekistan, and it aims to support the development of energy cooperation between the European Union, the littoral states of the Black and Caspian Seas and their neighboring countries.

Submarine cables:

International service is provided by three submarine fiber-optic cables in the Mediterranean and Black Seas, linking Turkey with Italy, Greece, Israel, Bulgaria, Romania, and Russia; also by 12 Intelsat earth stations, and by 328 mobile satellite terminals in the Inmarsat and Eutelsat systems (2002)

b) Socio-economic data

Oil and Gas Pipelines:

The energy dispute between Russia and Ukraine in the winter of 2008-09 was a clear indication of the importance of energy security for the region and for its customers. In the context of the Black Sea, the principal transport and pipeline routes for oil and gas from the Caspian basin and Russia to the West have become a key test of several types of relationship: Firstly, those between the producers; Russia, Azerbaijan, Turkmenistan and Kazakhstan, secondly, between the transit countries; Russia, Georgia, Turkey and Ukraine and finally between the consumers; EU countries, Turkey and others. The ability to strike a rational balance between the respective interests of all players, meaning security of supply for consumers, security of demand for producers and security of steady revenue for transit countries, will be a make-or-break issue for the development of successful models of cooperation between the Black Sea states (BSC).

Table 26. Oil in 2009.

	Armenia	Azerbaijan	Bulgaria	Georgia	Greece	Moldova	Romania	Russia	Turkey	Ukraine
Reserves (thousand millions barrels-2009)	0	7	0.0015	0.035	0.010	0	0.60	60	0.30	0.395
Production (thousand barrels daily-2008)	0	875.15	3.35	0.97	4.89	0	115.24	9789.78	46.11	101.27
Consumption (thousand barrels daily-2008)	47	121	120	17	433.98	15.80	255	2916	675.54	370
Imports (thousand	0	0	144	0.30	386.67	0	48	174	437.28	230

barrels daily-2008)	N/A	N/A	N/A	N/A	134.24	N/A	N/A	N/A	297.27	N/A
Exports (thousand barrels daily-2008)	0	730	0	0	21.40	0	5120	0	0	0
	N/A	N/A	N/A	N/A	131.58	N/A	N/A	N/A	133.05	N/A

[1]International Energy Statistics

Table 27. Gas in 2009 (International Energy Statistics).

	Armenia	Azerbaijan	Bulgaria	Georgia	Greece	Moldova	Romania	Russia	Turkey	Ukraine
Reserves (trillion cubic meters - 2009)	0	0.84	0.005	0.008	0.001	0	0.063	47.57	0.008	1.10
Production (billion cubic meters-2008)	0	16.19	0.31	<0.02	<0.02	0	11.41	662.21	1.01	19.79
Consumption (billion cubic meters-2008)	1.92	10.64	3.39	1.72	4.21	2.52	16.93	475.69	37.18	80.78
Imports (trillion cubic meters)	1.92	0	3.08	1.72	4.19	2.52	5.49	56.88	36.72	64.19
Exports (billion cubic meters)	0	5.55	0	0	0	0	0	243.41	0.42	3.19

Table 28. Major pipelines (Global Insight).

Name	Capacity	Source	Route	Notes
The Baku-Tblisi Ceyhan Pipeline (BTC)	1 million bb/d	Azeri Light crude	Azxerbaijan-Georgia-Turkey	Began operations in 2006. It is the only major export route for Caspian oil that does not pass through Russian territory or the crowded Turkish Straits.
Kirkuk-Ceyhan	1,65 million bb/d		Iraq-Turkey	Frequent sabotage attacks on the pipeline and feeder lines regularly disrupt operations.However, throughput has increased gradually and supplies have become more stable as violence in Iraq has declined
Samsun-Ceyhan (proposed)	1 million to 1,4 million bb/d			In May 2006 the Turkish government approved plans for the Samsun-Ceyhan pipeline. Initial construction began in 2007

Submarine cables:

Table 29. Telecommunication cables at the Black Sea (from www.cytaglobal.com).

Cable name (Acronym)	Name	Linking	Length	Capacity	Start Operation Year	Cost	Other
BSFOCS	Black Sea Fibre Optic Cable System	Bulgaria, Ukraine and Russia	1300 km	20 Gbit/s	September 2001	€42 millions	http://www.bsfocs.com/bsfocs-profile.pdf
KAFOS	Karadeniz Fiber Optik Sistemi - Black Sea Fibre Optic System	Romania, Bulgaria, and Turkey	527 km	622 Mbit/s	13 June 1997.		Is integrated with other systems such as TBL, TAE and ITUR
ITUR	Italian-Turkish-Ukrainian-Russian Submarine Fiber Optic Cable System	Italy; Turkey; Ukraine; Russia	3500 km	565 Mbit/s	August 1994		Thanks to the integration of the ITUR system with EMOS-1, KAFOS and SEA-ME-WE 3 systems, Türk Telekom has come into strategic prominence in handling the international communication traffic

c) Geographical distribution

Oil and Gas Pipelines:

