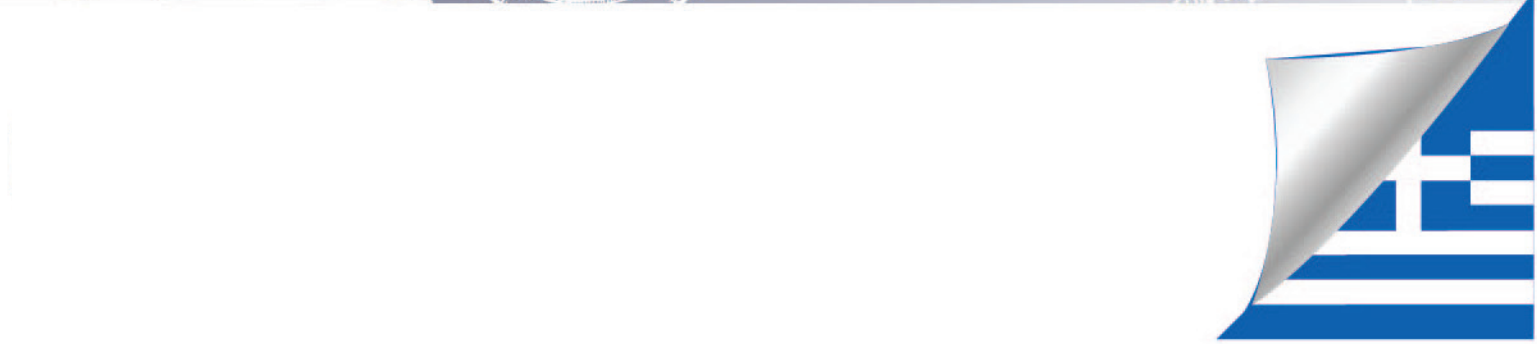


Blue Growth

Greece scale





Co-Evolve4BG

Analysis of Threats and Enabling Factors for Sustainable Tourism at Pilot Scale

Blue Growth Greece Scale



Union for the Mediterranean
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CPMR
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OVERVIEW

The present document was produced in the framework of **Co-Evolve4BG** project “*Co-evolution of coastal human activities & Med natural systems for sustainable tourism & Blue Growth in the Mediterranean*” in relation to Threats and Enabling Factors for maritime and coastal tourism development on a national scale” Co-funded by ENI CBC Med Programme (Grant Agreement A_B.4.4_0075).

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Abstract

This deliverable aims to integrate research, identify, and record Blue Growth concept at National (Mediterranean) Scale, its' established and emerging sectors, advantages and possible impacts of Blue Growth on Coastal tourism both for Mediterranean and Greece. It is based on a review of existing data at the national, Mediterranean, and European levels. The deliverable is structured to present the relationship between Blue Economy, Blue Growth and the corresponding sectors and identify the interaction between tourism and Blue Growth.

I. Blue Growth concept

I.1. Blue Growth Introduction

Blue Growth Concept is the most recent version for an integrated management of marine socioeconomic systems. According to (Eikeset *et al.* 2018), the appropriate definition of the term of Blue Growth has not been found. Thus, the term expresses different meanings; depending on the social environment in which it is used. So, the term is used with a lot of ambiguity.

The Blue Growth Concept is based on the Blue Economy. The Blue Economy consists of a series of branches and sub-sectors of the economy that are directly related to the seas and the oceans. Specifically, it includes the following sectors:

1. Sectors with proven contribution to the economy, such as fisheries and aquaculture, catch processing, shipbuilding and ship repairing, port activities, coastal tourism, and offshore oil drilling.
2. Areas with high development potential, such as blue biotechnology, desalination, coastal and environmental protection, marine wind energy and other marine renewable energy sources (tidal, wave, *etc.*).

According to (FAO, 2014), Blue Growth aims to make the most of the possibilities of oceans, seas and coasts to tackle damaging fishing practices and overfishing, take custom measures that promote cooperation between countries and play an important role for policy development.

Blue Growth is the EU's major maritime policy and includes the most important sectors of the maritime economy for Greece, which are coastal, and maritime tourism, shipping and shipbuilding industry, aquaculture, blue energy, marine biotechnology, marine mineral extraction. In all areas of the blue economy, innovation is crucial for harnessing the potential for development, job creation and the implementation of cost-effective marine environmental measures.

I.2. Blue Economy

Blue Economy employs about 5.4 million people (nearly 2.3% of the EU-27) and generates Gross Value Added of almost US \$500 billion (nearly 1.5% of the EU-27) a year. However, there is room for further development in some areas identified in this strategy (Addamo *et al.* 2021).

Blue Economy exceeds 5% of the National Gross Value Added or Employment in the insular Member States or those with archipelagos, which are Greece, Croatia, Malta, Cyprus and Portugal.

COVID-19 pandemic outbreak at the beginning of 2020 expressed a shock for the economies, with harsh consequences. It is expected that Blue Economy will be more affected, but also will grow faster with the recovery of the economy. At the same time, it presents some serious investment opportunities, although different sectors in the Blue Economy will be differently impacted, as shown in Table 2.

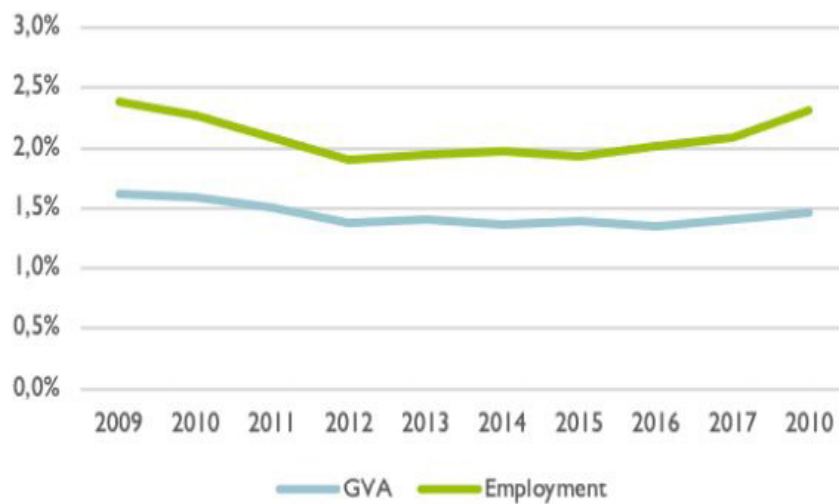


Figure 1. Blue Economy share on the EU (Addamo *et al.* 2021)

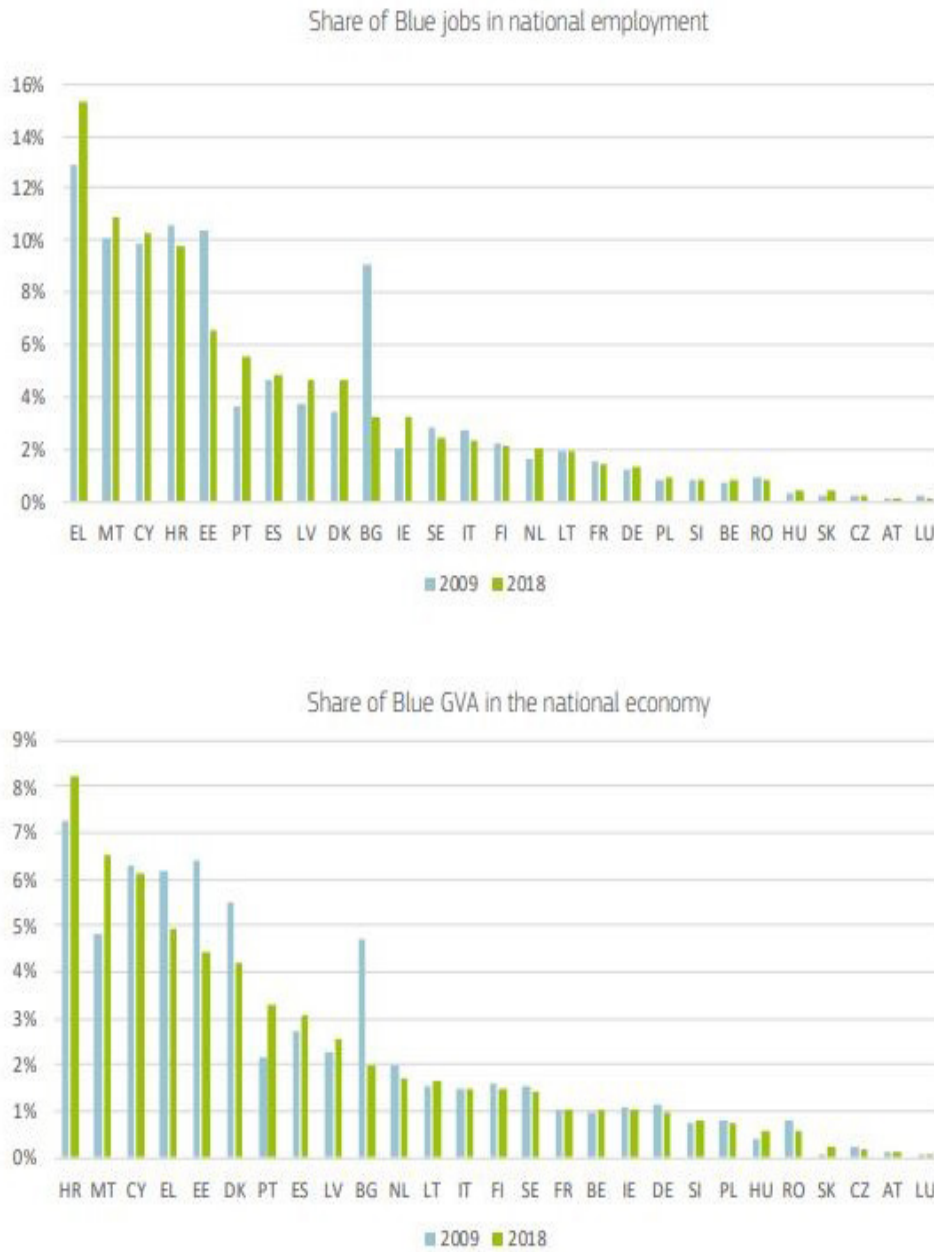


Figure 2. National contribution to the EU Blue Economy (Addamo *et al.* 2021)

