CO-EVOLVE

Promoting the co-evolution of human activities and natural systems for the development of sustainable coastal and maritime tourism

Deliverable 3.6.1

State of the Art

Activity 3.6

Threats to co-evolution in touristic areas - Mediterranean scale: Land-Sea uses and land-sea interactions

WP3

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1. Introduction and scope of work

The Mediterranean Sea and its coast has long been the focal point of interactions between different and often conflicting socio-economic activities. The coexistence of activities provides a ground for synergies' development but also creates a conflict grid which poses pressures to the hosting regions. The cumulative impacts from socio-economic activities and the constant competition over the allocation of natural resources have led to severe alterations in the balance of the Mediterranean coastal and marine ecosystems.

As highlighted by Hall (2001) "of all the activities that take place in coastal zones and the near-shore coastal ocean, none is increasing in both volume and diversity more than coastal tourism and recreation". The impacts of coastal tourism on the physical environment and the sustainability of the sector itself have been thoroughly explored in international research. However, little consideration has been given on the combined effects from the simultaneous development of different economic activities and their cumulative impacts on the Mediterranean coastal environment. In addition to new emerging demands on coastal and marine resources such as renewable energy and aquaculture, there is growing concern in the interactions between different economic activities and the chain reactions they may generate, thus altering the balance of the entire Mediterranean ecosystem (Kelly et al, 2014. MITOMED Project, 2015).

The target of the report is to identify major economic activities and their impacts in Mediterranean coastal tourism destinations in the context of ICZM/MSP. The results will later serve as a starting point for assessing the cumulative effect of different economic activities in Mediterranean coastal areas and will, eventually, form the basis for a comparative evaluation of land sea interactions at Mediterranean level.

2. Identification of coastal and maritime activities and their impacts on coastal ecosystems

2.1 Coastal and maritime tourism

Being the main tourist region in the world, the Mediterranean basin attracts more than 30% of the international tourist arrivals. The average annual rate of increase in foreign tourist arrivals exceeded 3,3% between 1981 and 1994, with tourist arrivals increasing from 110 million to 169 million. In the same period, the average rate of income from international tourism in the area was rapidly increasing and reaching up to 18,50% (Petric, 1997· Satta, 2004). In 2012 nearly 300 million international tourists visited the region, representing 30% of total world tourists and contributing more than 11% of Gross Domestic Product in Mediterranean countries (especially for Malta, Cyprus and Croatia). Briefly, almost one third of the world's international tourism is concentrated in the Mediterranean region, especially during summer months (Piante and Ody, 2015).

Approximately half of these arrivals are located in coastal areas, with coastal tourism representing the largest sea-related economic activity in the Mediterranean. Southern EU countries such as Spain, France and Italy have the leading role in the distribution of international arrivals in the Mediterranean region with total market share over 60% in tourits' arrivals, followed by rapid growth rates in Southern and Eastern Mediterranean countries (Satta, 2004· Piante and Ody, 2015).

Despite the declining competitiveness of several tourism destinations, differentiation in tourism needs, environmental and cultural preservation as well as climate change impacts in the region, UNEP/MAP (2012) still forecasts positive trends in coastal tourism flows for the next years throughout the Mediterranean basin reaching up to 500 million of international tourist arrivals, especially in Croatia, Greece and Morocco (average annual rate up to 2,6% until 2030). Future trends regarding nights spent at tourist accommodation in EU Mediterranean countries are estimated based on 2013 rates[1] –regarding the distribution of nights spent and growth rates of international tourists arrivals in the Mediterranean Sea region – and may lead to misleading forecasts in certain countries such as Greece and Croatia (Figure 1) (Piante and Ody, 2015).

[1] Future estimates are based on the assumptions of a constant share in the distribution of nights between countries (equal to the share observed in 2013) and a growth rate equal to that estimated for the arrivals of international tourists in the Mediterranean Sea region (Piante and Ody, 2015).

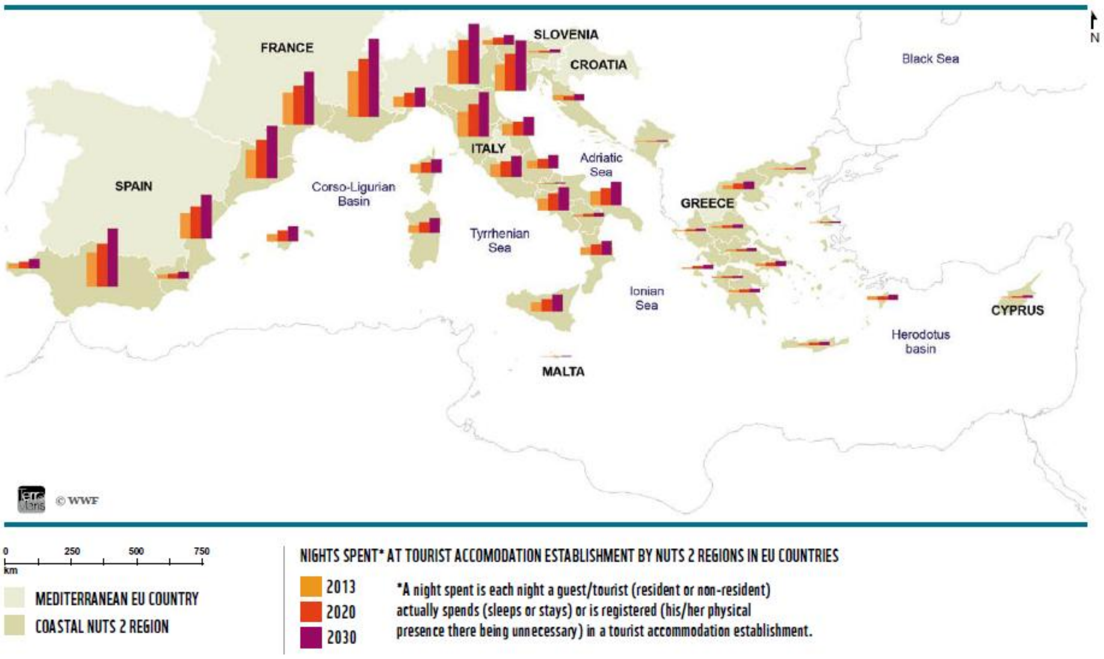

Figure 1: Past and future trends of nights spent at tourist accommodation in EU Mediterranean countries (2013, 2020 and 2030)
Source: Piante and Ody, 2015

Significant growth rates are also recorded in maritime tourism activities in the Mediterranean basin, especially in cruising and recreational boating. The Mediterranean Sea is among the most important cruise and yachting destinations in the world and also a rapidly emerging destination for recreational boating (Piante and Ody, 2015).

In 2011, the share of the Mediterranean Sea as a global destination for cruise tourism grew from 17.6% in 2008 to 21.7% while growth rates in the sector kept an upward trend for the last decade. Approximately 75% of cruise ports in the Mediterranean are located in Italy, Spain, France, Greece, Croatia and Slovenia and 9% in Turkey and Cyprus (Figure 2) (Piante and Ody, 2015). In this context and considering the level of flows in the Mediterranean, the main ports related to cruising activities are Barcelona and Palma de Mallorca (Spain), Napoli, Livorno and Civitavecchia (Italy), Piraeus (Greece) and Malta (Figure 3) (ESPON, 2013).

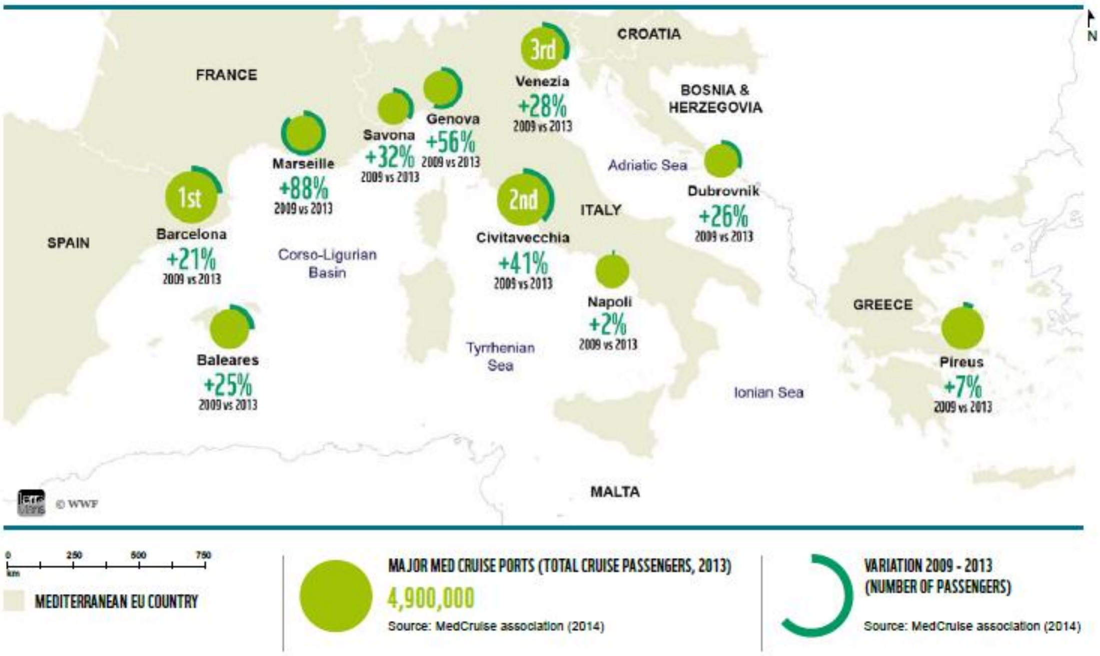

Figure 2: Growth of Med Cruise ports in number of passengers between 2009 and 2013
Source: Piante and Ody, 2015