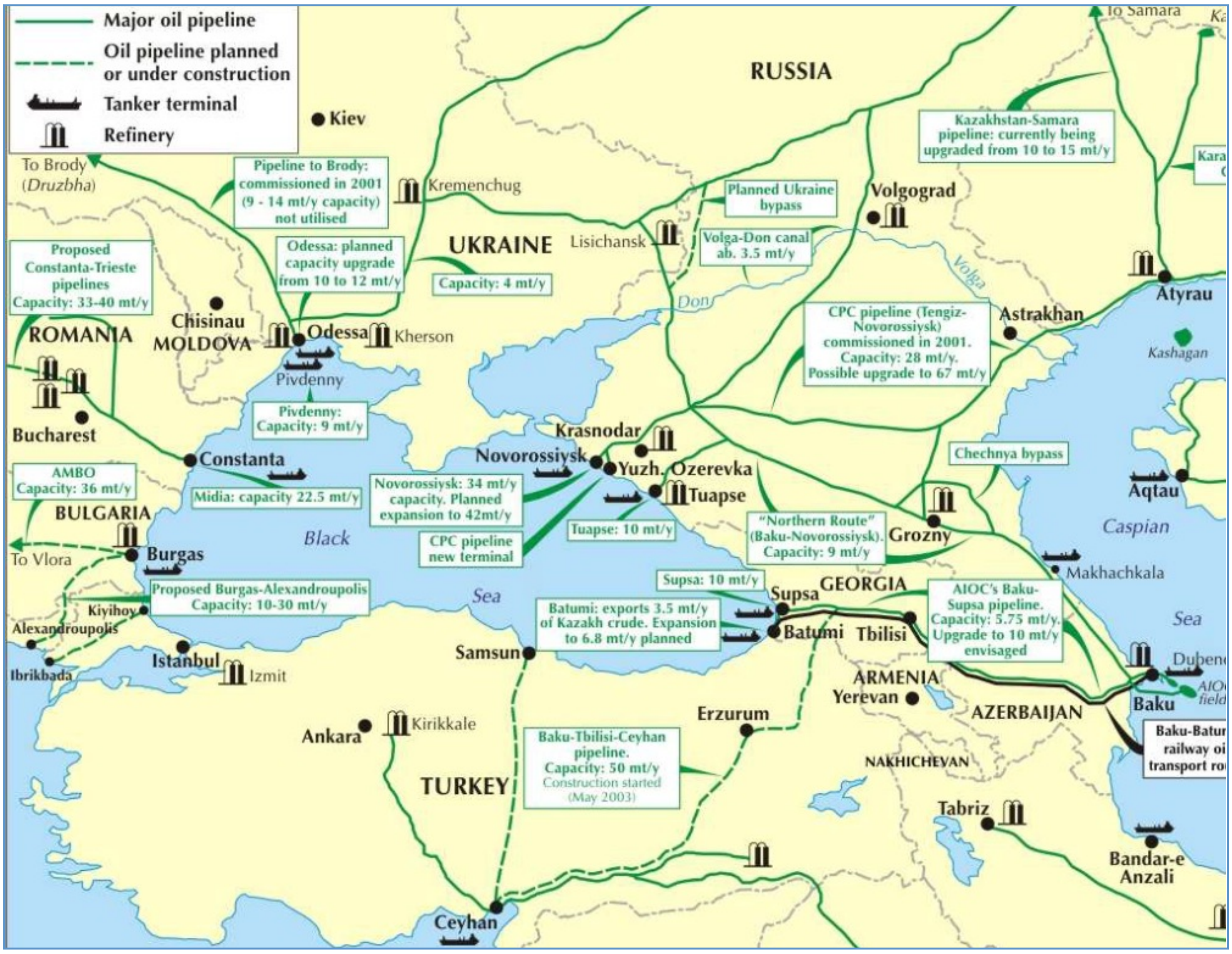


Figure 13. Schematic Map of the Black Sea Oil Transit Routes (IEA, 2005).

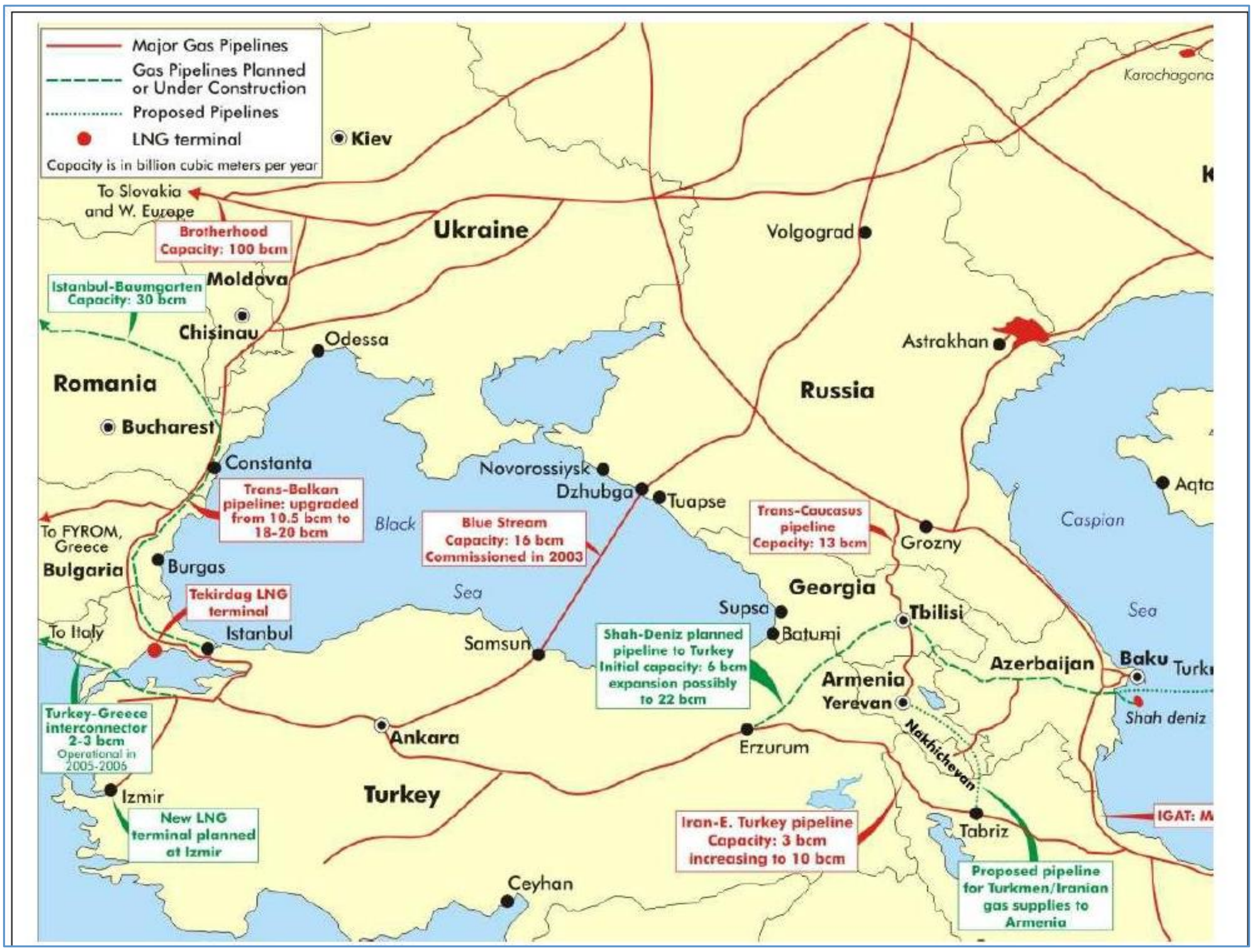


Figure 14. Schematic Map of Black Sea Natural-Gas-Transit Routes (IEA, 2005).