Table 1. Economic indicators for Blue Economy for 2018 (Addamo *et al.* 2021)

Indicator	Blue Economy (EU 2018)
Turnover	€658 billion
GVA	€180 billion
Gross Profit	€74.3 billion
Employment	4 million
Investments in tangible goods	€14.9 billion
Investment Ratio	24%
Average remuneration	€26,400

Table 2. COVID-19 crisis impacts on Blue Economy sectors (Addamo *et al.* 2021)

Sector	Size	Impact 2020	Recovery path
Established sectors			
Marine living resources	Medium	Strong	Prompt
Marine non-living resources	Small	Strong	Prompt
Marine renewable energy	Nascent	Medium	Prompt
Port activities	Medium	Strong	Prompt
Shipbuilding and repair	Small	Strong	Lagged
Maritime transport	Medium	Strong	Prompt
Coastal tourism	Very large	Strong	Very lagged
Emerging sectors			
Blue bioeconomy	Small	Strong	Prompt
Ocean energy	Nascent	Small	Prompt
Desalination	Nascent	Small	Prompt
Maritime defence	Small	Small	Prompt
Cables	Nascent	Small	Prompt
Research and Education	Nascent	Small	Prompt
Marine observation	Nascent	Small	Prompt

I.3. Blue Growth Strategy and ICZM

EU's Blue Growth Strategy is based on three factors:

1. Specific integrated maritime policy measures,
 - a. Sea-driven knowledge
 - b. Maritime Spatial Planning
 - c. Integrated maritime surveillance.
2. Marine Basin Strategies to ensure the most appropriate combination of sustainable development measures.
3. Targeted approach for specific activities:
 - d. Aquaculture
 - e. Coastal tourism
 - f. Maritime biotechnology
 - g. Ocean energy
 - h. Exploitation of seabed deposits

The Blue Growth Strategy Assessment identifies five (5) focus areas with the objective of increasing employment and in particular:

1. Ocean Energy
2. Aquaculture
3. Coastal Tourism
4. Maritime biotechnology
5. Non-living resources

Within this framework, to establish coastal management strategies that build further on the principles and elements set out in the Council Recommendation on Integrated Coastal Zone Management of 2002 and the Protocol to the Barcelona Convention on Integrated Coastal zone Management, ratified by the EU in 2010, the Protocol, "Integrated Coastal Zone Management", was developed, which concerns the dynamic process for the sustainable management and use of coastal zones, taking into account factors such as the weakness of coastal ecosystems, the variety of activities and uses and interactions between them. The main elements of Integrated Coastal Zone Management are:

1. Protection and sustainable use of coastal zones.
2. Conservation of natural resources from economic activities.
3. Protection of the characteristics of certain specific coastal ecosystems.
4. Recognition of the natural and cultural values of coastal landscapes.
5. Conservation and protection of cultural, archaeological, and historical heritage of coastal areas.
6. Ensuring effective governance and stakeholders' participation.
7. Undertaking awareness-raising, training, education, and research activities.

II. Initiatives to promote Blue Growth

European Union recognizes the meaning of cooperation at the level of the Mediterranean where there are more than 20 countries, including some in the European Union. While cooperation is necessary for coastal activities management, environment and maritime heritage protection, war and pollution avoidance, sea security improvement and blue growth promoting, the European Union has taken on some initiatives to improve this cooperation.

At West Mediterranean the initiative for sustainable development of Blue Economy has been developed. Five (5) European countries (France, Italy, Portugal, Spain, and Malta) and five (5) north-African countries (Algeria, Libya, Mauritania, Morocco and Tunisia) are contributing aiming to create a safer sea area and promoting a smart and resilient blue economy.

II.1. Blue Growth Interreg MED project

Blue Growth Interreg MED horizontal project (2019-2022) is the continuation of InnoBlueGrowth Interreg MED horizontal project (2016-2019) and is a main initiative to promote Blue Growth at Mediterranean level (Blue Growth, 2019).

Some projects of Blue Growth Interreg MED could be good practices to promote Blue Growth at National level. The transfer of results and/or tools could contribute to the development of blue growth at the national (Mediterranean) level. These projects are MISTRAL and BLUE CROWDFUNDING. Both MISTRAL and BLUE CROWDFUNDING projects have taken place in Greece and another project related to Blue Growth, the “Blue Growth Piraeus” took place in Piraeus, a coastal area in Athens.

The Institute of Oceanography of the Hellenic Centre for Marine Research (HCMR) and the Region of Crete participate in the project MISTRAL which is part of the European Transnational Cooperation Programme “Interreg MED”.

The aim of MISTRAL project is to strengthen a transnational partnership to:

- Make marine knowledge and sustainable innovation the key drivers for Blue Growth.
- Support Mediterranean clusters to become an excellent intermediary of knowledge for increasing blue economy.
- Design and implement sustainable development trajectories harmonized with the Mediterranean regions Smart Specialization Strategies.

MISTRAL has the ambition to develop a wider governance vision towards 2020 in the Blue Growth sector as well as, assuring the effective policy mainstreaming (MISTRAL, 2019).

BLUE CROWDFUNDING aims at improving and enhancing knowledge and capacities about crowdfunding in the Mediterranean area. Project's main objective is to improve innovation capacities in the Blue Growth sector by mainstreaming the use of crowdfunding. Project's partners in Greece are: INSULEUR, CROWDPOLICY and Region of Central Macedonia (BLUE CROWDFUNDING, 2021).

In other words, the ambition of the project is to trigger the shift from using public funds for innovation to using crowd funding and crowd sourcing to fund, test and validate innovative products and services of the Blue Economy.

II.2. Blue Growth Piraeus

Blue Growth Piraeus is an initiative to support start-ups and sustainable entrepreneurship on the maritime economy. In 2014, the city of Piraeus put in place Blue Growth Piraeus, a first-established at EU level innovation competition for the Blue Economy, with the objective to strengthen traditional economic activities with innovative business ideas.

Blue Growth Piraeus promotes socially and economically the city and helps to encourage entrepreneurship through:

- A continuous innovation mechanism with strategies regarding to Blue Economy.
- Improvement of skills and knowledge especially of young people in Blue Economy.
- Knowledge transfer to companies and start-ups.
- Strengthening of cooperation in the fields of research, education and practice (Blue Growth Piraeus, 2021).

Results achieved until now:

- Collaboration with 6 universities in Greece, Egypt, China, Cyprus, and ability to approach thousands of university students.
- At least 2 new competitions related to the Blue Economy have been established from other organizations.
- Establishment of more than 15 start-ups.
- Acceleration of 7 start-ups in the Blue Lab (Municipal Center of Entrepreneurship and Innovation for Blue Growth) in 2020.
- Creation of approximately 60 jobs.
- Implementation of more than 50 community networking events, also within the framework of several European projects (Blue Growth Piraeus, 2021).

III. Main challenges for applying Blue Growth

Pressures from human activities have biological and other impacts on marine ecosystems, degrading their condition and eroding their resilience. Human activities at sea include traditional sectors, such as fishing, shipping, tourism, aquaculture and extracting non-living resources. Living resources depend on good environmental and ecosystem states, while activities using non-living resources cause pressures on marine ecosystems and are mostly independent of their state and of the general state of the sea. Pressure on marine ecosystems is greater by human activities on non-living resources rather than those activities using living resources. Most land-based activities (notably agriculture and urban/industrial settlements), cause a range of widespread pressures across freshwater resources, oceans and seas. Pressures from human activities on marine habitats and species are found in 93% of Europe's marine area.

Marine pollution threatens the health of the marine environment and the use of the seas for commercial and recreational activities. Indeed, pollution is also one of the main drivers for the loss of marine biodiversity. Pollution has also a wide range of socio-economic and health consequences on Blue Economy.

Due to the complexity of the relation between economy and marine pollution the Marine Strategy Framework Directive (MSFD), tries to define marine pollution. Marine pollution according to MSFD is “the direct or indirect introduction into the marine environment, as a result of human activity, of substances or energy, which results in deleterious effects such as harm to living resources and marine ecosystems”.

The European Green Deal aims for a 90% reduction in Greenhouse gases (GHG) from all modes of transport, which are responsible for almost a quarter of Europe's GHG, and this includes sectors of the EU Blue Economy, such as shipping (Addamo *et al.* 2021).