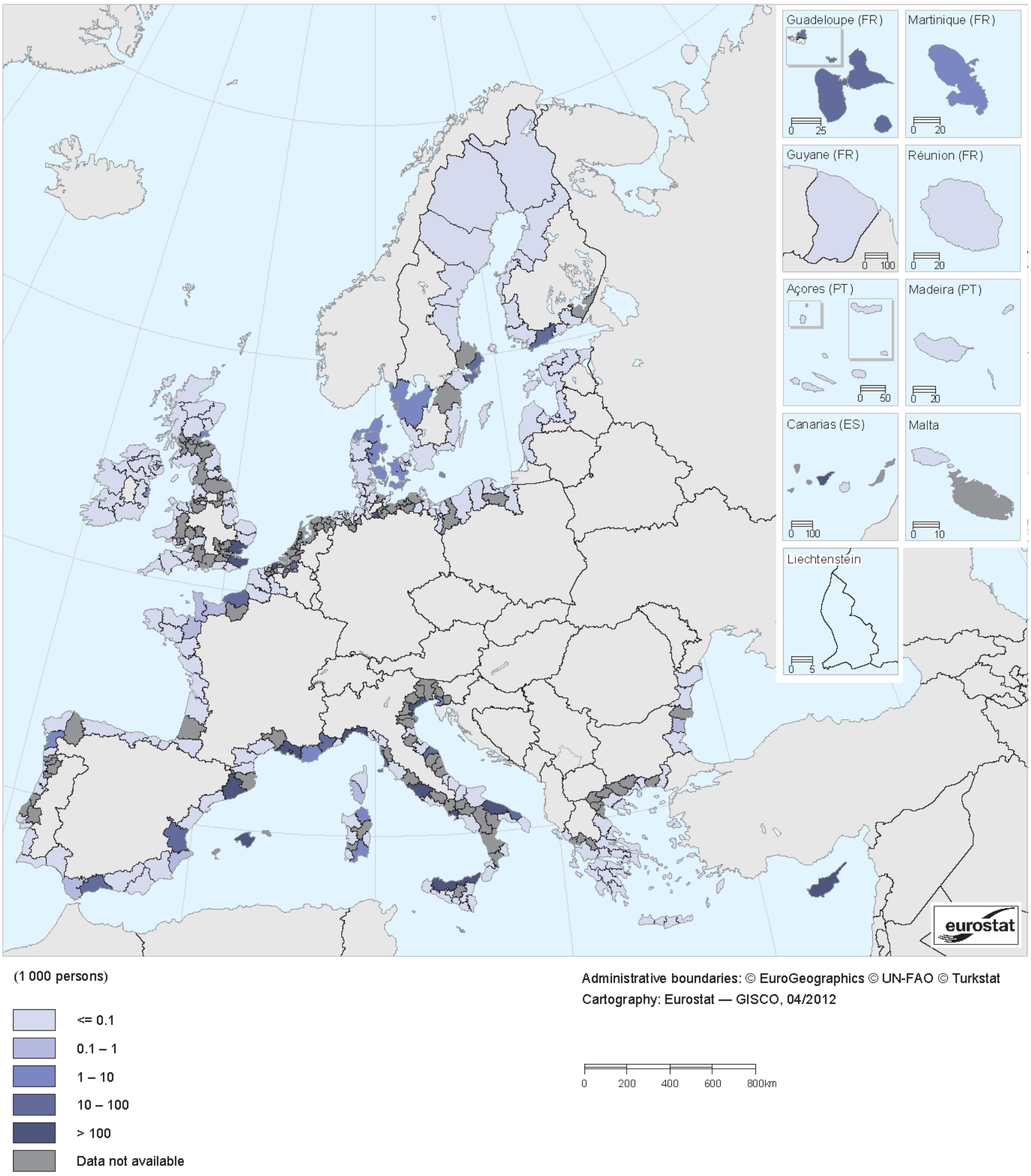

Figure 3: Cruise passengers in EU coastal regions by NUTS3 units in 2010 (1000 persons)
Source: Ec.europa.eu. (2017)

Recreational boating is also an important and rapidly growing economic activity in the Mediterranean basin, especially for France and Greece. There is a growing demand for spatial expansion of marinas and recreational ports in the Mediterranean coast, which is, however, restricted by the enforcement of environmental protection legislation. Over 900 marinas were identified in the Mediterranean coast in 2010 with most of them being located in Italy, Spain and France, while several new marina projects were identified in Greece, Spain, Malta and Italy in 2015 (Piante and Ody, 2015)

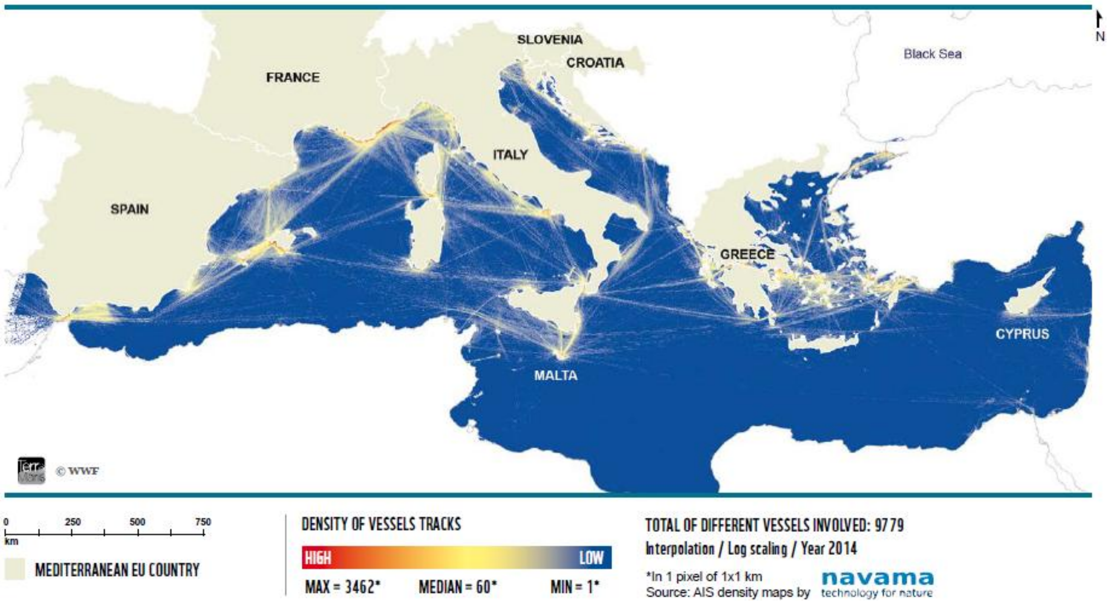

Figure 4: Density of Automatic Identification System (AIS) signals from EU pleasure crafts in 2014
Source: Piante and Ody, 2015

Impacts of coastal and maritime tourism

Mediterranean region is considered among the world's top tourism vulnerability hotspots regarding the pressures generated by the tourism sector on the environmental status of the area. Tourism impacts are not spread uniformly since they are highly concentrated in both space and time along the coastal zone. The increasing littoralization of coastal areas, including infrastructures, marinas and hotels, is a direct impact of tourism development in the Mediterranean. The loss of biodiversity (in both species and habitats), deterioration of water quality and physical alteration of coastlines and landscapes are only some of the various impacts of tourism development that threaten the environmental assets in the Mediterranean basin (Satta, 2004· Piante and Ody, 2015· Med-IAMER Project, 2015).

Among the major pressures identified in the area is the physical damage caused to the seafloor by beach nourishment, significantly altering marine water quality and disturbing benthic communities. Moreover, pollution generated from marine litter (wastewater and solid waste) has great implications for water quality in coastal areas, endangering both the environment and human health (Med-IAMER Project, 2015).

The density of tourist accommodation (bed places per km^2) (Figure 5) in Mediterranean coastal areas is indicative of the pressures exerted on the environment by tourism sector, with major hotspots located in France, Spain and Italy.

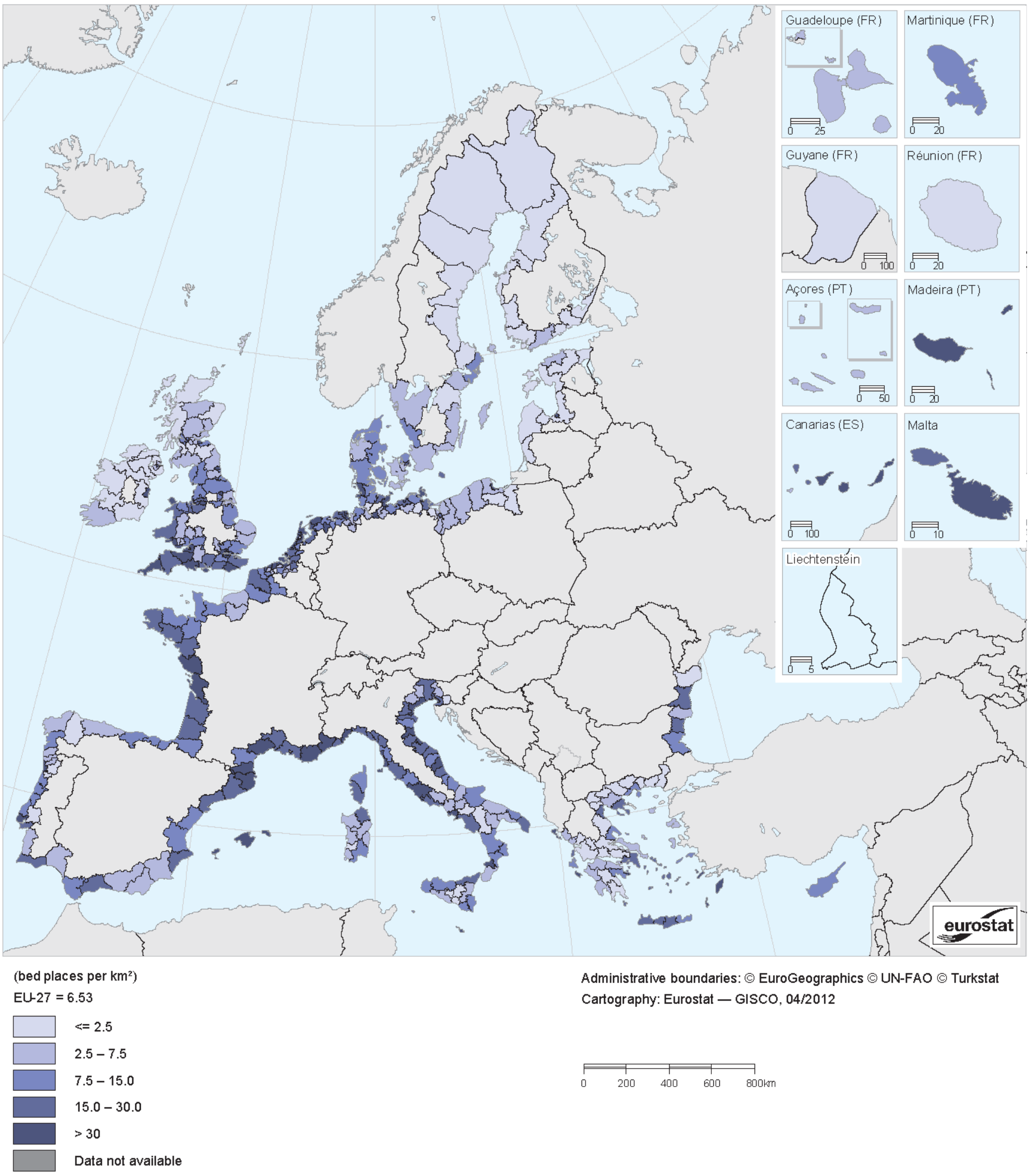

Figure 5: Density of tourist accommodation in hotels, campsites and other tourist accommodation in EU coastal regions by NUTS3 units in 2010 (bed places per km^2)
Source: Ec.europa.eu. (2017)

Cruise emissions include a wide range of organic and inorganic wastes in gaseous, liquid and solid form that entail different levels of risks to the environment (air emissions, wastewater, noise etc) (Caric and Mackelworth, 2014). An issue of major environmental importance related to the pressures exerted by cruising and recreational boating is the introduction of non-indigenous species to Mediterranean ecosystems. Major hotspots have been identified along the whole Mediterranean coast but mostly in Italy, Greece and Cyprus as well as in non EU countries such as Turkey, Israel, Lebanon and Egypt (Figure 6) (UNEP/MAP, 2012).