Submarine cables:

Telecommunications cables:

Figure 15. Schematic Map of the Black Sea telecommunication cables.

d) Future trends

Oil and Gas Pipelines:

There are various prospective oil explorations forthcoming at the Black Sea such as the one between Turkey-Shell and another one between Russia-ExxonMobil.

Shell has signed an agreement with Turkey's state-owned energy company TPAO on oil exploration in the western Black Sea region, envisaging drilling at least one well under the deal with a total drilling cost of around €115 million to €154. With this initiative Turkey has stepped up exploration efforts in the Black Sea and Mediterranean in co-operation with foreign companies as it tries to reduce its import dependence, but has yet to find oil in the Black Sea.

On the same hand ExxonMobil has signed an agreement with the Russian state oil company Rosneft to jointly explore and develop oil and gas resources in the Black Sea's Tuapse Trough. The area, covering 11,200 square kilometers, lies in deep waters in the northeast section of the Black Sea, offshore the Krasnodar region in Southern Russia, and is near to the major Russian oil export terminal at Novorossiysk. This is ExxonMobil's second largest venture in Russia after the path-breaking Sakhalin-I project (also in collaboration with Rosneft) about a decade ago. Rosneft estimates that the area could contain 7.3 billion barrels of oil equivalent of untapped oil and gas resources - about the same as the total proved reserves of Norway. The deal requires ExxonMobil to invest €769 million in the exploration stage. The agreement also gives the two companies an option to extend the partnership at a later stage, namely in the development of regional transportation infrastructure, possible exports from Novorossiysk, and/or crude oil sales to Rosneft's nearby Tuapse refinery. There is also the possibility of further collaboration in research and development for deepwater exploration.

Therefore, Russia's offshore production is expected to increase to about 15% of total oil production by 2020 from less than 5% today, and Russian companies may look to engage in many more such mutually beneficial partnerships in the future. Although this could signal the start of a new optimistic era for Russia´s offshore production, the regulatory framework and sometimes bitter legal wrangles could not allow for this development to occur.

Submarine cables:

If we look at TRACECA EU project results, which is open for all the initiatives promoting the development of regional transport dialogue and ensuring the efficient and reliable Euro-Asian transport links, promoting the regional economy on the whole, we observe that the traffic volume is increasing between Europe and Asia. As an example: by 2008 traffic amounted 20.1 Tbps, and forecast by 2012 is that traffic volume would surplus 81.1 Tbps.

From year to year the demand on bandwidths is increasing. For instance, traffic volume in 2008 amounted 20.1 Tbps, while for the year 2012 the traffic volume is assumed surplus of 81.1 Tbps.

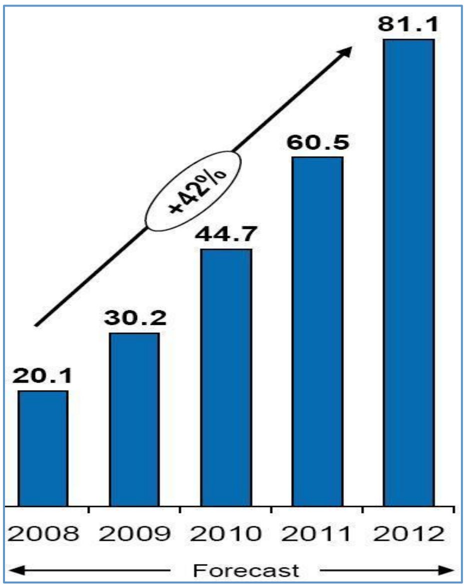


Figure 16. Increased traffic volume trend since 2008.

Furthermore, 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. The Poti-Constantsa route would have an estimated length of 1200 km and its costs are estimated to be around € 24.6 million. While the Poti-Istanbul route´s estimated length is 1059 km and its cost is estimated to be of € 22.3 million. The maximum term of construction is of 2 years and its construction turnover term -6-7years.

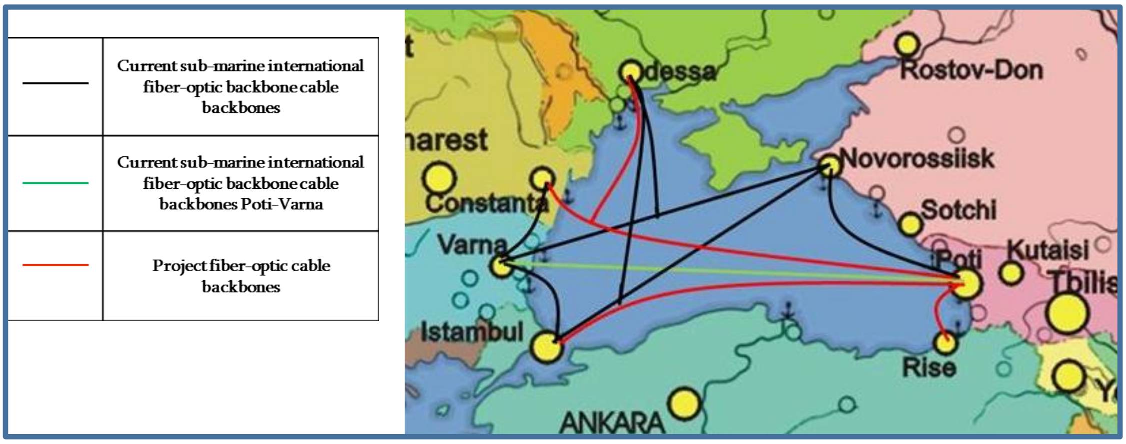


Figure 17: Schematic Map of the Poti-Constantsa fiber-optic submarine cable route