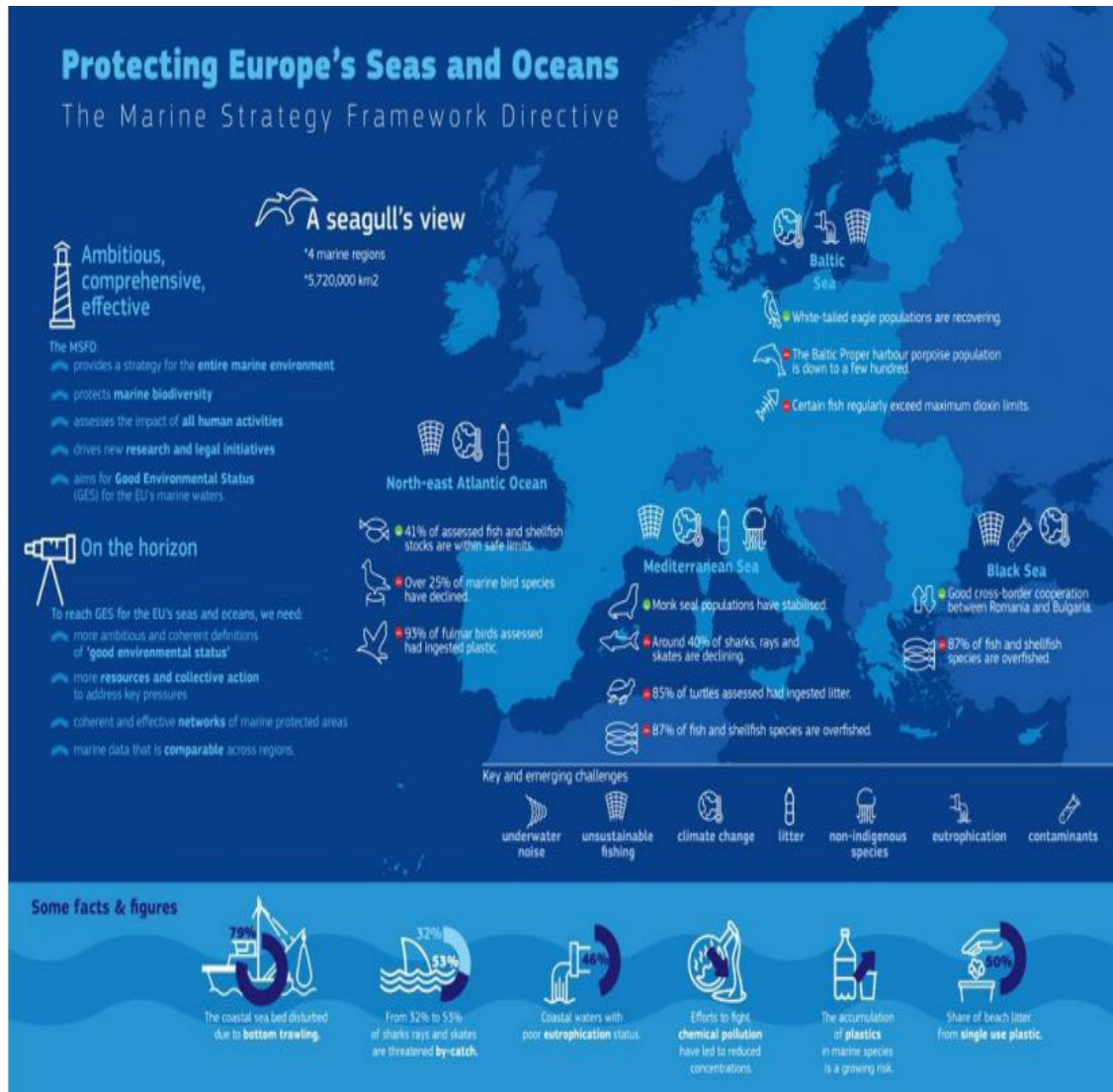


Figure 3. MSFD status of implementation (Addamo *et al.* 2021)

IV. Legal measures taken to promote Blue Growth

IV.1. EU Policy on Blue Growth

European Union has developed a strategy for sustainable Blue Growth, recognizing that oceans and seas are important levers for European economy that additionally have important power for innovation and growth. Also links this strategy to the “Europe 2020” Strategy for smart, sustainable, and inclusive development. EU’s policy for Blue Growth also contains MSFD, Blue Growth Strategy and ICZM (as analysed on section 1.3).

Aware of the meaning and the difficulties involved in developing such a policy, the European Union finances political priorities for the integrated maritime policy in accordance with Directive 508/2014 and through Work modules and annual Programs of the European Fund for Maritime affairs and Fishing. In addition, some relative funding tools are Horizon 2020, LIFE, COSME and EISF.

IV.2. Greek Policy on Blue Growth

Greece has included in its laws, policies about ICZM, MSP, and MSFD (Laws 3938/11 and 4546/18), while Blue Growth Strategy is considered in all projects that are being implemented. Also, there are references to other issues or sectors that influence indirectly the coastal zones on a plenty of presidential decrees, ministerial decisions, and other laws. These references are about management of protected areas, organization of port facilities, industry, tourism, *etc.* Regarding the Maritime Spatial Planning component, a legislative tool governs the coastline, in Article 3 of the law 4447/2016, which states that the National Spatial Strategy must include key sustainable development priorities for subcategories of the National Territory.

V. Established sectors

The main established sectors described by the Co-Evolve4BG project are analysed in this section: marine living and non-living resources, renewable energy, maritime transport, port activities, shipbuilding and repair and coastal and maritime tourism.

The employment generated by the established sectors of the Blue Economy is around 2,850,000 jobs and GVA is around €178 billion. Jobs and values are as shown below, for EU (Figure 5), Mediterranean (Figure 6) and Greece (Fig. 7).

Employment in established sectors of the Greek blue economy is around 574,102 jobs and GVA is around €7.9 billion. The contribution of the blue economy to the Greek national economy is considerable. Greece records the highest share in employment, as 15.3% of all national jobs are on Blue Economy sectors. However, Greece ranks fourth in GVA, with a contribution of 5.0%, as shown in Table 3. Coastal tourism is the dominant sector of the Greek blue economy, contributing around 85.8% to employment and 66.6% to GVA in 2018 (EC, 2021).

Greek shipping continues to hold the first position internationally even after the COVID-19 pandemic outbreak. The Greek fleet represents around 20.7% of total world tonnage and 54% of the total EU fleet. Greek ship owners control 32.6% of the world oil tankers' fleet, 21.7% of the world bulk carriers and 8.9% of the world container vessels (EC, 2021).



Figure 4. Blue Economy contribution on Greek Economy

Table 3. Evolution of the Blue Economy established sectors in Greece (The EU Blue Economy Report Annexes, 2021)

Persons employed (thousand)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Living resources	43.1	44.2	43.5	42.6	39.6	36.4	37.9	38.3	35.5	35.0
Non-living resources	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ocean energy	-	-	-	-	-	-	-	-	-	-
Port activities	6.8	6.7	6.1	5.7	6.3	14.0	15.6	15.5	14.9	14.7
Shipbuilding and repair	9.5	9.0	6.5	6.6	5.7	8.1	7.8	8.4	8.1	8.5
Maritime transport	23.6	21.1	20.9	19.2	18.1	21.9	20.7	20.3	20.1	23.4
Coastal tourism	493.3	396.4	283.7	178.9	225.9	293.7	243.0	315.8	361.5	492.4
Blue economy jobs	576.5	477.6	360.9	253.1	295.7	374.1	325.1	398.4	440.1	574.1
National employment	4,469	4,306	3,979	3,636	3,459	3,480	3,548	3,610	3,683	3,751
Blue economy (% of national jobs)	12.9%	11.1%	9.1%	7.0%	8.5%	10.8%	9.2%	11.0%	12.0%	15.3%

GVA (€ million)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Living resources	237	301	332	223	182	283	262	649	530	495
Non-living resources	4	5	5	5	4	4	3	6	4	5
Ocean energy	-	-	-	-	-	-	-	-	-	-
Port activities	331	342	276	257	268	539	718	767	781	746
Shipbuilding and repair	441	265	235	200	175	196	218	186	175	165
Maritime transport	1,123	788	713	784	724	1,030	1,234	1,126	1,119	1,248
Coastal tourism	11,006	8,399	5,750	3,294	3,961	3,885	3,404	3,627	4,973	5,313
Blue economy GVA	13,142	10,101	7,310	4,761	5,314	5,937	5,838	6,361	7,582	7,972
National GVA	212,391	199,644	181,909	168,979	160,237	157,913	156,613	154,044	157,526	160,789
Blue economy (% of national GVA)	6.2%	5.1%	4.0%	2.8%	3.3%	3.8%	3.7%	4.1%	4.8%	5.0%