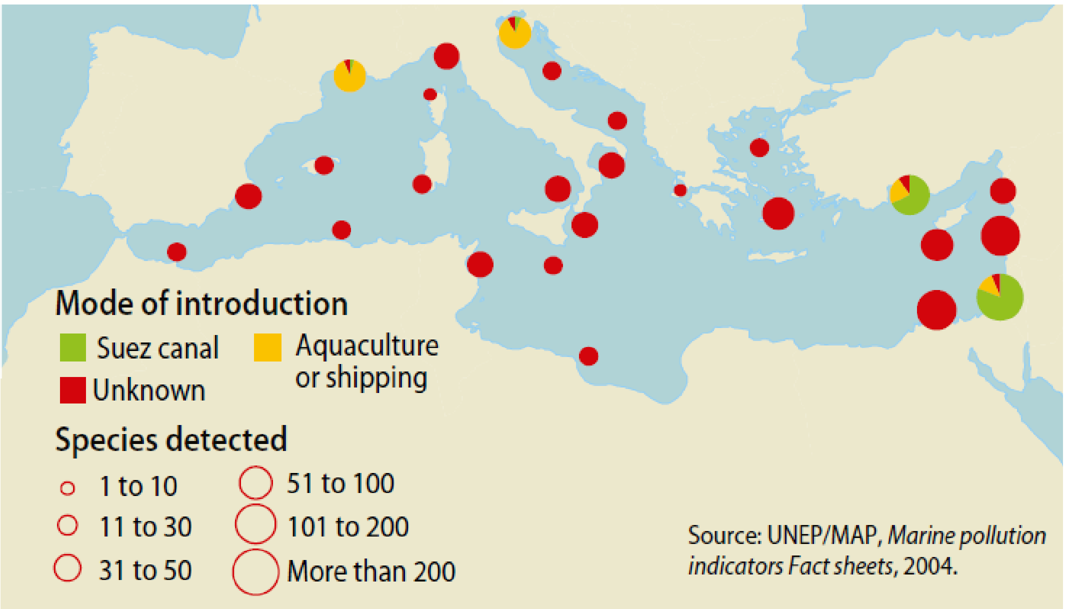

Figure 6: Number and mode of introduction of non-indigenous species in Mediterranean basin
Source: UNEP/MAP, 2012

The number of marinas and the mean distance among them is another important indicator regarding the artificialization of the coastal zone and the possible loss of natural habitats. In Italy, Spain and France the number of marinas exceeds the total of 120 and the mean distance between them is below 30 km (Table 1) (Piante and Ody, 2015).

Table 1: Number of marinas and mean distance between them

	Number of marinas	Distance (km)
Italy	253	29
Spain	191	14
Greece	135	111
France	124	14
Croatia	81	72
Turkey	37	140
Tunisia	29	45
Algeria	24	50
Libya	15	118
Albania	11	38
Morocco	9	57
Israel	8	22
Egypt	6	159
Malta	6	30
Cyprus	3	261
Lebanon	3	75
Syria	3	61
Slovenia	3	16
Montenegro	2	147

Source: Piante and Ody, 2015

2.2 Fisheries and Aquaculture

Fishing and aquaculture in the Mediterranean fall under the jurisdiction of the General Fisheries Commission for the Mediterranean (GFCM). Although professional fisheries represent an important source of income and employment in coastal regions (annual GVA exceeds 2 billion Euros), Mediterranean fisheries have been declining over the past years because of the overexploitation of fish stocks, environmental degradation and intense development of other coastal socio-economic activities (UNEP/MAP-Plan Bleu, 2009· Piante and Ody, 2015).

Mediterranean professional fisheries are mainly located in the continental plateau up to 200m isobaths outside the four Fisheries Restricted Areas and the deep sea trawling ban area (see Figure 7). The density of AIS signals identifies more precisely the fishing areas, although small-scale vessels are not taken into account due to lack of respective data (see Figure 8) (UNEP/MAP-Plan Bleu, 2009· Piante and Ody, 2015).

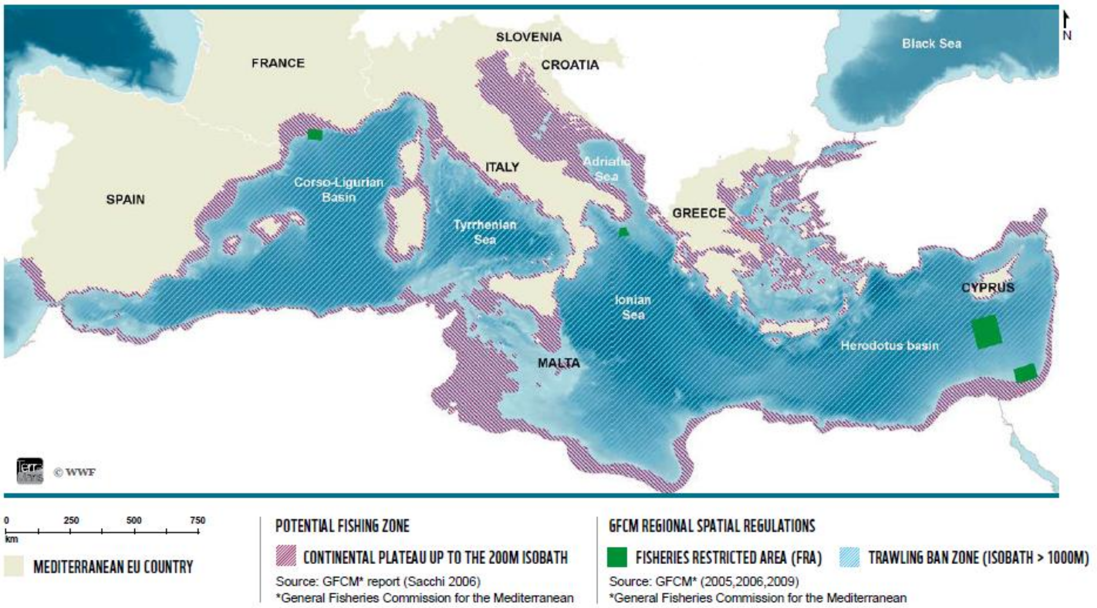

Figure 7: Major fishing areas (continental plateau up to the 200m isobaths), deep-sea trawling ban area under 1000m and Fisheries Restricted Areas in the Mediterranean Sea
Source: Piante and Ody, 2015

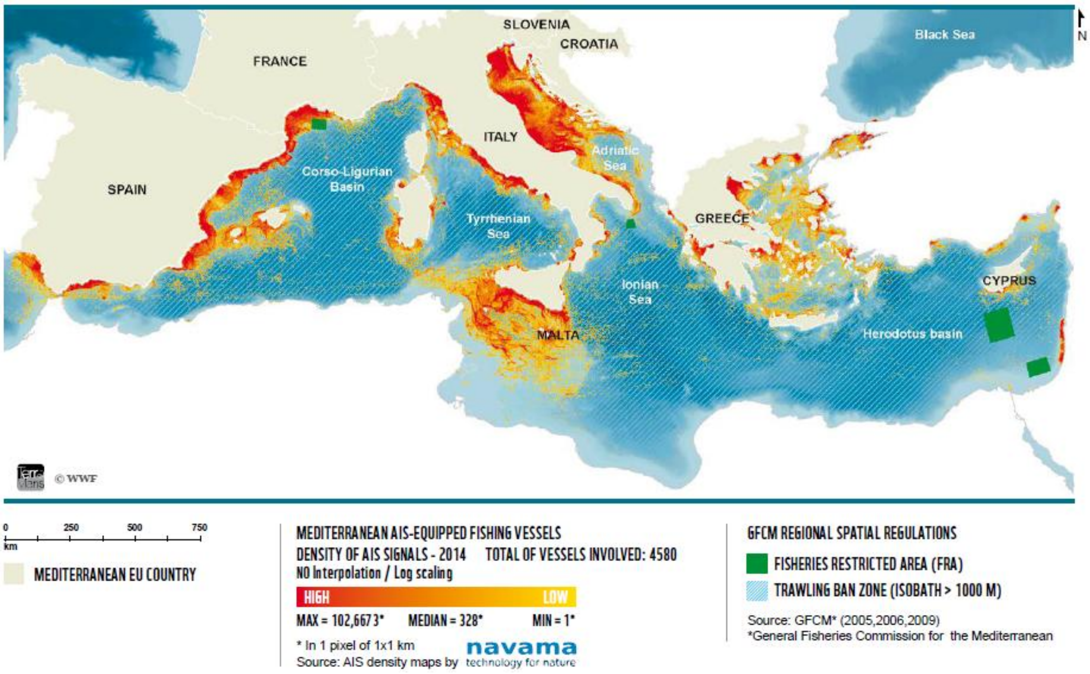

Figure 8: Density of Automatic Identification System (AIS) signals from Mediterranean AIS-equipped fishing vessels
Source: Piante and Ody, 2015

Regarding the distribution of fishing vessels, half of the fishing fleet operating in the Mediterranean Sea comes from EU countries with Greece and Italy accounting for more than one third of the total operating vessels. Only Greece accounts for more than 20% of the total number of fishing vessels in the Mediterranean Sea, most of them operating in the Aegean Sea (Piante and Ody, 2015).

Despite the adopted reformed EU Common Fisheries Policy (CFP) in 2014 that sets new limitations and governance processes in order to maintain fish stocks and manage the capacity of the EU fishing fleet, the total number of vessels may increase in the near future as a result of the Southern Mediterranean countries' development in the sector (UNEP/MAP-Plan Bleu, 2009. Piante and Ody, 2015).

In parallel to the continuous decline of natural fish stocks, the aquaculture sector maintains its upward trend in the Mediterranean area during the past decades and addresses the increasing demand for fish products. Moreover, it provides more than 120.000 direct jobs and represents a total production value of 2.5 billion euros in the area. In the EU Mediterranean countries the growth of the sector is likely to exceed 100% in production and value by 2030, with the use of environmentally friendly techniques (Piante and Ody, 2015).

In terms of aquaculture production, six countries - Egypt, Greece, Italy, Spain, France and Turkey - account for the 95% of the total production (both freshwater and marine aquaculture) in the Mediterranean region (see Figure 9). Approximately 58% of production comes from the western European countries, although Greece is the leading marine offshore fish farming producer with over 120 000 tonnes of bass and bream annually (UNEP/MAP-Plan Bleu, 2009). The greatest concentration of aquaculture farms as well as the highest production numbers (tons/year) is identified in the Aegean-Levantine Sea. (UNEP/MAP, 2012· Piante and Ody, 2015).

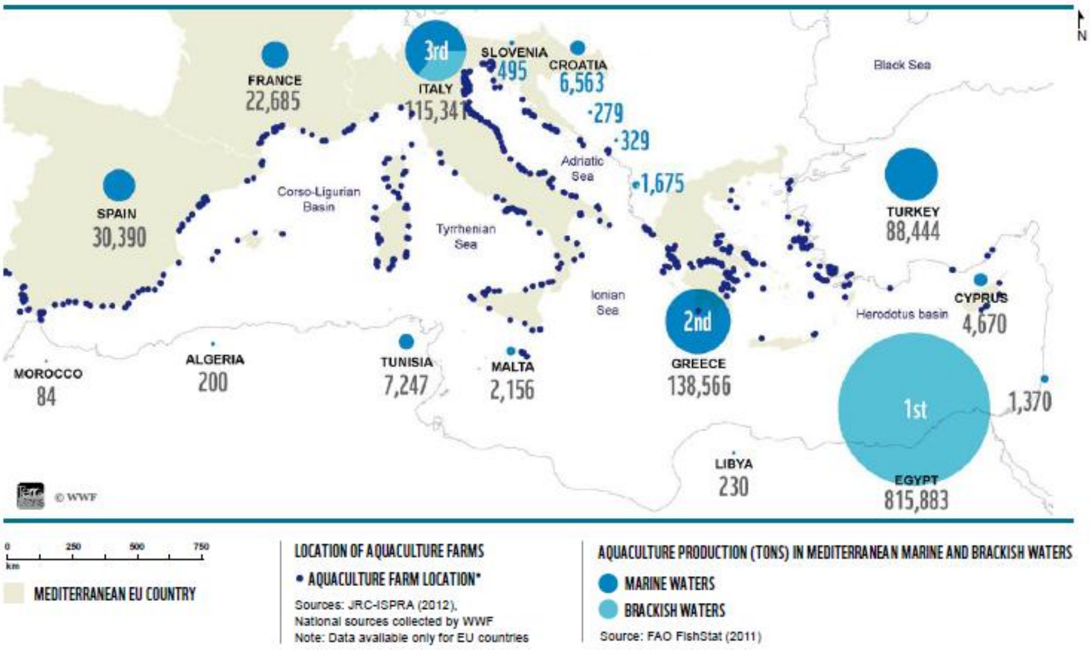

Figure 9: Aquaculture fish farms and total production (tons/year) in the Mediterranean region
Source: Piante and Ody, 2015