4.3.4 Links to environmental pressures

There is a common misconception that nowadays most international communications are routed via satellites, when in fact well over 95 per cent of this traffic is actually routed via submarine fibre-optic cables. Data and voice transfer via these cables is not only cheaper, but also much quicker than via satellite (Carter *et al.*, 2009). Thus, there is a need to control and determine the best practices to settle these submarine cables. The International Cable Protection Committee has established a set of environmental criteria which we will summarize below:

The total length of fiber-optic cables in the world's oceans is c.1 million km (Carter *et al.*, 2009). In terms of physical size, a modern cable is small. The deep-ocean type has a diameter of 17–20 mm and its counterpart on the continental shelf and adjacent upper slope is typically 28–50 mm diameter because of the addition of protective armoring. Despite this small footprint, fiber-optic cables may still interact with the benthic environment. Thus Environmental Impacts Assessments need to be carried out in order to assess and ensure that any environmental effects of cable laying and maintenance are taken into account before authorization is provided to lay a cable on the seabed.

Physical damage

Modern cables are usually buried into the seabed at water depths down to c.1500 m as a protective measure against human activities. However, some shallow-water cables may be placed on the seabed in areas unsuitable for burial, e.g. rock or highly mobile sand. For water depths greater than c.1500 m, deployment on the seabed is the preferred option (Carter et al., 2009). Thus, surface-laid cables may physically interact with the seabed under natural or human influences, creating the abrasion of rocks.

Biological disturbance

Over benthic biota: Overall, studies have demonstrated that cables have no or minimal impact on the resident biota. On the basis of 42 hours of video footage, the comprehensive study of Kogan et al. (2003, 2006) showed no statistical difference in the abundance and distribution of 17 animal groups living on the seabed within 1 m and 100 m of a surface-laid coaxial scientific cable. Likewise, 138 sediment cores with an infauna of mainly polychaete worms, nematodes and amphipods showed that the infauna was statistically indistinguishable whether near or distant from the cable. The main difference associated with the cable was that it provided a hard substrate for the attachment of anemones (Actiniaria). These organisms were abundant where the cable traversed soft sediment that normally would be unsuitable for such animals. Fishes, especially flat fishes, were more common close to the cable at two observational sites where small patches of shell-rich sediment had formed, probably in response to localized turbulence produced by current flow over the cable (Carter *et al.*, 2009).

Over marine mammals and fish: Records extending from 1877 to 1955 reveal that 16 faults in submarine telegraph cables were caused by whales (Heezen, 1957; Heezen and Johnson, 1969). Thirteen of the faults were attributed to sperm whales, which were identified from their remains entwined in the cables. The remaining faults were caused by a humpback, killer and an unknown whale species. In most instances, entanglements occurred at sites where cables had been repaired at the edge of the continental shelf or on the adjacent continental slope in water depths down to 1135 m. However, whale entanglements have nowadays ceased completely. In a recent review of 5740 cable faults recorded for the period 1959 to 2006 (Wood and Carter, 2008), not one whale entanglement was noted. This cessation occurred in the mid-1950s during the transition from telegraph to coaxial cables, which was followed in the 1980s by the change to fibre-optic systems.

Other physical disturbance (underwater noise, marine litter)

Given our incomplete knowledge of the different responses of marine animals to different sources of noise (National Research Council, 2003), cable survey equipment is regarded as posing only a minor risk to the environment (SCAR, 2002) compared to prolonged high-energy midrange sonar systems, which may be associated with standings of some whale species (Fernandez *et al.*, 2005) and are the subject of ongoing research (Claridge, 2007).

4.3.5 Gap Analysis

There is a clear evidence that both, the Mediterranean and the Black Sea are being highly used in terms of submarine cables and pipelines. However, a gap of information has been found when looking at the specificities these uses require in terms of legislation, potential conflicts with other marine uses, etc. According to the Convention on the High Seas of 1958-Freedom of the high seas, include freedom to lay submarine cables and pipelines. Thus, although coastal states have sovereign rights and jurisdiction in their exclusive economic zone, other states have the right to lay submarine cables and pipelines, and other uses associated with the operation of submarine cables and pipelines. This entails major troubles in terms of potential conflicts which may occur with other uses in the area and potential accidents which could also occur.

Furthermore, our incomplete knowledge of the different responses of marine animals to different sources of noise makes it even harder to determine their potential impacts onto the Mediterranean and Black Sea marine environments.

This highlights a major gap in submarine cables and pipelines legislations which should be shortly addressed for a correct management of our environments.

4.4 Marine hydrocarbon (oil and gas) extraction

Prepared by D. Sauzade, Plan Bleu, on the basis of former Plan Bleu grey literature.

4.4.1 Introduction

a) General context

Production in the Mediterranean is concentrated in waters of Egypt, Libya, Tunisia and Adriatic in Italy, but other areas are promising as offshore of the Levantine (Israel, Palestine and Lebanon) and Western Mediterranean (Catalonia and France). Production on the Black Sea shores has known several peaks in the past especially in Romania, followed by complete breaks for various political reasons. Nowadays, the Black Sea region can be considered as complex but hugely important area for hydrocarbon development. Recent offshore exploratory drilling activities are promising in most of the Black Sea, both for the shelf and the deeper areas.

However, the development of the offshore oil and gas production in the east part of the Mediterranean and in the Black sea is heavily conditioned by the evolution of the regional territorial conflicts, especially the Palestinian-Israeli and the Cyprus-Greek-Turkish ones.

b) 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.