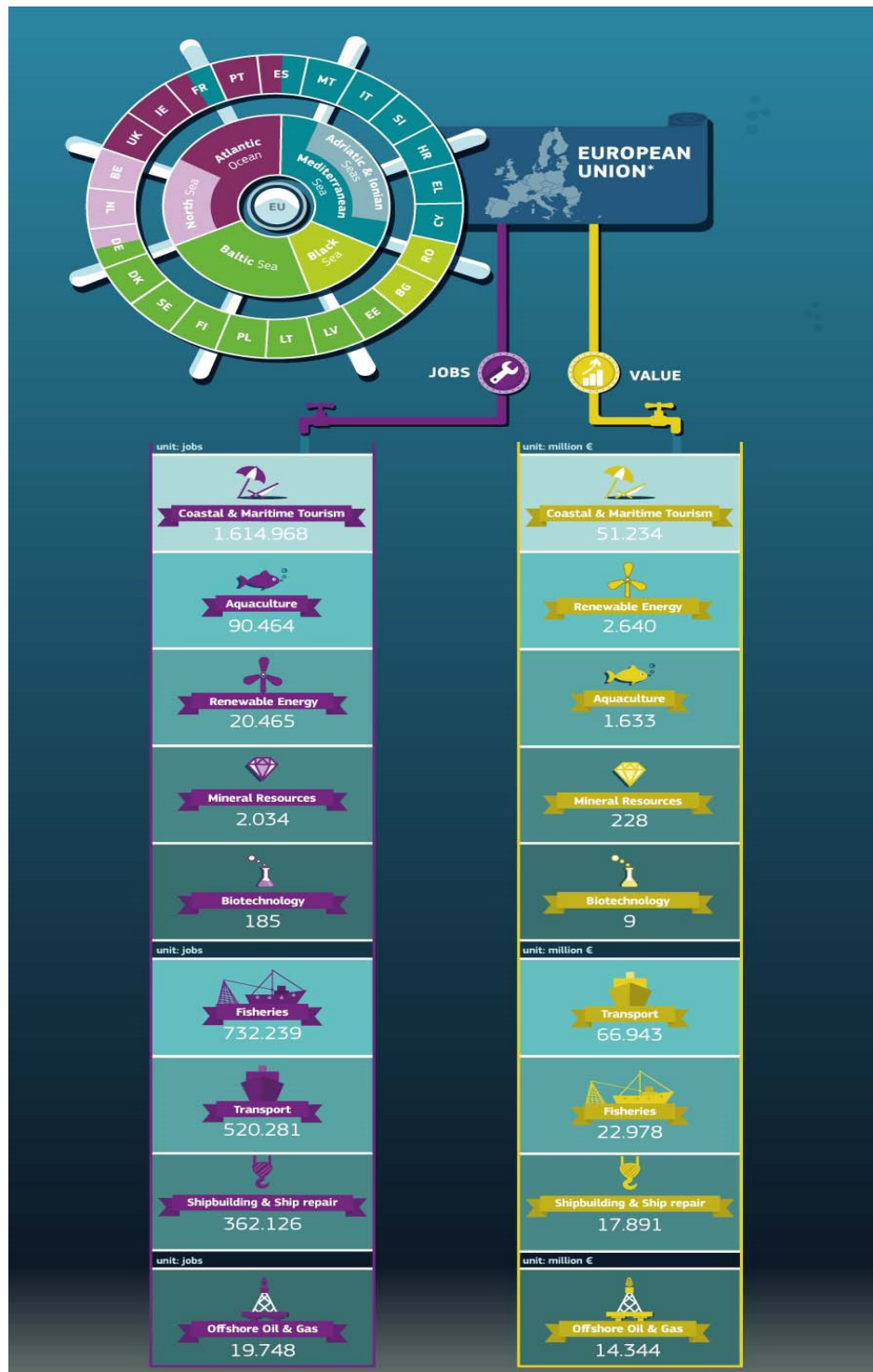


Figure 5. The Blue Economy in EU shown in jobs and values
(ec.europa.eu/assets/mare/infographics/)

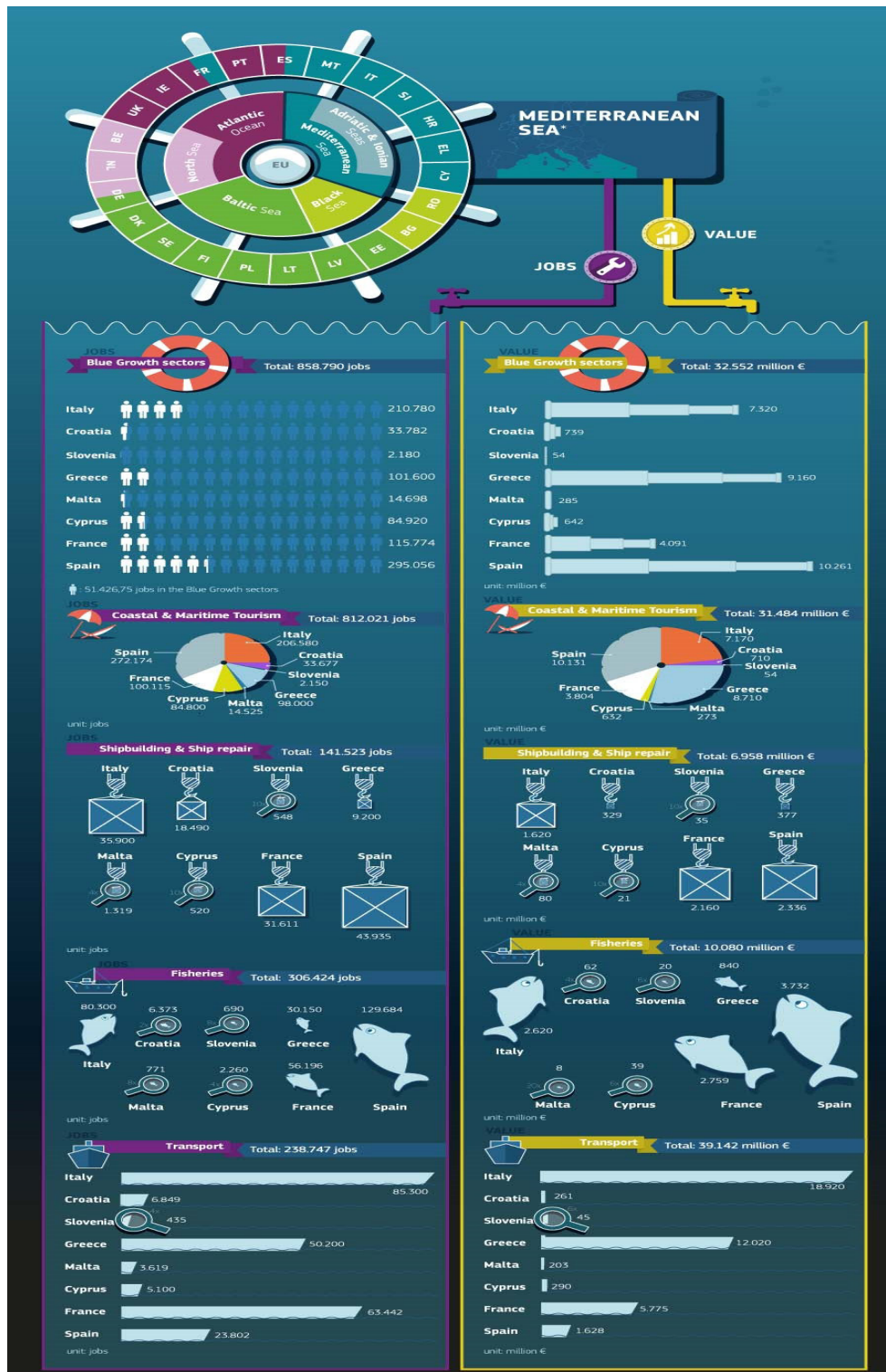


Figure 6. The Blue Economy in MED shown in jobs and values
(ec.europa.eu/assets/mare/infographics/)