As it has already been stressed out, aquaculture production in the EU Mediterranean countries is expected to grow over 100% by 2030, exceeding 600.000 tons. The sector has been recognized as one of the five priority sectors in EU's Blue Growth Agenda. Almost all leading countries in the sector, besides Greece, have stabilized their production because of geographic and environmental constraints and competition with other coastal activities. The development and implementation of new environmentally friendly techniques in aquaculture production systems is expected to provide new opportunities for further development of the sector (Piante and Ody, 2015). Certain countries have already taken steps towards improving production methods and reducing environmental impacts by introducing impact assessment procedures prior to authorizing the installation of aquaculture structures or by upgrading technical specifications of existing structures (UNEP.MAP, 2009)

Impacts of fisheries and aquaculture production

Overfishing and especially bottom trawling and longlining are regarded among the major factors for reducing biodiversity in the Mediterranean basin. Alterations in seabed habitats from bottom fishing trawlers lead to overall reduction in the complexity of the seafloor structure. Italy, Greece and Spain are in primary positions when taking into account the density of bottom trawlers in EU Mediterranean countries (Figure 11). Marine food webs are irreversibly affected by fisheries pressures that lead to increased jellyfish numbers and reduction in large predator species. Marine litter and underwater noise also pose major pressures on species and habitats (UNEP/MAP 2012. Piante and Ody, 2015. Med-IAMER Project, 2015).

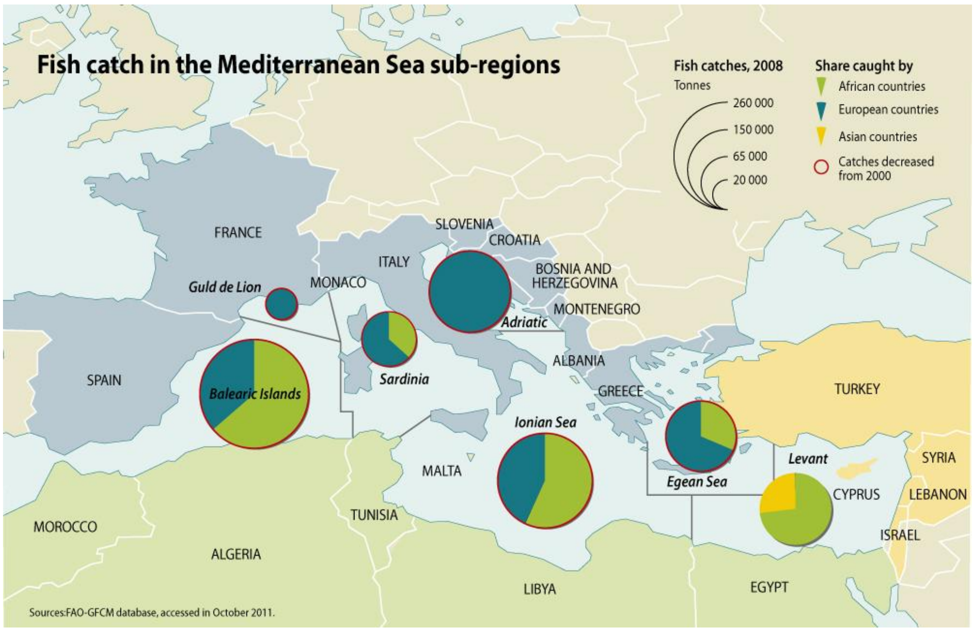

Figure 10: Fish catch shares in the Mediterranean sub-regions
Source: UNEP/MAP, 2012

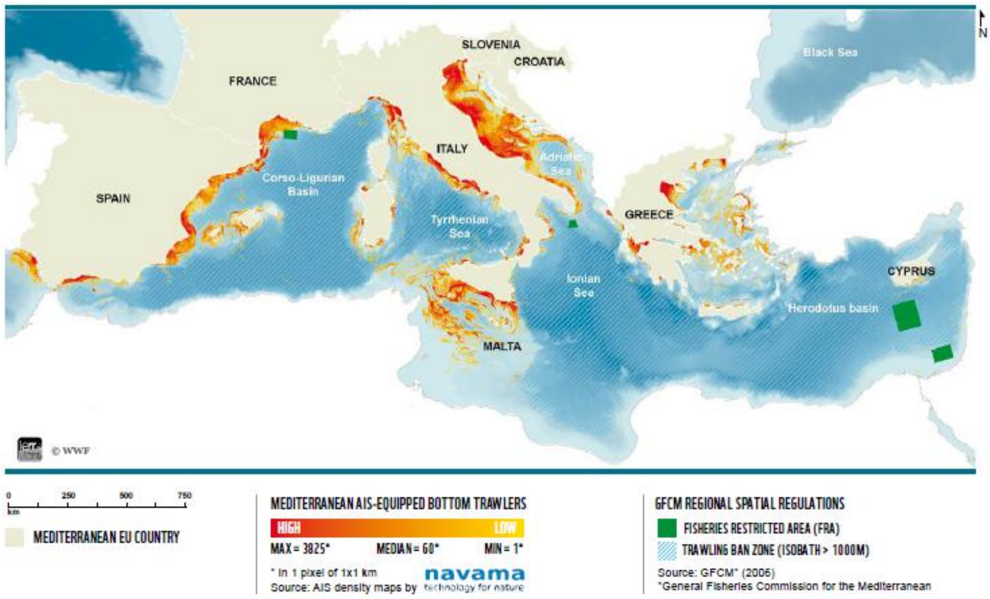

Figure 11: Density of Automatic Identification System (AIS) signals from Mediterranean AIS-equipped trawlers
Source: Piante and Ody, 2015

Biological interactions are the main environmental concern regarding aquaculture production impacts. The release of farmed organisms and the introduction of non-indigenous species from aquaculture facilities may lead to important environmental degradation and alterations (UNEP/MAP, 2012· Piante and Ody, 2015). Major hotspots with acknowledged introduction of non-indigenous species by aquaculture are mostly in Italy, Greece and Turkey (Figure 12).Other environmental implications from the aquaculture industry are mostly caused by improperly treated discharges into the ecosystems. More specifically, the discharge of chemicals used in fish farms as well as the discharge of organic matter and nutrients through fecal material and uneaten food may lead to hypoxic conditions and eutrophication, especially in areas with poor water circulation (Med-IAMER Project, 2015).

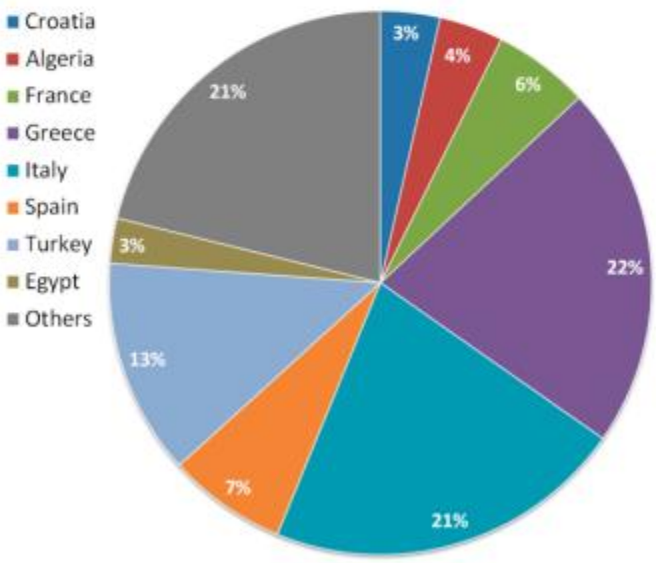

Figure 12: % of Alien Species introduced through aquaculture activities in the Mediterranean coast
Source: Med-IAMER Project, 2015

2.3 Energy extraction and exploration

The number of offshore oil and gas operations in the Mediterranean Sea region has been steadily increasing in the past years. Although a small producer in relation to world production, Mediterranean oil reserves represent 4,6% of world oil reserves. EU Mediterranean countries maintain a low share in oil and gas production (mainly Italy and to a lesser extent Spain, Croatia and Greece – Figure 13) compared to the rest of the region, where more than 90% of the reserves are held by Libya, Algeria and Egypt. However, EU Mediterranean countries play an important role in linking African supply to European demand, through the operation of several gas pipelines in the Mediterranean Sea (Piante and Ody, 2015).

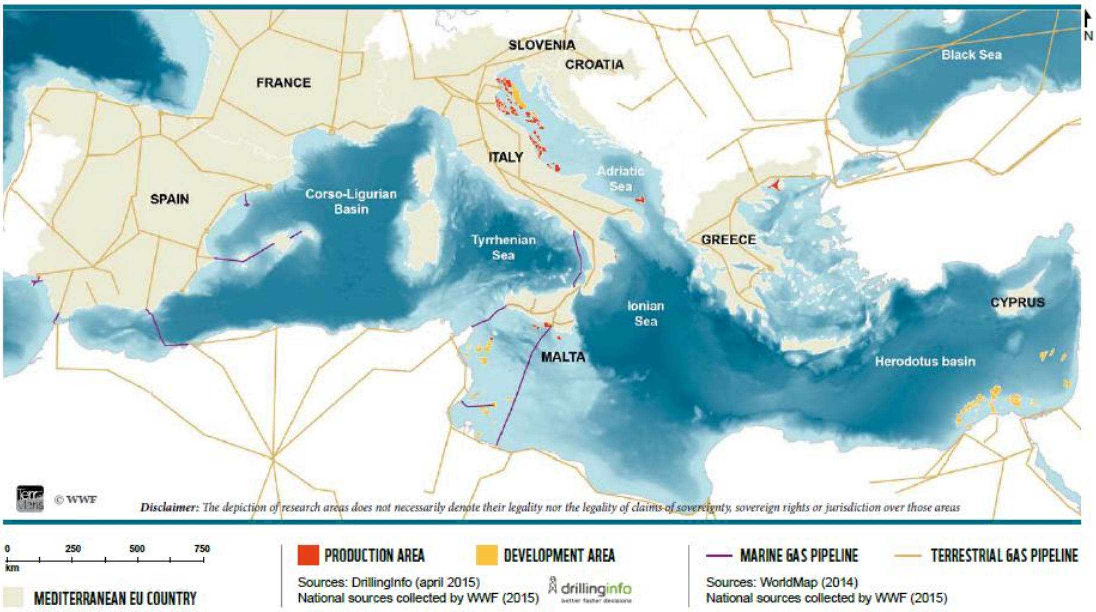

Figure 13: Offshore oil and gas production contracts, and natural gas pipelines
Source: Piante and Ody, 2015

Although European gas and oil production is not expected to grow in the next years as in other regions, hydrocarbon exploration projects and associated drilling activities keep spreading all around the Mediterranean. Whereas current production covers just about 1% of the Mediterranean area, exploration contracts cover 23% of its surface in addition to the 21% of open and bid blocks areas set by the government for potential offshore oil and gas development (Figure 14) (Piante and Ody, 2015). Among the most promising exploration regions are four sites in Greece (north-west Peloponnesus, Ioannina, Aitoloakrnania and the Gulf of Patraikos) and three in Italy (Val d' Agri in the southern region of Basilicata, Abruzzo and in the lower Adriatic Sea of Brindisi) (UNEP/MAP, 2012).