4.4.2 Sector and socioeconomic analysis for the Mediterranean

The data used for the socioeconomic assessments and the assumptions made in case of extrapolation and value transfers are presented in Table 32. Gap Analysis.

a) Production

At the international level, the Mediterranean countries are relatively small producers of oil and gas, with 5.8% of global oil production and 5.7% of global production of natural gas in 2010. Considering the offshore production only, about 0.8% of oil production and 1.9% of global gas production come from the 250 or so of offshore oil and gas platforms (Court, 2011). After an initial phase of growth and decline between 1965 and 1973, offshore oil production in the Mediterranean took off after the first oil shock in 1974, reaching its peak in 1993 and decline slightly thereafter. During the last 10 years, oil production in the Mediterranean has remained relatively stable with an output of 34.6 million of tons of oil equivalent (TOE) in 2000 and 33.7 MTOE in 2010.

However, the production of offshore gas has increased steadily since the 1970s (see Table 30) and more than doubled between 2000 and 2009. It was only in 2010 that the gas production decreased slightly from 56.1 MTOE in 2009 to 55.1 MTOE in 2010.

Table 30. Volume of offshore oil and gas in the Mediterranean, 2000-2010.

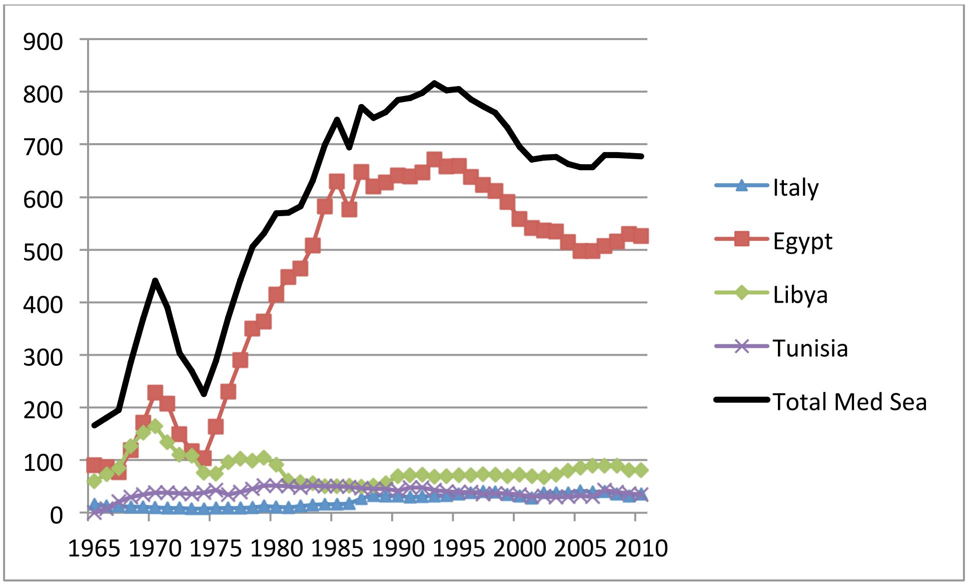
Years	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Past trends
Oil production (Mtoe / year)	34.6	33.4	33.6	33.6	33.0	32.7	32.7	33.8	33.9	33.8	33.7	→
Gas production (Mtoe / year)	22.8	25.6	26.8	28.4	31.7	40.1	49.6	51.1	53.7	56.1	55.1	↗
% Production offshore Med / total oil worldwide	0.93%	0,90	0,90	0.88%	0.82%	0.81%	0.80%	0.83%	0.83%	0.85%	0.83%	→

% Production offshore Med /total gas worldwide	1.05%	1.14%	1.18%	1.20%	1.30%	1,60	1.91%	1.92%	1.94%	2.09%	1.91%	↗

Sources: BP (2011), The Petroleum Economist (2004) and author estimate for the offshore share

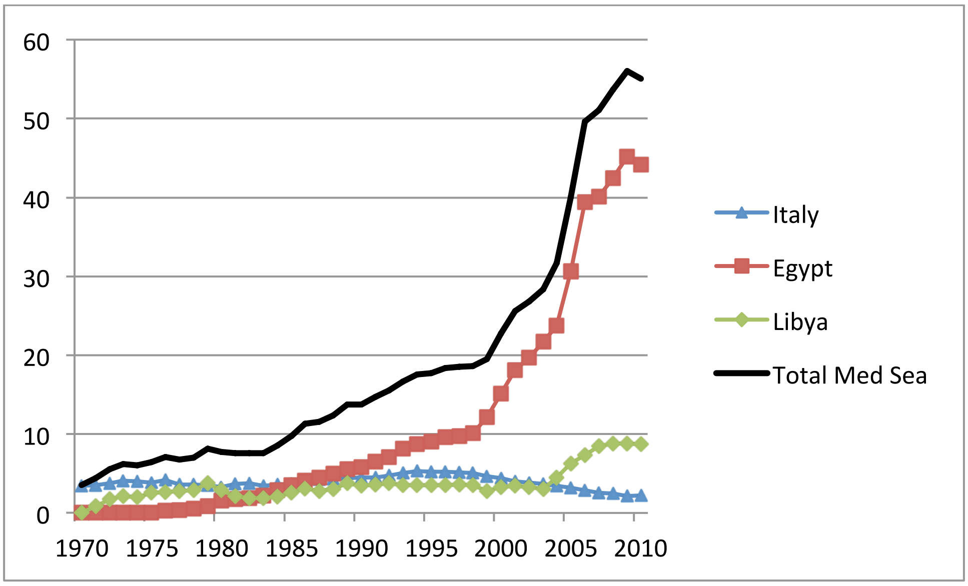
These data are illustrated by the following graphs (see Figure 18 and Figure 19).

Figure 18. Evolution of offshore oil production in the Mediterranean, thousands of barrels /day, 1970-2010.



Sources: BP (2011), The Petroleum Economist (2004) and author estimate for the offshore share

Figure 19. Evolution of gas production offshore in the Mediterranean, Mtoe / year, 1970-2010.



Sources: BP (2011), The Petroleum Economist (2004) and author estimate for the offshore share

b) Socio-economic data

Turnover of oil and gas are heavily dependent on oil and gas prices and often very volatile. This volatility explains the turnover increase in 2008: compared to 2007, the production volume increased by only 0.3% for oil and 5.1% for gas, while revenues rose by 21.1% for oil and 40% for gas.