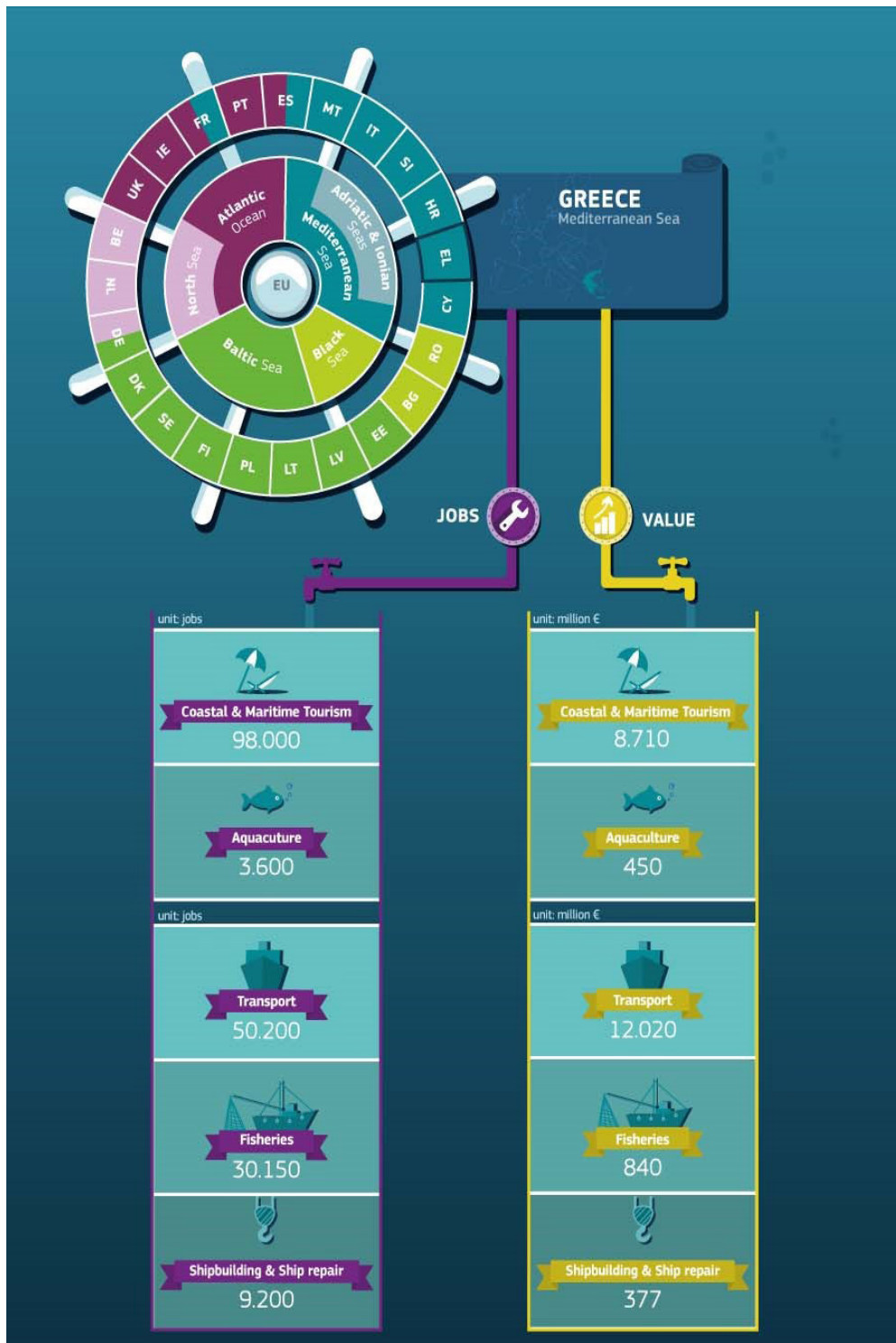


Figure 7. The Blue Economy in Greece shown in jobs and values (ec.europa.eu/assets/mare/infographics/)

V.1. Marine living resources: fisheries

The European Union has the sixth largest production of fishery and aquaculture products and covers approximately 3% of world production. The EU has about 59,000 active vessels landing about 4.5 million tons of seafood worth around €6.7 billion with aquaculture sector reaching a production of 1.2 million tons worth €4.1 billion in 2018. Employment in living marine resources in the EU Blue Economy represents around 12% of total jobs and GVA around 11% of the total in 2018, with signs of improvement compared to 2009. Also, capture fisheries production has increased and so profits have risen over the last few years, partly due to better status of fish stocks and increased opportunities (Addamo *et al.* 2021).

Fish and shellfish stocks management remains critical in the Mediterranean Sea, with 87% of the assessed stocks overfished and a significant lack of knowledge about fishing pressure and reproductive capacity. In this regard, the MedFish4Ever initiative has launched a new political impetus to restore fisheries governance.

Fisheries have been an activity of vital importance for the communities of the island and coastal regions of Greece for thousands of years. Greece is a net exporter of fish and fish products. Between 2008 and 2018, exports increased by a total of 11%, while imports decreased by 14% (OECD, 2021). Fisheries in the Greek seas can be grouped into two large categories: Small-scale artisanal fisheries and Large-scale fisheries. Small-scale fisheries use nets, long lines, and traps. They are fundamental parts of the Greek island and coastal economy and culture, representing 97% of the Greek fishing fleet, and providing 50% of the total national catch. Large-scale fisheries use gear such as benthic trawling and purse seine nets. They make up approximately 3% of the Greek fishing fleet but provide 50% of the total fish catch. When deployed unsustainably, they can cause extensive damage to marine ecosystems. Catch levels in the Mediterranean have declined by 30% in the last 10 years. Although stock and catch assessments regarding the Greek seas are limited, research in the eastern Aegean Sea has indicated a decline of up to 50% in catch levels of small-scale fisheries just between 2009 and 2011 (Archipelagos, 2022).

V.2. Marine living resources: aquaculture

Aquaculture production has remained stable over the last decades even if its value has increased. The production mussels, which is the main species produced in the EU has decreased in recent years due to environmental factors. The production of other important species (such as seabream and seabass), where the producers have higher degree of control on the production factors, has increased (Addamo *et al.* 2021).

The EU aquaculture reached about 1.2 million tons in sales and around €4.1 billion in turnover in 2018. Profitability for the EU aquaculture was positive in 2018, however the GVA decreased by 8%. Production is mainly concentrated in four countries: Spain with 27%, France with 18%, Italy with 12% and Greece with 11%. These four countries are making up to 69% of the sales and cover 62% of the turnover in the EU-27 (Addamo *et al.* 2021).



Figure 8. Shares of employment and GVA in the EU Marine living resources sector, 2018 (Addamo *et al.* 2021)

In 2018, Greece produced 0.2 million tonnes of fish (including molluscs and crustaceans), with a value of USD 794.4 million. 80% of this value came from aquaculture and 20% from fisheries (that is, the capture of wild resources). Between 2008 and 2018, the quantity produced increased by 5%, while its value decreased by 22% (OECD, 2021). Additionally, the marine aquaculture sector has come near to completion of a major restructuring, consolidating the three largest Greek aquaculture companies, hence representing 75% of the country's total marine aquaculture production (OECD, 2021).

V.3. Marine non - living resources: Offshore O&G

Most of the current European oil and gas production takes place offshore, mainly in the North Sea and to a lesser extent in the Mediterranean and Black Seas. Offshore production occurs in the Mediterranean on the continental shelf in Greece, Spain, and Croatia. Employment in non-living resources of the EU blue economy accounts for around 0.2% of total jobs and 2% of total GVA (Addamo *et al.* 2021). Offshore oil and gas sectors record a decline due to the decrease of production. Although, crude production and consumption are in a decline, crude oil and its products remain the main contributors to energy consumption.

Offshore drillings in Greece are present only near the island of Thasos in the Northern Greece in the region of Eastern Macedonia and Thrace. The Oil Field of Prinos is in the northern Aegean Sea, between Thasos and Kavala. Discovered in 1971 and began

production in 1974, it was named after the village of Prinos which is the nearest inhabited place. The proven reserves of the Oil Field of Prinos were estimated at around 90 million barrels, and production is centred on 1,900 barrels per day (300 m³/day). By 2020, it has delivered 120 million barrels of crude, exceeding the original estimate. Due to market concerns and economic crisis based on the measures taken to confront the COVID-19 pandemic in early 2020, oil prices collapsed.

As a result of the active compressional tectonics, Greece is primarily a mountainous country, with more than 300 mountains, about 40 of which exceed elevations of 2,000 m. It is also characterised by deep sea waters, which reach depths of over 3,500 m. The blocks offered for offshore exploration lie in areas with water depths ranging from a few hundred metres to 3 500 m. Clearly, this is not an easy environment for oil companies to work in. However, the industry's deep-sea technology is already well developed and successfully tested; Ultra-deepwater exploration well (3,400 m, Total's Raya-1 well in Uruguay) continues drilling trend in global exploration (HHRM, 2019).

V.4. Marine non-living resources (traditional): operation / extraction of gravel, sand, clays, kaolin, Extraction of salt

EU Blue Growth Strategy identifies seabed mining as an important component of future economy. Sand and gravel demand is likely to increase in the next years. As coastal communities attempt to adapt to new pressures affected by climate change, dredging, beach nourishment and sand reclamation may intensify.



Figure 9. Shares of employment and GVA in the EU Marine non-living resources sector, 2018 (Addamo *et al.* 2021)

Greece is a major global supplier of several key industrial minerals, notably bentonite, magnesite, and perlite. The country's position as a leading producer of these minerals is well established. Greece is the only producing country of huntite, the leading global supplier of perlite, the second in the production of pumice and bentonite, and the first in the export of magnesium compounds within the EU. Greece is also the second largest producer in the EU, and the fifth largest worldwide, of lignite (brown coal). The West Macedonia Lignite Centre, with a production of 62.5 million tons of lignite and overall solid material transportation of 340 million m³ in 2008 and the Megalopolis Lignite Centre, with 13.2 million tons of lignite and overall material transportation of 40.1 million m³ in 2008, comes under the Public Power Corporation's (PPC) Mines Division (Mavroidis *et al.* 2011). These lignite mines supply twenty-one (21) power plants with an installed capacity of 5,287 MW, which corresponds to 50% of the total installed capacity of the country. Lignite exploitation is still based on the continuous method of excavation - transportation - deposition. The mining procedure of a lignite deposit includes extraction, transportation, and deposition of materials (lignite and co-excavated waste materials). The co-excavated waste materials are transported and put back mainly in the excavation voids to minimize the impact on the landscape.

Moreover, Greece has significant deposits of clay, limestone, slate, gypsum, kaolin, mixed sulphide ores (lead, zinc), olivine, pozzolan, quartz *etc.* Finally, there are significant mineral deposits which have not yet been exploited, or where exploitation has temporarily ceased (such as manganese, chromite, uranium, gold, oil, emery, salt *etc.*), as well as major geothermal energy potential, suitable either for power generation or for various thermal applications. The annual land uptake by mines, quarries and waste dump sites is estimated at 1984 ha/y (Mavroidis *et al.* 2011).