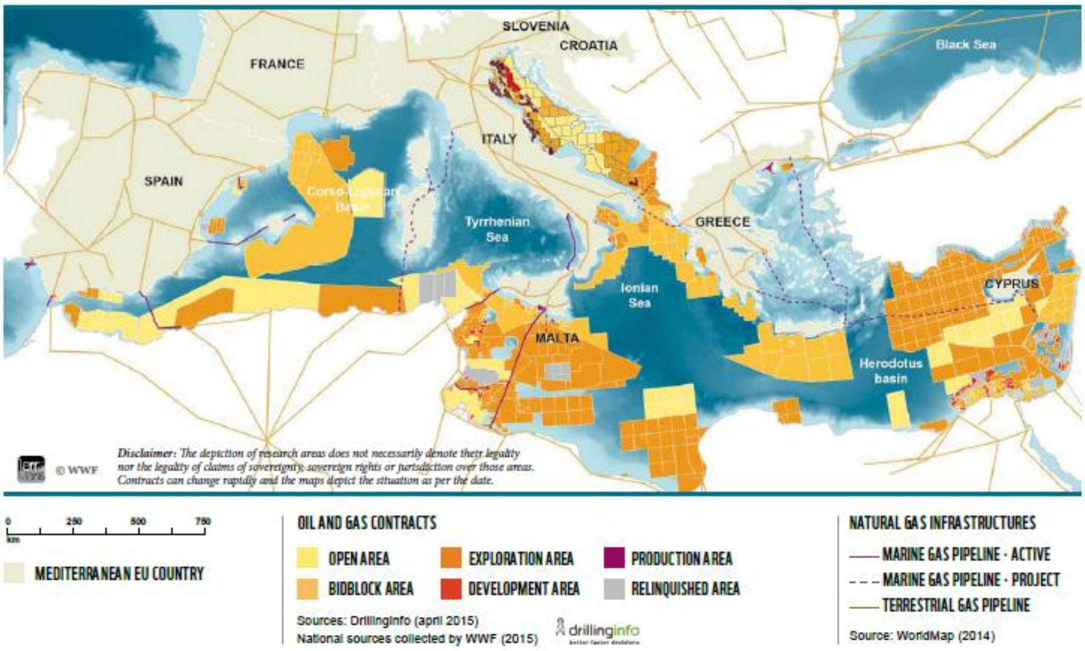

Figure 14: Current offshore oil and gas exploration and production contracts, active and projected gas pipelines in the Mediterranean Sea
Source: Piante and Ody, 2015

In terms of blue energy, the Mediterranean Sea records limited resources and development compared to Northern European countries. Only the offshore wind sector is expected to grow in the near future in order to achieve the EU Climate and Energy Policy Framework's target by 2030, regarding the production of 27% of the total EU electricity demand from renewable energy sources. The number of wind farm projects currently operating in the Mediterranean region is quite limited (Figure 15), mostly because of technical constraints (low wind speed and high bottom depth) (Piante and Ody, 2015).

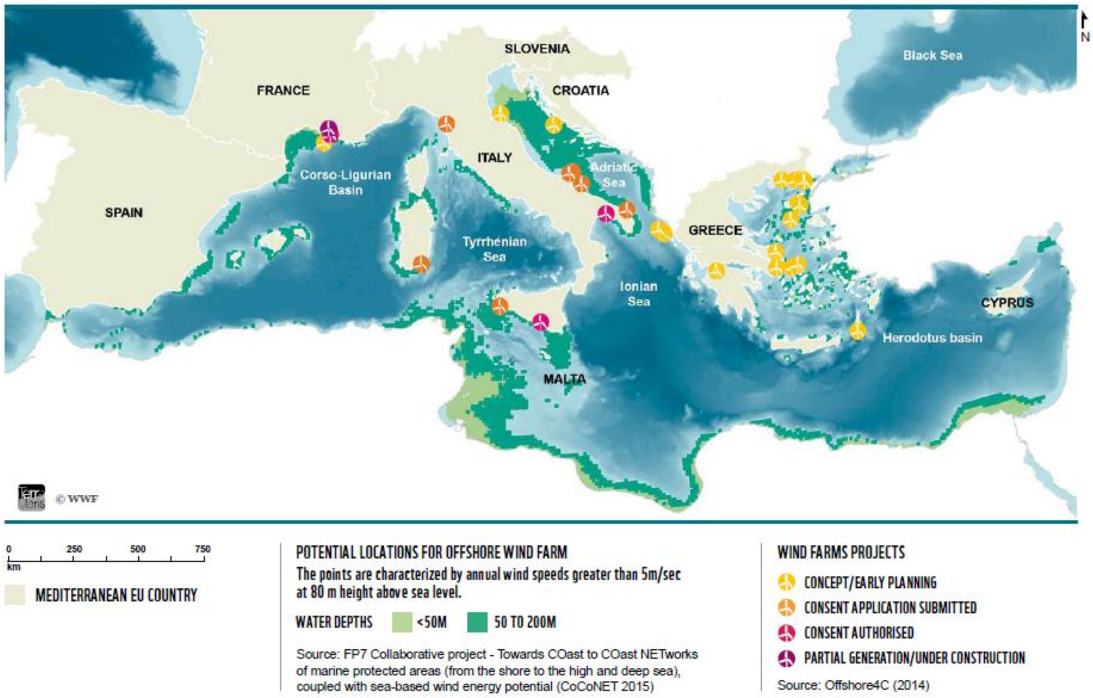

Figure 15: Offshore wind farm projects in the Mediterranean
Source: Piante and Ody, 2015

Impacts of energy extraction and exploration

Offshore oil and gas installations may lead to a series of destructive impacts for the environment such as accidental and operational oil spills. The majority of oil spills caused by the sector is minor in relation to other activities (for example shipping) and they mainly occur during loading and discharging operations in ports and terminals. The most important accidents in offshore oil and gas industry until 2009 were reported in Italy (16) and to a lesser extent Greece and Spain (5 and 4 respectively). Given the fact that the majority of accidental oil spills have occurred during exploratory drilling operations and the increasing number of exploratory contracts in the Mediterranean region (especially in seismic areas), the risk of new oil spills is only expected to increase in the near future (Piante and Ody, 2015).

Other impacts of offshore energy operations include seafloor and geological disturbances from increasing the exploration depth, effects on marine species from intrusive noise and biochemical interactions from the release of polluted water (UNEP/MAP, 2012).

2.4 Agriculture

Agriculture in the Mediterranean basin is mainly rain-fed or irrigated cultivation, although other common agricultural land uses like pasture and animal feed-lots also exist to a lesser extent. Approximately 85% of Mediterranean agricultural production is comprised by cereals, vegetables and citrus fruits. A downward trend is noted in the annual average growth rate of the main agricultural production (Figure 16), from 2,25% in 1961-1983 to 1.62% in 1984-2007 (UNEP/MAP-Plan Bleu, 2009, Lobianco and Esposti, 2006).

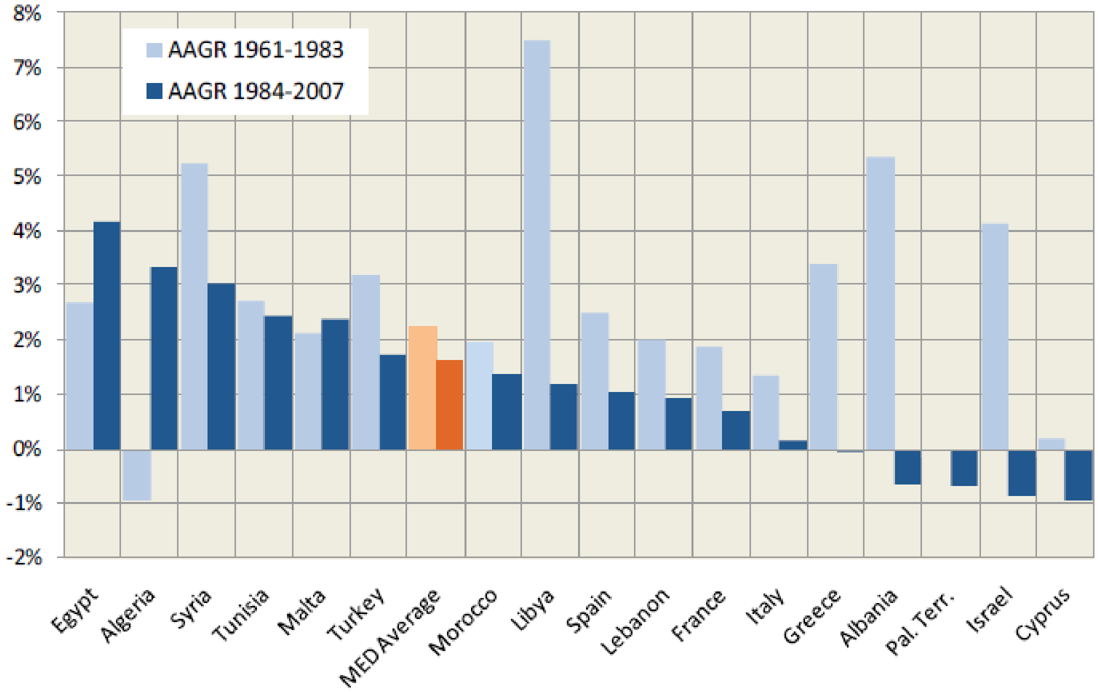

Figure 16: Annual average growth rate of the main Mediterranean production (cereals, vegetables and citrus fruits), 1961-2007 (%)
Source: UNEP/MAP, 2012

Mediterranean agriculture accounts for almost one third of the total EU25 agricultural land and presents higher shares both in labour and GDP in comparison to the rest EU25 continental economies. The total area of cultivated land in the Mediterranean basin has remained approximately stable in the past decades but is still higher compared to continental EU. Mediterranean agriculture is more intensive regarding per ha labour and production, although it is considerably limited by land restrictions (smaller farms). Higher productivity gains are achieved on irrigated land through intensification of the production process. In contrast to the significant decrease of arable land (Figure 18), irrigated surface area has doubled since 1960, exceeding

20% of total cultivated land (UNEP/MAP-Plan Bleu, 2009, Lobianco and Esposti, 2006).