In terms of employment, the numbers of direct jobs and total jobs have been estimated to have increased by about 55% between 2000 and 2010 for all oil and gas activities, a development that is closely linked to the rapid evolution of gas operations at sea

Table 31. Socio-economic data related to offshore oil and gas production in the Mediterranean Sea, par value estimates 2000-2010.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Oil production turnover (In billion €)	9.6	7.95	7.65	7.21	8.31	11.33	13.01	13.33	16.14	10.79	14.83
Gas production turnover (In billion €)	2.86	4.18	3.67	4.08	4	7.57	12.41	11.99	16.97	13.74	10.82
Added value oil and gas (direct contribution to GDP) (In billion €)	8.62	8.39	7.83	7.81	8.79	13.08	17.58	17.51	22.9	16.97	17.74
Direct jobs (In thousands, oil and gas combined)	15.6	16.0	16.4	16.8	17.5	19.7	22.3	23.0	23.7	24.4	24.1
Total jobs (direct + indirect) (In thousands, oil and gas)	116.3	119.5	122.3	125.7	131.0	147.3	166.7	172.0	177.4	182.0	179.9

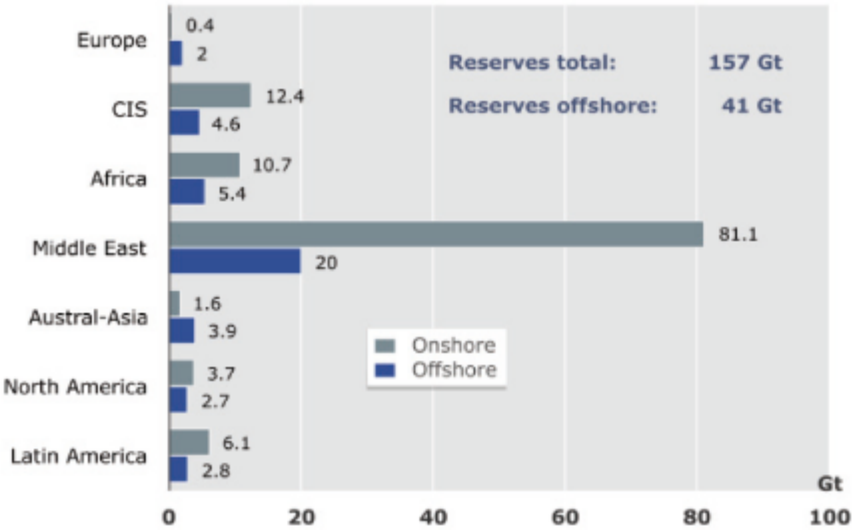
Sources: BP (2011); Oil and Gas UK (2011); The Petroleum Economist (2004) and author estimate for the offshore share

c) Geographical distribution

The global oil and gas reserves are distributed very heterogeneously. Figure 21 shows the distribution of world oil reserves by region. It highlights that the majority of oil reserves are located onshore and especially in the Middle East.

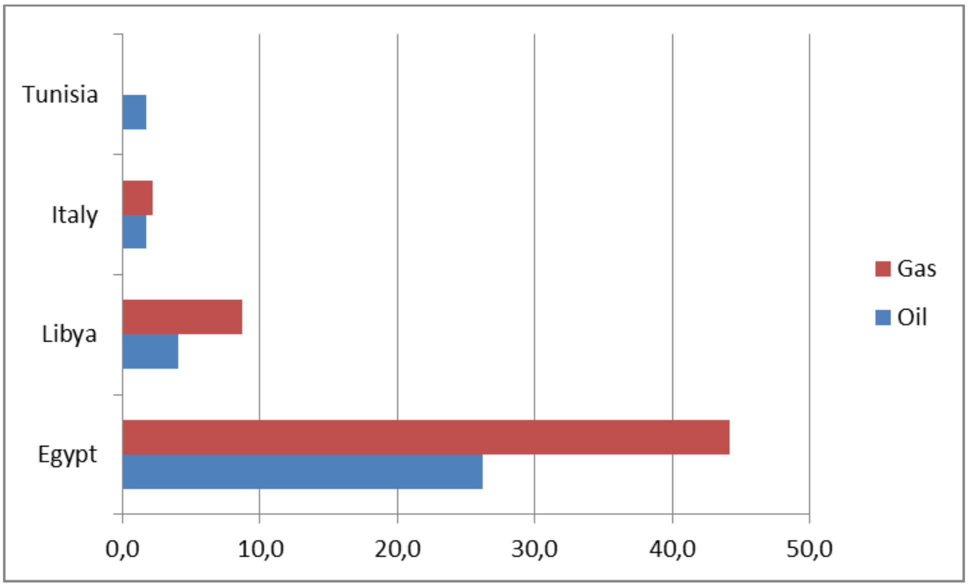
In the Mediterranean, about 14% of oil production and 35% of gas production comes from offshore operations. The offshore production is concentrated in the waters of the Tunisia, Italy in the Adriatic, Libya and Egypt, as shown in Figure 21. In the Mediterranean, Egypt is the largest producer of oil and gas offshore, with 80% of gas production and oil production in the region. Tunisia produces mostly oil with 5% of offshore oil production of the region.

Figure 20. Oil reserves in the world, by region.



Source: BGR (2010)

Figure 21. Current Oil and gas production offshore in the Mediterranean, 2010, Mtoe / year.



Sources: BP (2011); The Petroleum Economist (2004) and author estimate for the offshore share

d) Future trends 2020

With the current level of production, the reserve life of Mediterranean oil is thirty years and those gas fifty years. New exploration operations or production of oil and gas are under study or currently in process on the coasts of Spain, Croatia, Egypt, Israel, Lebanon, Libya, Tunisia, Turkey and in the Maltese and Cypriot waters. Algeria is preparing to expand its exploration program to offshore areas in 2011.