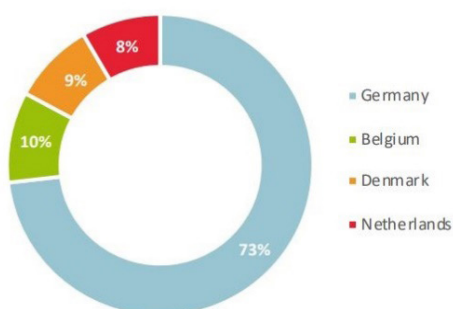
V.5. Marine Renewable Energy

Ocean energy technologies are currently being developed and tested to exploit the vast source of clean, renewable energy that seas and oceans offer. Although still at the research and development stage and not yet commercially available, promising ocean technologies include wave energy, tidal energy, salinity gradient energy and ocean thermal energy conversion (OTEC). Wave and tidal energy are currently the more mature of these innovative technologies (Addamo *et al.* 2021).

Europe is the world leader in offshore wind energy, with over 90% of the world's total installed capacity. EU now has a total installed offshore wind capacity of 14.6 GW across 11 countries. In 2020, 2.4 GW of new capacity were added to the grid. Germany currently leads in offshore wind energy with 73% of the jobs and 61% of the GVA, followed by Denmark with 31% of the GVA. The sector is in large expansion (Addamo *et al.* 2021).

Development of Marine Renewable Energy sector creates probable synergies with Oil and Gas sector, with requirements such as construction, maintenance, and decommissioning of offshore projects. These synergies are not only limited on the energy sector but also on shipping, port activities and other maritime industries. Shipyards and ports could benefit from offshore energy because ports are home of wind turbines' manufacturers. The Offshore Renewable Energy Strategy published by the European Commission at the end of 2020 paves the way for offshore wind and other offshore renewable technologies to contribute to the EU's ambitious energy and climate targets of the European Green Deal.

Employment by Member State



Value added by Member State

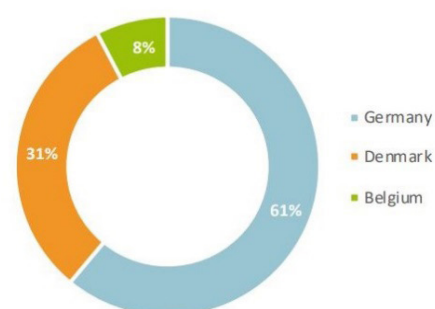


Figure 10. EU Offshore wind energy sector's employment and GVA, 2018
(Addamo *et al.* 2021)

Greece has almost 16,000 km of coastline, so the exploitation of marine technologies could contribute to the power supply of most islands as well as of the mainland. Medium-sized and small remote islands face serious electrification and water shortage problems (Egbert and Ray, 2003) because their electricity generation is based on outdated internal combustion engines consuming expensive and heavily polluting imported diesel or heavy (mazut) oil. Taking into consideration the remarkable wave potential of these islands (Xanthaki *et al.* 2017), wave energy utilization – among the emerging renewable energy technologies – is indisputably ranked among the energy sources that could resolve the controversial issue of energy demand coverage, especially on remote islands.

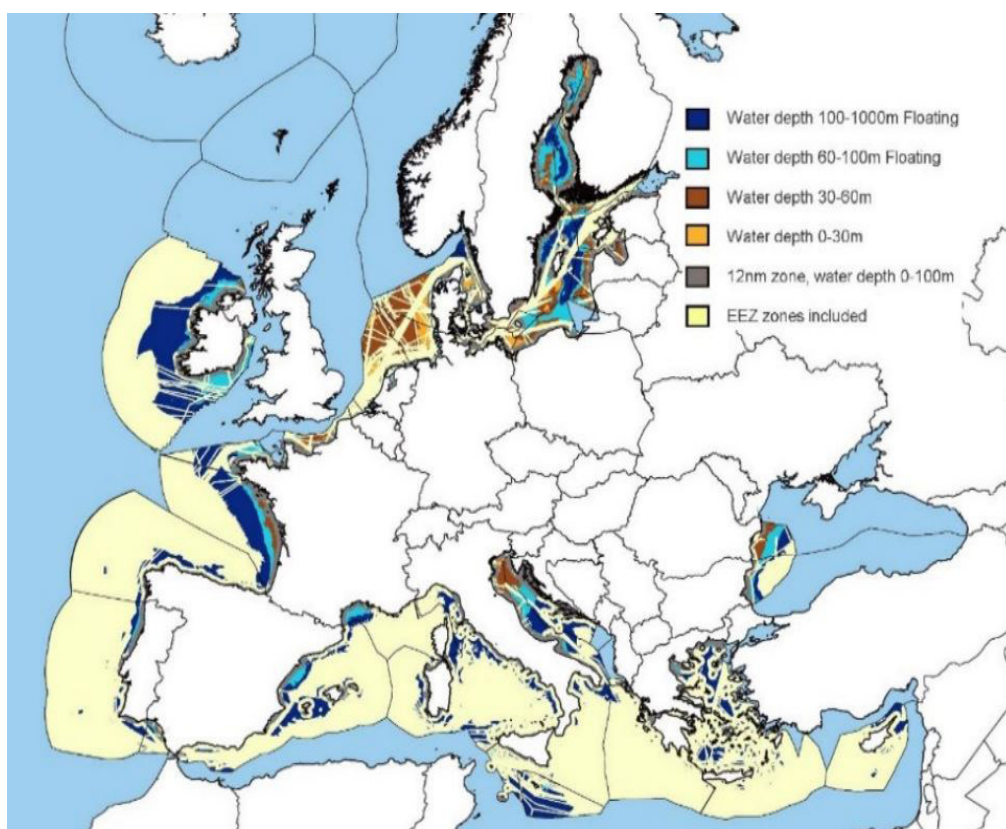


Figure 11. Offshore Wind Potentials (Addamo *et al.* 2021)

V.6. Maritime Transports

Maritime transports in the EU represent about 80% of worldwide goods transportation and 33% of the intra-EU trade. About 420 million passengers embarked and disembarked at EU ports in 2019. Employment in the maritime transport sectors of the EU blue economy accounts for around 9% of jobs and 17% of GVA. Maritime generated a GVA around €30 billion; while the investment ratio estimated at 45% and the turnover reported about €160 billion. Germany leads Maritime transport, contributing with 35% of the jobs and 37% of the GVA, followed by Italy with 17% of the jobs and 16% of the GVA (Addamo *et al.*, 2021).

Greece remains the world's largest ship owning nation with a fleet of 4,901 vessels. Greek shipowners' controls 19.42% of global deadweight tonnage (dwt). In 2020, the Greek-owned fleet grew by over 4% to approximately 364 million dwt. Greece continues to increase its share of the European Union (EU)-controlled fleet. The Greek-owned fleet represents 58% of the EU-controlled fleet. More than a third of the Greek-owned fleet or 1,706 vessels, fly the flag of a European Union member state (IHS, 2021).

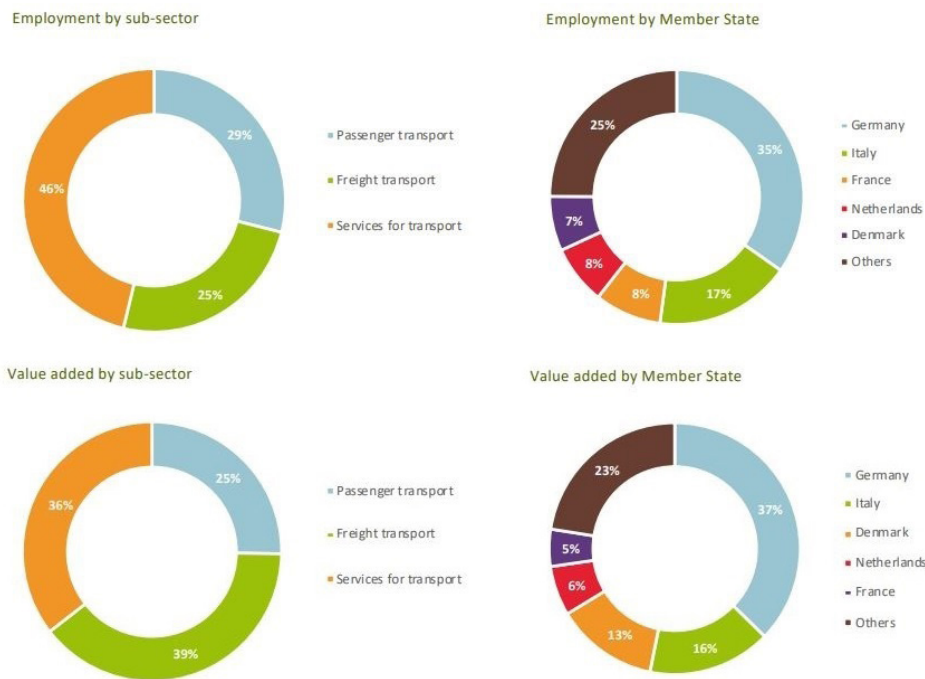


Figure 12. EU Maritime transport sector's employment and GVA, 2018
(Addamo *et al.* 2021)

V.7. Port activities

Ports generated around €26.5 billion GVA in 2018 with gross profit at €10.6 billion and turnover at €65.1 billion. Employment in the sector is approximately 384,039 jobs with an annual salary of €41,295.