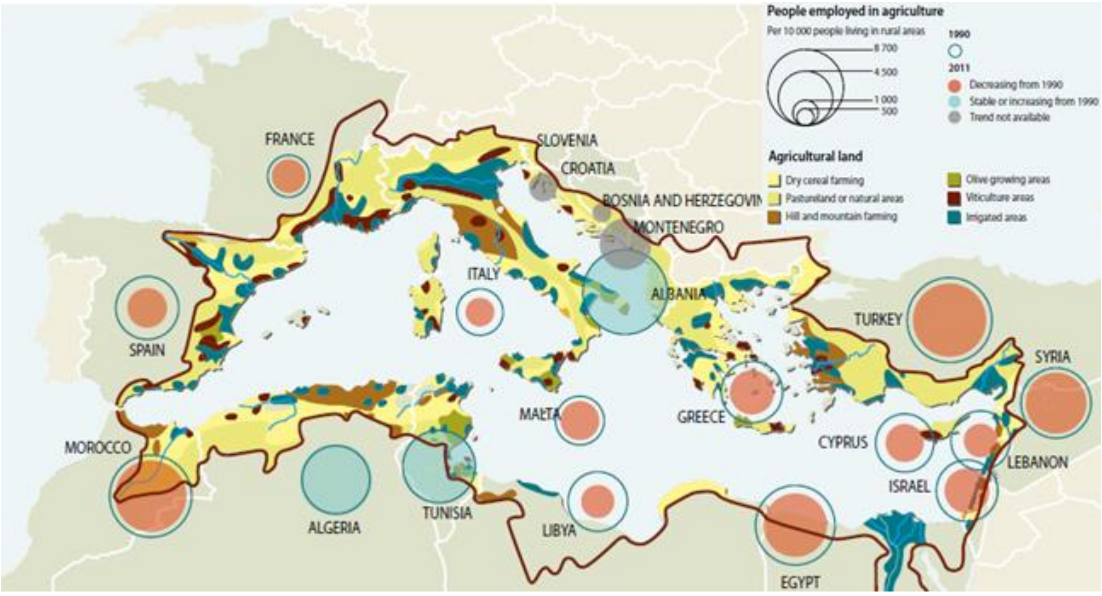

Figure 17: Agriculture and population in the Mediterranean basin
Source: UNEP/MAP, 2012

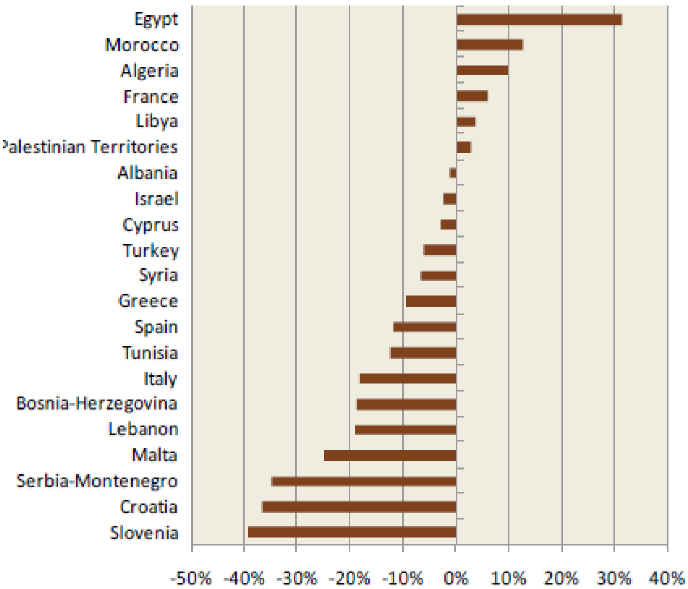

Figure 18: Loss or gain of arable land between 1980 and 2005 (%)
Source: UNEP/MAP-Plan Bleu, 2009

Impacts of agriculture

Agriculture activities and especially intensive irrigated cultivation have various and complicated impacts on the environment. The application of fertilisers and pesticides (Figure 19) introduce nutrients and pathogenic microorganisms into the environment which eventually end up to the rivers, ground waters and the sea through surficial run-off and sediment transport. The main results are increasing soil erosion (especially in drier areas of the Mediterranean), reduction of grazing areas and eutrophication or hypoxia phenomena (Figure20). Such impacts enhance further the upcoming effects of climate change by aggravating processes like desertification and biodiversity loss (UNEP/MAP, 2012, Lobianco and Esposti, 2006).

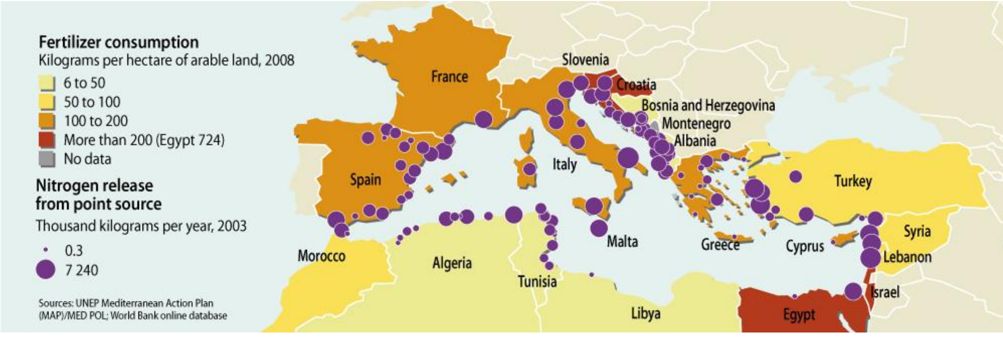

Figure 19: Use of fertilizers and nitrogen release in the Mediterranean region
Source: UNEP/MAP, 2012

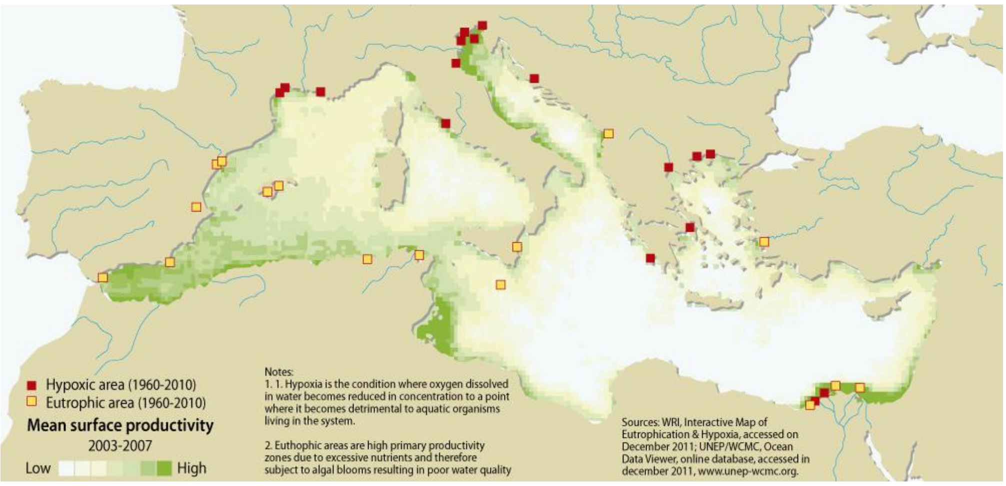

Figure 20: Eutrophic and hypoxic hotspots in the Mediterranean region
Source: UNEP/MAP, 2012

2.5 Maritime transport

As the crossroad between Europe, Africa and Asia, the Mediterranean Sea registers high growth rates in maritime transport activities. It represents a major waterway in the world transport industry as an exchange route for products, energy and passengers. International fluxes are dominant in the major traffic routes, mostly by crude oil and container shipments (Piante and Ody, 2015). The major axis with over 90 % of total oil traffic connects the eastern passages of the Straits of the Dardanelles and the Suez Canal with the Straits of Gibraltar, passing between Sicily and Malta and approaching the coasts of Tunisia, Algeria and Morocco (Figure 21) (UNEP/MAP, 2012) (Piante and Ody, 2015).

The Mediterranean coast accounts for more than 600 commercial ports and terminals and almost half of them are located in Greece and Italy. Twenty one Mediterranean ports are included in the world's top 100 ports regarding port calls, deadweight tonnage, container flows and cargo volume. In economic terms, more than 70 billion euros are generated in the Mediterranean Sea from maritime transport activities which is equivalent to 5% of the total revenues worldwide (Piante and Ody, 2015).

Given the fact that the Mediterranean Sea recorded a rise of 58% in terms of transit capacity and an increased size of vessels by 30% since1997 (with number of port calls increasing by 14-20%) (Figure 22), it is expected that shipping will increase both in routes density and traffic intensity in the coming years (UNEP/MAP-Plan Bleu, 2009· Piante and Ody, 2015).

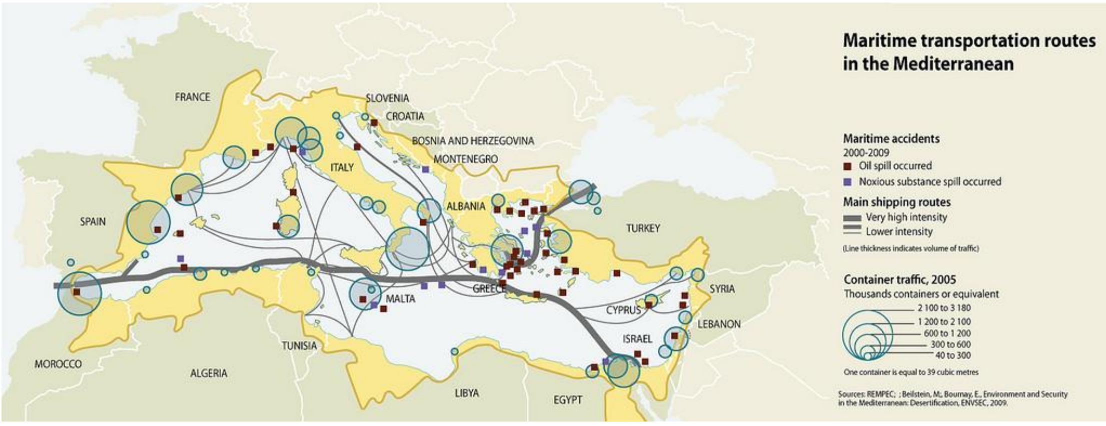

Figure 21: Transportation routes in the Mediterranean basin
Source: UNEP/MAP, 2012

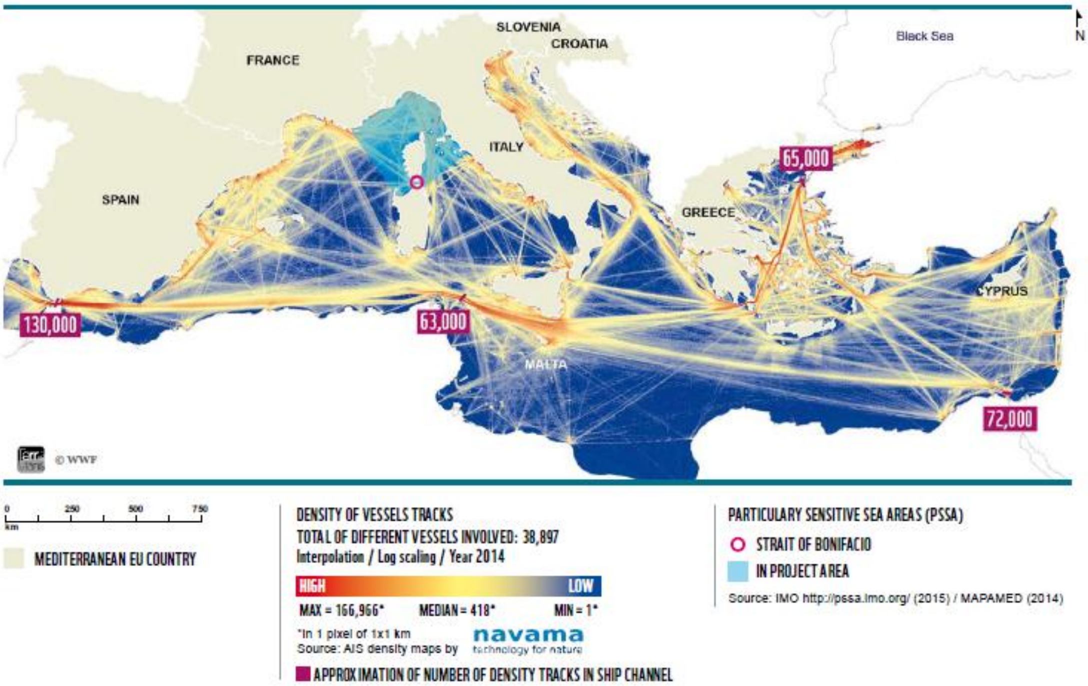

Figure 22: Density of Automatic Identification System (AIS) signals from all vessels (including fishing vessels) in 2014
Source: Piante and Ody, 2015

Specifically for freight transport, a significant increase is expected in liquid bulk traffic and mostly oil transport by 2025. Oil transport is already predominant in the Mediterranean maritime transport accounting for more than 18% of the global crude oil traffic and is expected to increase with exports of crude oil from the Caspian region and the Black Sea (UNEP/MAP/2012). Moreover, important growth rates are projected in container shipping under the Trans-European Networks (TEN-T) initiative “Motorways of the Sea” that aims to facilitate the mobility of the internal market and expand European-Asian exchanges by 6.3% per year (although current container shipping is mostly connected to North-European ports). TEN-T also sets as a priority the inclusion of 82 major EU ports in the core network infrastructure by 2030. Southern and Western Mediterranean sea-ports are expected to expand their hinterland and increase their traffic compared to the congested northern EU ports (Piante and Ody, 2015).