Recent discoveries of large gas fields in the waters of Egypt, Israel and Lebanon or the oil discoveries in the waters of Libya strengthen the some experts' predictions of an increase in oil drilling and gas in the coming years, mainly in the eastern part of the Mediterranean (Court, 2011).

In addition, the Mediterranean is a deep sea; the development of deep offshore operation over 500m depth is a factor favouring the exploitation of oil and gas in the Mediterranean. These are major technological advances in the field of seismic and subsea facilities and an increase in crude oil prices that make profitable investments, even at great depths.

e) Sector and socio-economic analysis by subregions

Western Mediterranean Sea

This area includes parts of the coasts and waters of Spain, France, Italia, Tunisia, Algeria and Morocco.

Algeria is currently the largest producer in the Mediterranean for oil and gas, production being currently only onshore. Algeria's offshore, where recent seismic surveys have been conducted, is considered a promising deep water frontier. To date, however, there are only a few exploration wells drilled and only one in deep water. State-owned company plans to start drilling offshore in 2011-2012. (OME, 2011)

Regarding the north part of the basin, exploration surveys have been conducted offshore the Catalonia shelf of Spain and in the recent French EEZ (formerly EPZ) in a large ultra-deep area (2600 m) south of the Provencal coasts. There is no regular production.

Sector analysis

Open sea

- Production tonnage in oil and gas : 0
- Number of installations: 0

Economic analysis

Open sea

- Value: 0€
- Turnover: 0€

Social analysis

Open sea

- Current permanent employment for the open sea operation is probably nil.

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.

- Situation could be different in Algeria where production could be triggered by good results of the on-going explorations, high energy price and policies effectively favourable to foreign investments.

Adriatic Sea

This area includes parts of the coasts and waters of Italia, Croatia, Bosnia-Herzegovina, Montenegro and Albania.

The Italian west coast of Adriatic Sea is subject to permanent production activities. Approximately hundred platforms at sea, which extract mainly gas, are distributed along the Northern and Central Adriatic coast, on depth between 10 to 120m.

Sector analysis

Open sea

- Production figures in oil and gas: 0
- Number of installations: 0

Economic analysis

Open sea

- Yearly production value: 0

Social analysis

Open sea

- Employment: 0

Projections

The Adriatic offshore fields are mature, especially for gas, and will be declining in the coming years. In an optimistic scenario, the Italian RIE (2012) foresees a marginal increase of 0.75TEP year for 2020 (+ 10%) if a large revamping program for the offshore platforms is rapidly implemented. These developments are mostly concerning the coastal areas.

Aegean-Levantine Sea

This area includes parts of the coasts and waters of Greece, Turkey, Cyprus, Syria, Lebanon, Israel, Palestinian territories, Egypt and Libya and.

Production concerns mainly Egypt in coastal waters (<200m), but the area is promising offshore Egypt and all along the Levantine coast in open waters. More natural gas reserve could be located off the South East Mediterranean Shore. In 2009-2010 the world's largest deep water gas discoveries of the last decade have been identified in this area with the fields de Tamar and Leviathan situated offshore Israel in depths around 1500_1700m (OME, 2011)

In Egypt, natural reserves are on the rise and untested areas are still to be explored. A recent assessment identifies potentially extractable resources in the Nile Margin Reservoir, onshore and near-shore, and in the Nile Cone, in deep water (OME, 2011).

Sector analysis

Open sea

- Production figures in oil and gas: nil or marginal
- Number of permanent installations: nil or marginal

Economic analysis

Open sea

- Yearly production value: nil or marginal

Social analysis

Open sea

- Employment: nil or marginal

Projections

Current production and large promising reserves, mainly gas, are situated offshore the south and east of the region, not far from large consumption area. The outlook is for a robust growth in gas production, coming from Egypt and Israel, who will become gas exporter. Development of these fields will mainly depend on the political stability of the region.

Ionian Sea and the Central Mediterranean Sea

This area includes parts of the coasts and waters of Italy (Sicily), Albania, Greece, Libya Tunisia and Malta.

Current offshore production mainly concerns Libya and Tunisia. Libya has the largest proven oil reserves in the Mediterranean region and some observers think that the reserve may be higher based on potential in both onshore and offshore sedimentary basins, of which large parts remains poorly explored. The offshore eastern Tripolitan Basin is mentioned in the list of the areas recognized to have exceptional potential for major undiscovered petroleum resources. (OME, 2011).

Unlike its prolific oil producing neighbour, Algeria, Tunisia's upstream oil industry is modest. Offshore fields are located in the Gulf of Gabes.

It should be noted that Malta is a known flag state for mobile offshore fleet.

Sector analysis

Open sea

- Production figures in oil and gas: nil or marginal
- Number of permanent installations: nil or marginal

Economic analysis

Open sea

- Yearly production value: nil or marginal

Social analysis

Open sea

- Employment: nil or marginal

Projections

It is assumed that the Libyan oil production will reach the pre-crisis level by late 2013 and its contribution to the Mediterranean oil production will increase strongly by 2030, barely offsetting the decline in all other Mediterranean countries. Its gas production will also increase during this period. The Libyan oil and gas reserves concern both onshore and offshore fields. However the offshore part in these future productions is still unknown.

Tunisian offshore production will be progressively depleting.