A lot of EU ports are clusters of energy and industry. Cooperation between ports, line and other logistics' actors is necessary to ensure efficient and smooth cargo flows. Basic services for Blue Economy sectors (*e.g.*, maritime transport, renewable energy, tourism, defense, *etc.*) are provided by port activities. Although beyond of these key services, ships also dock, refuel, and offload their waste at ports.

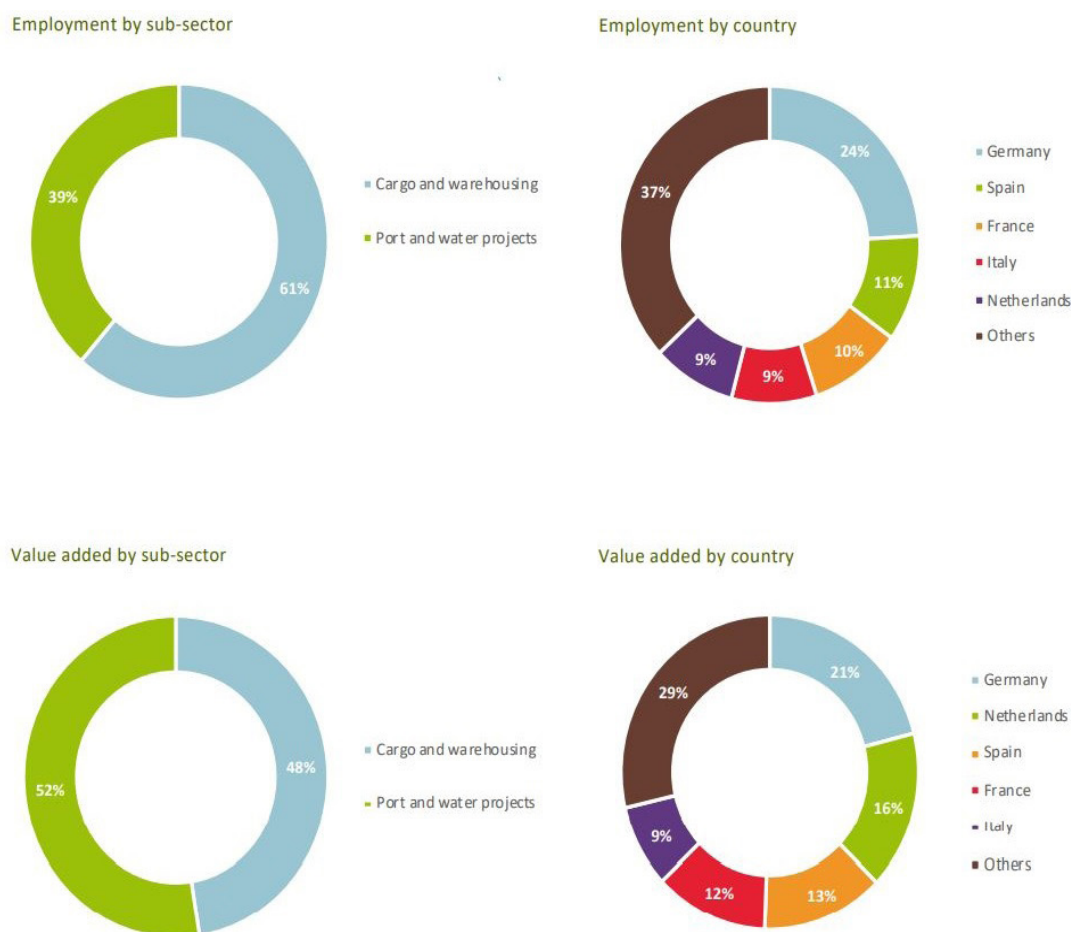


Figure 13. Employment and GVA in the port activities sector in the EU, 2018
(Addamo *et al.* 2021)

The average value for the number of 20-foot containers passing through the Greek ports during 2000 – 2020 was 2.77 million containers with a minimum of 0.67 million containers in 2008 and a maximum of 5.99 million containers in 2019 (Fig.14). The latest value from 2020 is 5.76 million containers. For comparison, the world average in 2020 based on 100 countries is 8.39 million containers.

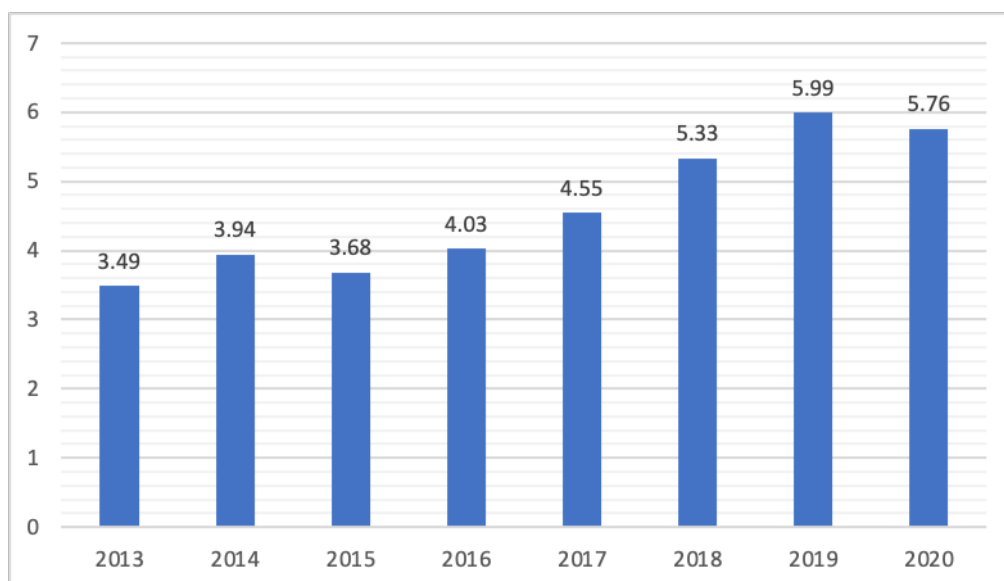


Figure 14. Number of 20-foot containers passing through the ports of Greece, 2000-2020

V.8. Shipbuilding and repair

In Europe are located about 300 shipyards highly specialized. Segments of shipbuilding with high level of technology and added value, such as cruise ships, offshore support vessels, ferries, mega yachts, *etc.* are very promoted in the area. The EU is also a global leader in the production of high-tech, advanced maritime equipment and systems. The sector in EU is about 7% of the jobs and 8% of the GVA in the total EU Blue Economy in 2018.

The potential impact of emissions from shipbuilding operations on their immediate environment can be very significant, especially given that shipyards are inevitably near and on water, which increases the likelihood of propagation of some of those emissions, notably due to the hazardous materials (such as asbestos, lead or mercury; *Addamo et al. 2021*).

Greece's developed shipyards are Skaramangas, Elefsina, Syros and Avlida, which is now in the process of privatisation. An important part has also been played, mainly regarding repairs, by the Piraeus-Perama ship-repair zone, which operates on the basis of independent small and medium-sized enterprises (SMEs). The activities of these SMEs, which in recent years have been in deep crisis, have at times represented more than 50% of total repairs performed in Greece. The ship-repair zone owes its share of the market to the important know-how of the shipbuilding and ship-repair teams that work there. The Skaramangas shipyard is the biggest industrial shipbuilding unit, as far as turnover and number of workers are concerned. During the past 15 years, however, turnover in Greek shipyards has been steadily decreasing, as has the number of persons employed.



Figure 15. EU Shipbuilding and repair sector's employment and GVA, 2018
(Addamo *et al.* 2021)

V.9. Coastal and maritime tourism

EU counts about 40% of global arrivals. Coastal areas and islands tend to be the major reason about this. Their unique characteristics make them ideal places for leisure and tourism activities. The increasing number of tourists led to concerns about the sustainable tourism of coastal areas and an example of these concerns is the Co-Evolve4BG project.

Coastal areas recorded more than three quarters of the total nights spent in tourist accommodation across Malta, Cyprus, Greece, Croatia, Portugal, and Spain in 2017 while the three most popular tourist destinations in the EU, are coastal and are, the Canary Islands, Catalonia in Spain and the Adriatic coastal region of Jadranska Hrvatska in Croatia.

Greece, consisting of numerous islands and having one of the largest fleets in the world, has the potential to become a European strategic port of "Blue" economic development. Living Prospects, realizing the geostrategic dynamics of the country in the Mediterranean and Adriatic Sea, being a marine crossroads between Europe, Africa and Asia, as well as the resulting prospects for cooperation and economic growth,

provides consultancy services to port authorities, private and public bodies due to projects related to the improvement of integrated maritime policies, improves access to maritime information, undertake effective and sustainable administration and management of maritime activities and actions related to coastal tourism.

About 2.4 million businesses in EU (of which 90% are SMEs) are in the tourism industry, which records about 10% of GDP while for every €1 generated in the tourism sector €0.56 Added Value is created. The sector directly employs more than 2.8 million people with an average salary of around €18,360 in 2018 (Addamo *et al.* 2021).