In terms of passenger transport, the Mediterranean Sea is already considered among the busiest regions of the world, accounting for more than 50% of the total EU passenger maritime traffic. Taking into account maritime passengers in coastal regions and the density of AIS signals from passenger vessels, Greece and Italy together account for more than 80% of the total passenger maritime traffic (Figures

23 and 24). Driven by tourism development and taking into account the significant growth in the cruising sector, passenger traffic in the Mediterranean Sea is expected to continue its upward trend in the near future (Piante and Ody, 2015).

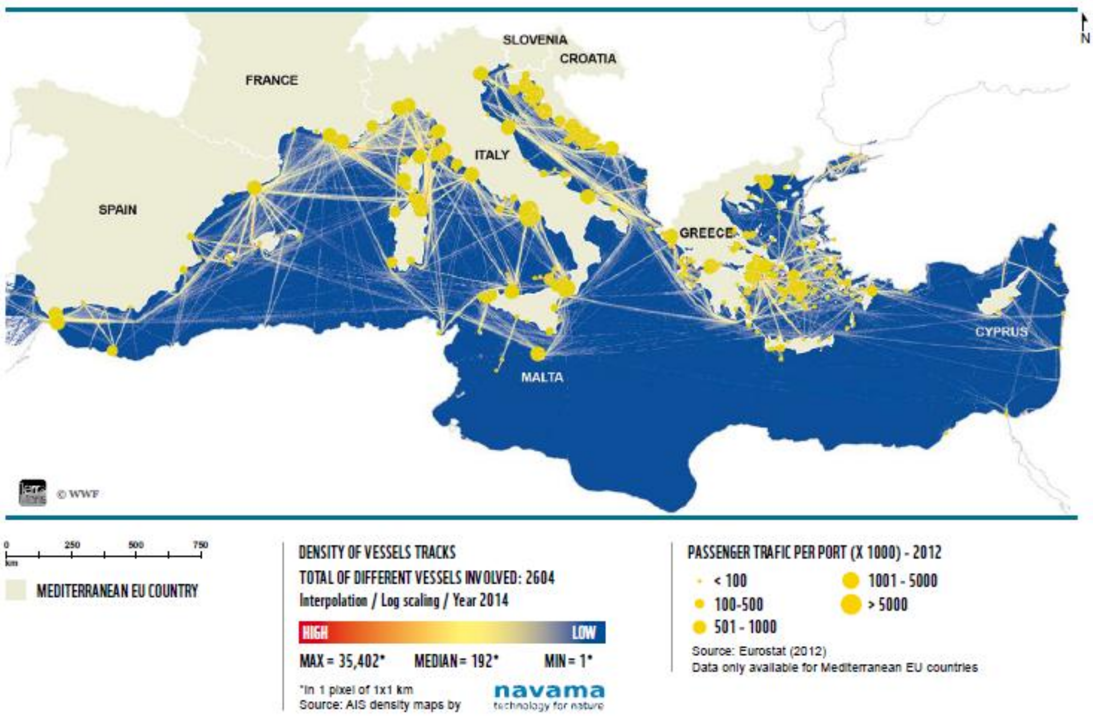

Figure 23: Density of Automatic Identification System (AIS) signals from passenger vessels in 2014 and passenger traffic per port in 2012
Source: Piante and Ody, 2015

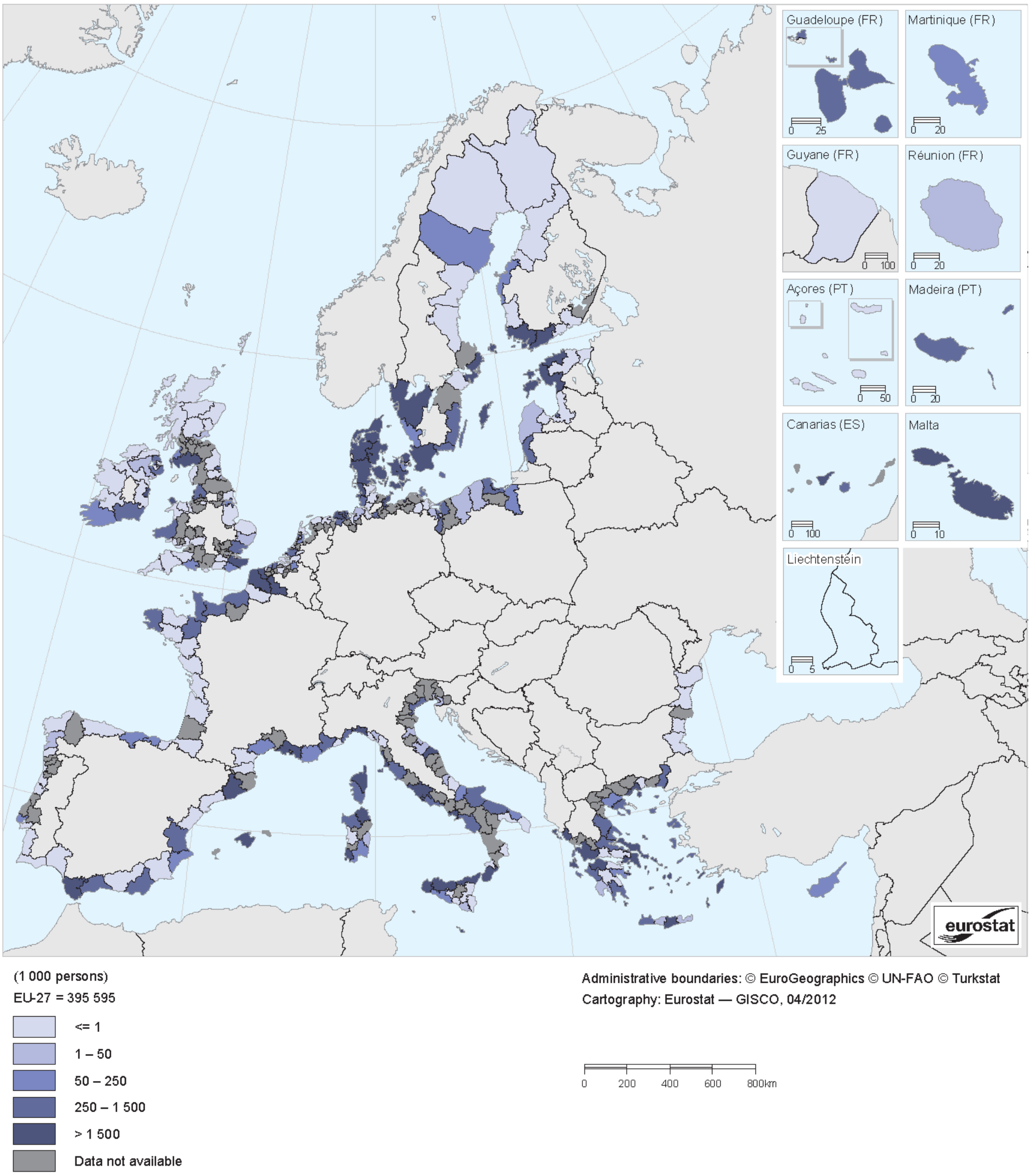

Figure 24: Maritime passengers in EU coastal regions by NUTS3 units in 2010 (1000 persons)
Source: Ec.europa.eu. (2017)

Impacts of maritime transport

The most important impacts related to maritime transport affecting the coastal and marine environment are due to ship emissions and marine accidents, introduction of invasive species and pathogens, anti-fouling paint biocides, underwater noise and fragmentation of coastal landscapes and habitats related to the inevitable development of coastal infrastructures (ports, motorways and railways) (UNEP/MAP, 2012. Piante and Ody, 2015).

Emissions and leaks of hazardous substances by maritime transport are responsible for 70% of marine pollution in the Mediterranean basin. Oil transport is the main cause of pollution in the Mediterranean region, which is more polluted by oil than any other sea worldwide. Deliberate oil dumping represents the main source of oil pollution in spite of the strict regulations related to waste disposal. According to Med-IAMER Project (2015), approximately 0.1% of the transported crude oil per year is deliberately disposed in the sea in tank washing operations. Taking into account the amount of oil spills already occurred and the possible oil slicks caused by maritime transport in the Mediterranean basin, Greece, Italy and to a lesser extent Spain and France may be attributed as the major EU Mediterranean hotspot for possible oil pollution (Figure 25) (UNEP/MAP, 2012. Piante and Ody, 2015). At Mediterranean level, approximately 80% of hydrocarbon pollution is attributed to routine shipping and only 10% to accidental oil spills (Med-IAMER Project, 2015).

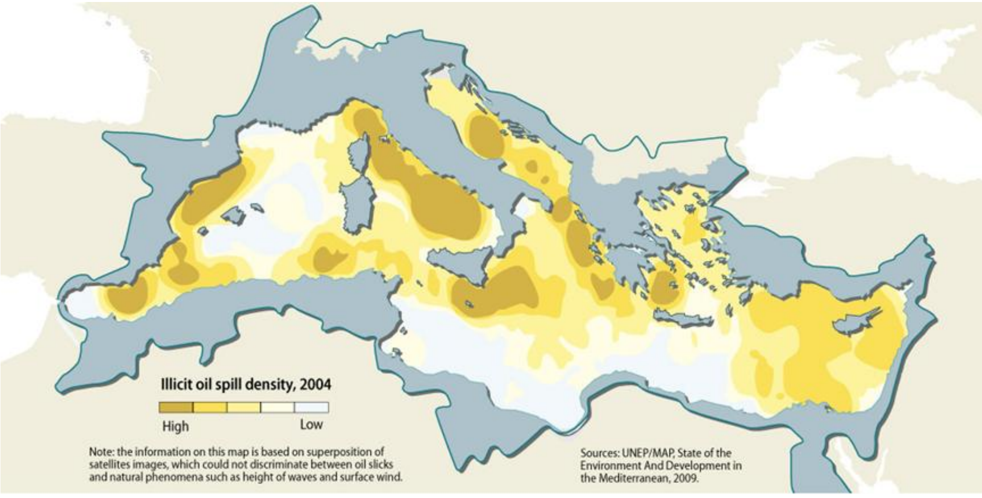

Figure 25: Possible oil spills locations and density
Source: UNEP/MAP, 2012

Another major impact of maritime transport is the introduction of non-indigenous species to marine ecosystems through the discharge of ballast waters and sediments. Greece, Italy and Turkey represent the highest invasion levels, approximately 63% of the total, in the Mediterranean coasts (Figure 26). Underwater noise, especially in congested maritime routes crossing important conservation areas, also leads to abandonment of maritime habitats and alterations of mammals' behavior (UNEP/MAP, 2012; Piante and Ody, 2015; Med-IAMER Project, 2015).