4.4.3 Sector and socioeconomic analysis for the Black Sea

a) Production

Shows of oil and gas have been observed on the shores of the Black Sea since antiquity, with the first commercial production beginning in the 1850's in Romania. Since then, Romania witnessed two peaks of oil production, one of gas, and is now a net importer of both. Ukraine, once a net gas exporter is now heavily dependent on imports from Russia. Other countries, believed to be poorly endowed with petroleum, also went through boom and bust cycles of their own – Georgia during the 1980's, Bulgaria during the 1970's, and Moldova as well – but production there was and remains marginal. (Nitzov, 2010)

While all of the littoral countries around the Black Sea except Russia are today net oil and gas importers, the case of Ukraine stands out. Its proven oil reserves are small, only 0.4 billion barrels at the end of 2007, smaller than those of Romania (0.5 billion barrels) and about the same as Turkey (0.3 billion barrels). However, Ukraine boasts about a trillion cubic meters of gas reserves, a resource base that would generally be adequate enough to make the country self-sufficient in natural gas, since the reserves are equivalent to some 15 years of consumption at current levels. However, Ukraine imports up to two-thirds of the consumable gas at prices that it can hardly afford. (Nitzov, 2010)

b) 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 the general 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. In 2009, Turkey's state-owned petroleum company, TPAO, and Brazil's Petrobras signed an agreement for the exploration of oil in the Black Sea. The estimated oil reserves that could be discovered by the exploration program at 10 billion barrels or more, which may be sufficient to support all of Turkey's oil demand. Similar opportunities may exist offshore of Georgia, Ukraine, and Bulgaria. (Nitzov, 2010)

c) Sector and socio-economic analysis by subregions

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 shelves 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. However a large exploration program has been recently launched by the Turkey's state-owned petroleum company.

<u>Sector analysis</u>

Open sea

- For now, these exploration programs are focussed on the Coastal areas (< 200m depth)

<u>Economic analysis</u>

Open sea

- Nowadays, value for the open sea is probably marginal or nil.

<u>Projections</u>

There is evidence of large oil and mostly gas reserves in the shelves of the Black Sea. However the development of the production will greatly depends on the world energy market and of the regional political context. Production will be boosted by cheaper and safer conditions than elsewhere.

4.4.4 Links to environmental pressures

a) 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.

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

b) Policy context evolution

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 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].

More recently, 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.

c) Main pressures caused in the marine environment 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: <u>Contamination by hazardous substance</u>, 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: <u>systematic introduction of solid and liquid wastes</u>, specially produced waters, with a local impact
- <u>Physical disturbance of marine life due to noise,</u> especially during the seismic surveys required by the exploration phase.

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

- Biological disturbance due to potential introduction of introduction of non-indigenous species and translocation caused by associated shipping operations.

4.4.5 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 500€ to 2 000 € for a country report or a regional map). Free reports generally concern largely outdated studies. Moreover offshore activities are usually not set apart from the onshore one, as they produce the same commodities. 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 needed in view to provide orders of magnitude and some general perspectives.

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 Mediterranean and Black sea is nowadays in the coastal area. However projections show that these activities will be developed in open sea in the next decades.

Table 32. Inventory of the various data used for each assessment and assumptions made in case of extrapolation or value transfer.

Theme	Indicators:	Sources	Assumptions	Comments
Segregation offshore / onshore	Production from offshore oil / gas	The Petroleum Economist Ltd.., 2004, World Energy Atlas 2004, Schlumberger	This source provides a map of the onshore and offshore oil and gas wells. For a given country, it is possible to calculate the ratio offshore wells on total wells. This ratio is a proxy to calculate the offshore fraction.	2004 World Energy Atlas is outdated. Assumption is not necessarily valid and provides only an order of magnitude. This ratio has been used for all countries excepted for Italy, for which a ratio given by (Trabucco, 2012 – quoting ENI) has been used.
Economic data	Turnover	BP, 2011, BP Statistical Review of World Energy June 2011; German Federal Office of Economics and Export Control (BAFA).	Production (and sale) of oil and gas is averaged throughout the year.	To calculate the turnover, we used data on the annual production of oil and gas and we have multiplied with the respective average annual price in U.S. $. Then, this figure has been converted into € using annual average exchange rate.
Economic data	Value	D. Pugh, 2008	The ratio of value added / turnover is the same as the one in UK and in all Mediterranean countries.	The value added was calculated using an estimated value factor was applied to the turnover. This rate was estimated by D. Pugh for oil and gas activities in the UK.
Social Data	Employment	Oil & Gas UK, 2011, BP, 2011;	The ratio jobs / total output of oil and gas (toe) is the same in the Mediterranean and in the UK.	The combination of data from BP and Oil & Gas UK has been used to calculate the ratio jobs / Mtoe in 2010.This rate has been reported on the Mediterranean production to assess employments.

5 CONCLUSIONS

The objective of this first deliverable of the Task 1.2 (Analysis of socio economic activities in open sea) is to assess in socioeconomic terms the environmental impact of human activities using the open sea, at sub regional levels in the SES. This assessment complements the analysis carried out by natural scientists in T1.1 (Analysis of pressures and processes and their impact on the ecosystems).

Following the DPSIR model, it provides an overview of the socio economic drivers (D) exerting pressures (P) on the open sea ecosystems whose knowledge is required to prepare the responses (R) aiming to reduce the impacts (I) to an acceptable level. More specifically, this work is in coherence with the economic and social analysis to be carried out in the MFSD Initial assessment. This preliminary and basin wide economic and social analysis will be followed by the D1.4 which will focus on the four Pilot cases of the WP6 (Adaptive policies and scenarios). These assessments will be part of the contextual background needed for the preparation of future programme of measures and policies aiming to achieve or maintain the Good Environmental Status at Pilot Cases and Basin levels.

A similar work has been made in the framework of the WP2 for the Task 2.2, focused on the coastal areas instead of the open water, here defined as waters including the seabed and subsoil beyond 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 that PERSEUS is a research project, which allows to explore innovative ways, and to take some freedom with the operative logic. Regarding innovation, the economic and social assessment of the use of the Mediterranean or Black sea waters at basin scale has never been attempted to date. Distinction between coastal areas and open waters has made this first attempt more challenging.

The analysis has been focused on the following main sectors: Fisheries, Maritime transport, Submarine cable and pipeline operations and Marine hydrocarbon (oil and gas) extraction.

- 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)
- 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 pipe lines 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 are nowadays rather installed in coastal seas whereas electrical and mostly 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.

For all these sectors a consistent, economic and social analysis of the use of waters has been performed. 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 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.

This preliminary and basin wide economic and social analysis will be followed by the D1.4 which will focus on the four Pilot cases of the WP6 (Adaptive policies and scenarios). These assessments will be part of the contextual background needed for the preparation of future programme of measures and policies aiming to achieve or maintain the Good Environmental Status at Pilot Cases and Basin levels.

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