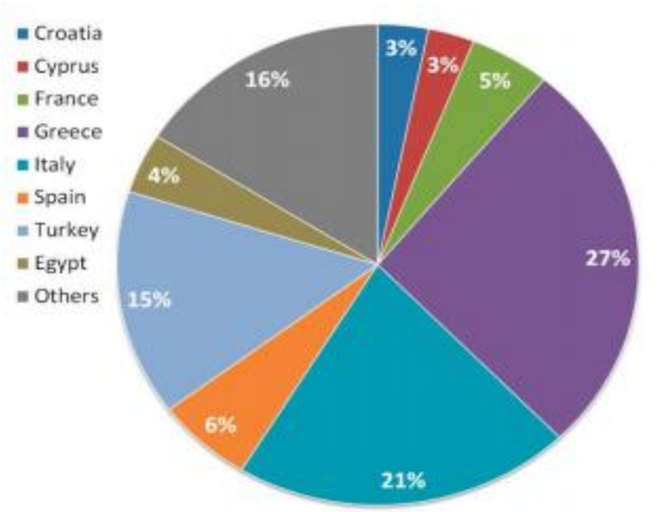

Figure 26: % of Alien Species introduced through maritime transport activities in the Mediterranean coast
Source: Med-IAMER Project, 2015

3. MSP and ICZM as tools for addressing coastal and maritime activities' interactions

Coastal zones, being areas of valuable habitats and ecosystem services, attract a variety of competing interests and activities within a limited space. The multi-uses taking place in these areas make them highly vulnerable to both human and natural hazards, causing adverse effects on each other (land use conflicts) and on the coastal marine environment (anthropogenic activities – marine environment conflicts) (Tuda et al., 2014 ˙Bramati et al., 2014 ˙Harik et. al, 2017). New emerging demands on marine space and resources, such as coastal and maritime tourism or renewable energy developments etc., highlight the potential for user-user conflicts (Kelly et al., 2014). These conflicts weaken the ability of the ocean and coastal areas to provide the necessary ecosystem services upon which humans and all other life on earth depend (Ehler and Douvere, 2009). Though late, the need for protection and establishing ground rules in these precious areas has been understood as evidenced by the existing policies, strategies and directives, such as Maritime Spatial Planning and Integrated Coastal Zone Management, developed to comprehensively address the management of conflicts and other threats.

'Maritime spatial planning'(MSP) is a process through which human activities can be analyzed and organized in coastal and maritime areas in order to achieve ecological, economic and social objectives (DIRECTIVE 2014/89/EU). Essentially, MSP is a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve objectives usually specified through a political process (Ehler and Douvere, 2009).

'Integrated coastal zone management' (ICZM) is a dynamic, multi-disciplinary and iterative process to promote sustainable management of coastal zones. It covers the full cycle of information collection, planning (in its broadest sense), decision making, management and monitoring of implementation. ICZM uses the informed participation and co-operation of all stakeholders to assess the societal goals in a given coastal area, and to take actions towards meeting these objectives. ICZM seeks, over the long-term, to balance environmental, economic, social, cultural and recreational objectives, all within the limits set by natural dynamics (European Commission, 2000).

MSP and ICZM are two approaches which can operate in a combined way for a comprehensive and sustainable management of coastal and maritime areas. They are complementary tools; their geographical scope overlaps in the coastal and territorial waters of the European Union's Member States, where maritime spatial plans can map existing human activities and identify their most effective future spatial development, while integrated coastal management strategies ensure the integrated management of these human activities. Applied jointly, they both improve sea-land interface planning and management (DIRECTIVE 2013/0074/EU).

3.1 MSP and ICZM as tools for facing land-sea interactions (similarities and differences)

As it is clear from their definitions, MSP and ICZM are two processes similar in many aspects. Their spatial reference, objectives and character are common, as they both promote integrated, strategic, and participatory processes aiming to maximize compatibilities and synergies among human activities and reduce conflicts among human uses and between human uses and natural environment (Ehler and Douvere, 2009).

Although MSP and ICZM involve a strategic approach to planning in terms of uses and activities, their main difference is their implementation scale; typically ICZM is applied to maritime zones less than two kilometers from the coastline, conversely MSP can be applied to much wider areas such as coastal watersheds or Exclusive Economic Zones (European MSP Platform, c2017). In other words, ICZM refers to a more local scale, while MSP is often applied at larger scales.

Regarding their objectives, both are focused on social, economic and environmental targets towards sustainability. Specifically, they share policies with the same goal - the resolution of land use conflicts for the development and conservation of coastal and maritime environments (Papatheochari, 2008). According to Douvere (2010), ICZM aims at integrating the land and sea interface through the rational planning of activities and a better coherence between public and private activities that affect the use of the coastal zone. MSP aims at creating and establishing a more rational organization of the use of maritime space and the interactions among its uses, balancing the demand for development with the need of environmental protection, achieving multiple objectives through public, participatory and well planned processes (DEFRA, 2008 cited by Douvere, 2010).

A common characteristic is also the promotion of an integration among sectors, levels of government, disciplines, countries, across the land-water interface. Until recently, governments applied a mainly sectoral approach towards maritime issues, but now realize that a more integrated approach is required to manage increasing pressures on coastal areas (Olsen et al., 2011 cited by Kelly et al., 2014). MSP and ICZM entail holistic approaches, which tackle problems that current single-sector management approaches are not sufficient to deal with. They also provide guidance to each single-sector ensuring the integrated and comprehensive management of maritime environments (Douvere, 2010). Traditionally, ICZM focuses on a process-oriented approach that emphasizes five different dimensions of integration: between sectors, between levels of government, across the land-water interface, between disciplines, between nations (especially when nations share an enclosed or semi-enclosed water body) (Garriga, 2013). Meanwhile, MSP is based on a different approach; it focuses on allocation of ocean space to economic activities and the designation of areas for conservation and protection (Douvere, 2010). Both tools do not replace single-sector planning. Instead, they aim to provide guidance for a range of decision-makers responsible for particular sectors, activities or concerns so that they will have the means to make decisions confidently in a more comprehensive, integrated, and complementary way (Ehler and Douvere, 2009).

MSP and ICZM are both continuous, iterative and adaptive processes focused on the long-term vision. MSP constitutes a ten-step process governed by national authorities:

- Step 1: Identifying need and establishing authority
- Step 2: Obtaining financial support
- Step3: Organizing the process through pre-planning
- Step 4: Organizing stakeholder participation
- Step 5: Defining and analyzing existing conditions
- Step 6: Defining and analyzing future conditions
- Step 7: Preparing and approving the spatial management plan
- Step 8: Implementing and enforcing the spatial management plan
- Step 9: Monitoring and evaluating performance
- Step 10: Adapting the marine spatial management process (Ehler and Douvere, 2009).

ICZM, is a five-step process governed mostly by local authorities:

- Step 1: Establishment
- Step 2: Analysis & Futures
- Step 3: Setting the Vision
- Step 4: Designing the future
- Step 5: Realizing the future (UNEP/MAP[2], 2012)

Legally binding constitutes one of the main differences among these approaches. In spite of ICZM Protocol entry into force in 2011, including its ratification by EU, which means that it has become part of the EU law and could have binding effects, ICZM remains a more flexible and informal instrument (UNEP/MAP[2], 2012). Indeed, there is no EU binding requirement for all Member States to conduct ICZM, and practice varies according to local conditions. However, for the Mediterranean basin, the ICZM Protocol to the Barcelona Convention defines a common binding framework for ICZM. MSP, by contrast, is a formal requirement for all EU Member States whose principles are implemented through maritime spatial plans (European MSP Platform, c2017).

As it is evident, both approaches are necessary for addressing coastal and maritime uses and activities' interactions; they are essential in order to examine and deal with the impact of human activities in urban and regional coastal zones. Unfortunately, the two approaches did not co-operate from the beginning, but in the last years they are treated as a single effort. There should be synergies between them as MSP creates a new impetus for further implementing the ICZM principles. Specifically, ICZM should be consorted with maritime spatial planning to make its principles more tangible and operational by examining spatial and temporal dimensions of ICZM principles (Douvere, 2010). In that case meaningful results are likely to be produced (Douvere, 2010).

3.2 Identification of knowledge gaps

Although MSP and ICZM have already been implemented and considerable work has been done, some knowledge gaps remain. These gaps, related to framework, methods, tools and data, reflect challenges that could potentially impede their successful implementation in the future (Douvere, 2010).

The experience so far has shown that there is a need for common and evolved framework integrating ICZM and MSP. Access to data (data integration and management) to support decision-making procedures as well as digital tools (e.g. GIS-based tools) to identify and map activities and their interactions and the use of social sciences to study coastal populations perceptions regarding coastal issues, integrating seashore and sea users into coastal governance are essential components for such a framework (European MSP Platform, c2017). According to Blue MED (2014), their necessity lies in i) the implementation of EU and international policies (e.g. ICZM Protocol and EU Directive on MSP, but also related policies and

Directives) through ready to use data for planning and management at the different geographical scales and through integrated, effectively used and maintained tools to assist decisions, providing quality assurance and quality control; ii) the prevention of conflicts of multiple activities, to favor the development of coastal and maritime protected areas. Moreover, such a framework should incorporate not only an economic assessment, but also environmental and social evaluations, for a more effective and efficient MSP and ICZM (Douvere, 2010).

Monitoring and evaluating performance is very important for the efficient maritime and coastal planning and management. Outputs delivered from this step are (i) monitoring system designed to measure indicators of the performance of maritime spatial management measures, (ii) information on the performance of maritime spatial management measures that will be used for evaluation and (iii) periodic reports to decision makers, stakeholders and the public about the performance of the maritime spatial management plan are the main outputs that should be delivered by this process (Ehler and Douvere, 2009). Due to the long-term vision of both MSP and ICZM, maritime and coastal planning and management should take into account the changes and trends may occur in near or far future. (Douvere, 2010). In the evaluation methods and specifically the evaluation of cumulative impacts of coastal and maritime uses and their related pressures on the maritime ecosystems, many knowledge gaps are identified. As mentioned by Blue MED (2014), the overarching principle of EU and International policies refers to a sustainable delivery of ecosystem services in an equitable way, where human population and economic/social systems are seen as integral parts of the ecosystem, including ICZM diagnostics and projections at local scales (coastal counties and cities), coastal risks prevention, coastal and marine environment protection, avoidance or mitigation of conflicts in coastal and maritime activities. In this context, evaluation is important to practically support the implementation of the Ecosystem-Based Management (EBM) principle developing an aware planning (including climate changes at local scales) in coastal and maritime areas and activities (European MSP Platform, c2017). Furthermore, already adopted MS Plans should be under constant evaluation. Identifying meaningful indicators to measure their progress are important for their success. Such indicators, however, should not only concentrate on measuring the state of the coastal and maritime environment, but more importantly, should focus on the performance of the spatial and temporal management measures implemented through MSP and ICZM (Douvere, 2010).

Another gap concerns the data availability. Statistical and geospatial data serve multiple purposes in the maritime planning and coastal management processes. The goals of MSP and ICZM should be accomplished with the use of appropriate data acquired from various sources (Kocur-Bera, 2014). However, the available data are a limiting factor. Although there is data for terrestrial and marine environment and ecosystems individually, the need of a database for land and sea interface remains. Geographical Information Systems (GIS) is also a significant component of these processes, as it visualizes the transboundary continuity of land-sea uses. A database and GIS are useful tools to define the intertemporal changes - identify the current conditions and needs and project the future trends. Therefore, their necessity consists of preparing, implementing, monitoring and evaluating efficient MS and ICZM plans.

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