The COVID-19 pandemic outbreak in early 2020 hit coastal tourism at the worst possible time. Coastal tourism starts on Easter when the businesses need an income boost to stabilize but with the lockdowns followed by an outbreak this period never came. The recovery period is expected slowly and in a longer-term framework, but many businesses will not fully recover.

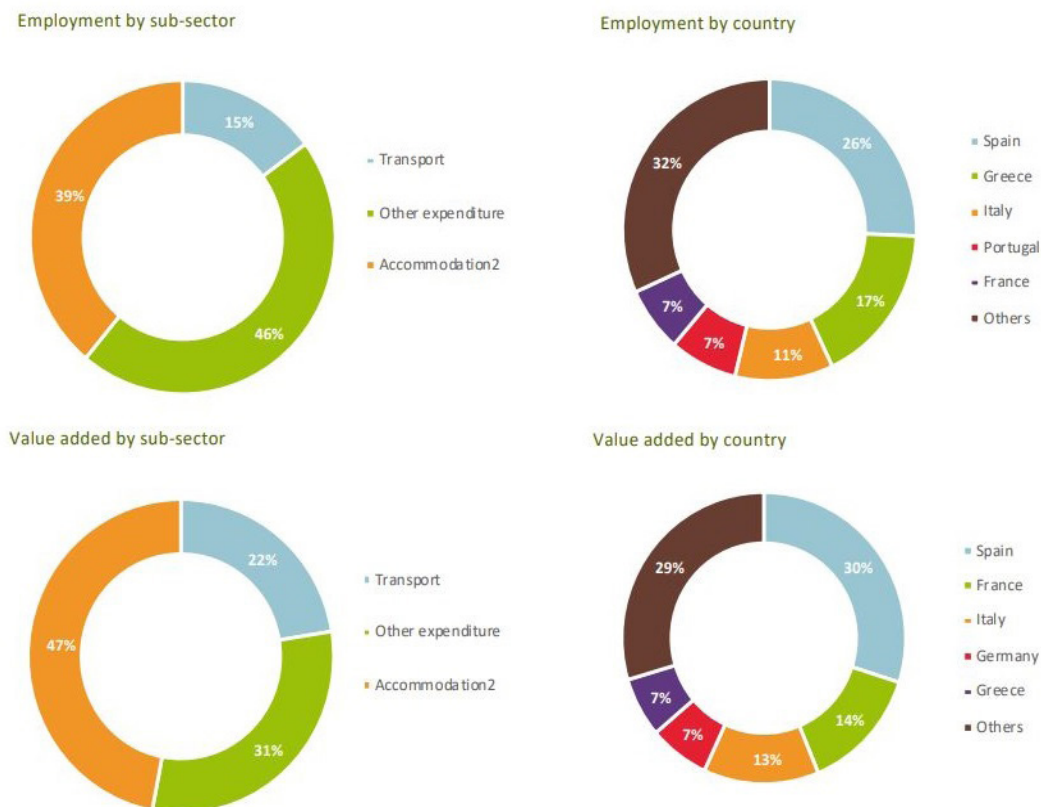


Figure 16. EU Coastal tourism sector's employment and GV, 2018 (EC, 2021)

VI. Emerging Sectors

Main emerging sectors as described by Co-Evolve4BG project are analyzed on this section. Deep sea mining blue bioeconomy, biotechnology, desalination, maritime defense and submarine cables.

VI.1. Marine non-living resources: marine minerals (deep sea mining)

Deep-sea mining could supply the growing demand of raw materials, such as rare elements and cobalt.

Marine materials have been extracted for a long time in Europe with an example of maerl beds which extraction is for agricultural use as a fertilizer at rates of up to 500,000 tons per year (in France). Extracting minerals and metals has also some challenges to face, such as mapping of reserves, appropriate and safe technology development, and other challenges on environmental impacts. These impacts must be better known and accompanied by solid environmental and legal frameworks.

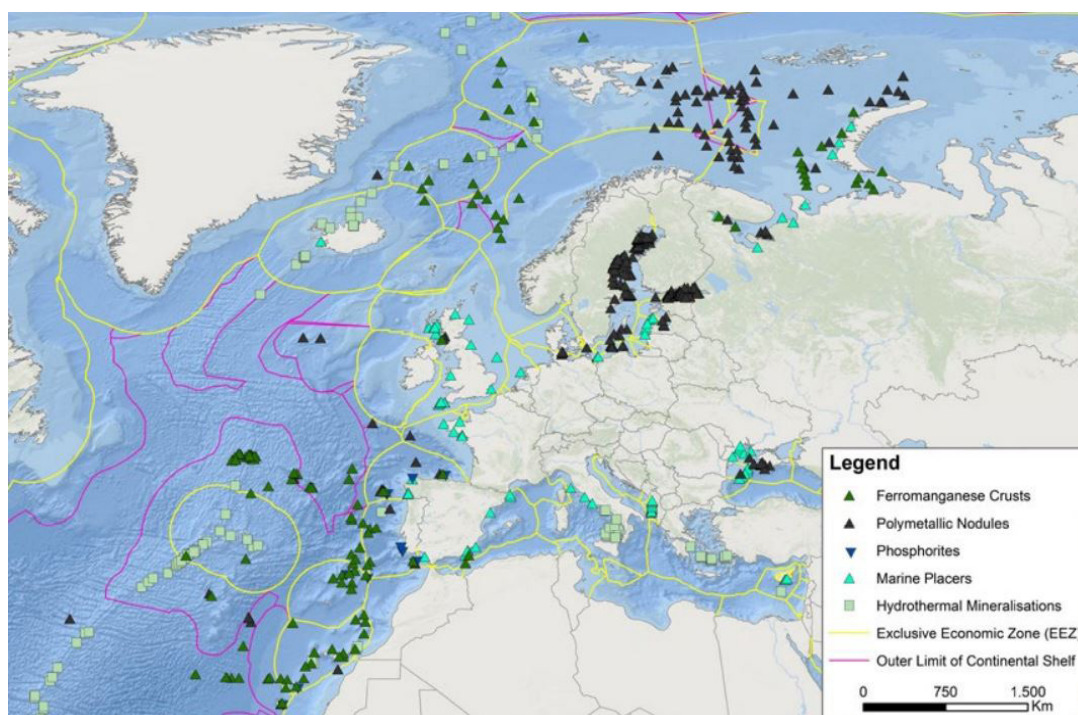


Figure 17. Existence of marine minerals in the EU (Addamo *et al.* 2021)

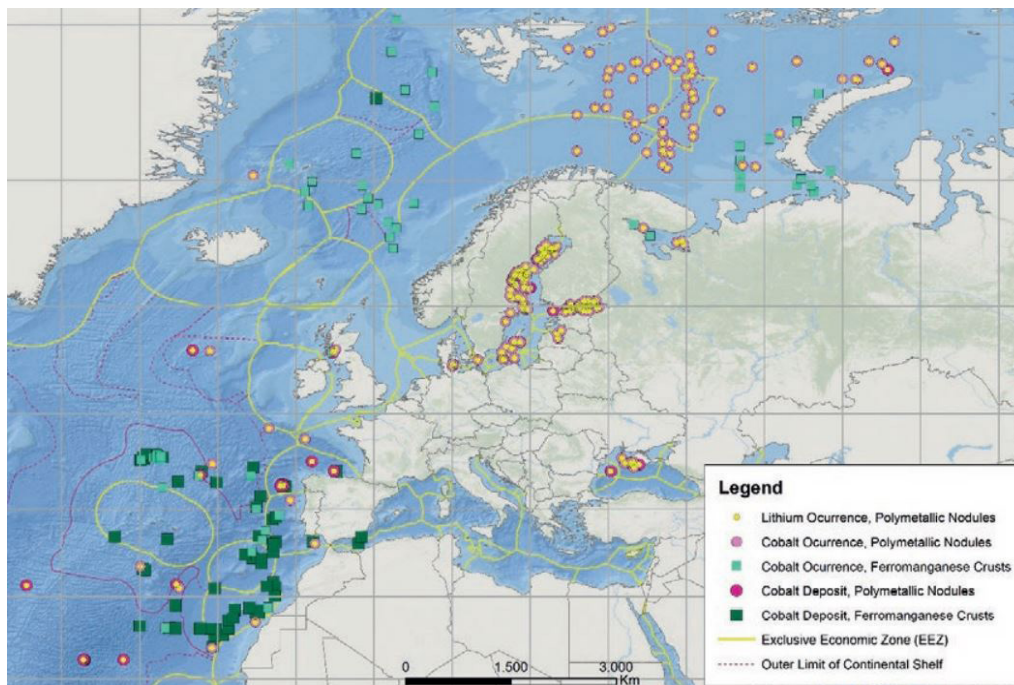


Figure 18. The existence of cobalt and lithium in Europe (Addamo *et al.* 2021)

There is not any commercial deep-sea mining project in Europe. In this context, scientists believe that biodiversity loss from deep-sea mining is inescapable, irreversible, and most likely permanent. The EU will keep up research funding on the impacts of these activities and on environmentally friendly technologies.

The harshness of mining impacts requires new and innovative technologies that can limit generating adverse environmental impacts during mining and that can develop appropriate policies. The EU funds some studies and projects aiming at increasing the knowledge of marine mineral resources and ecosystems to better understand the potential impacts of mining and the way to reduce them.

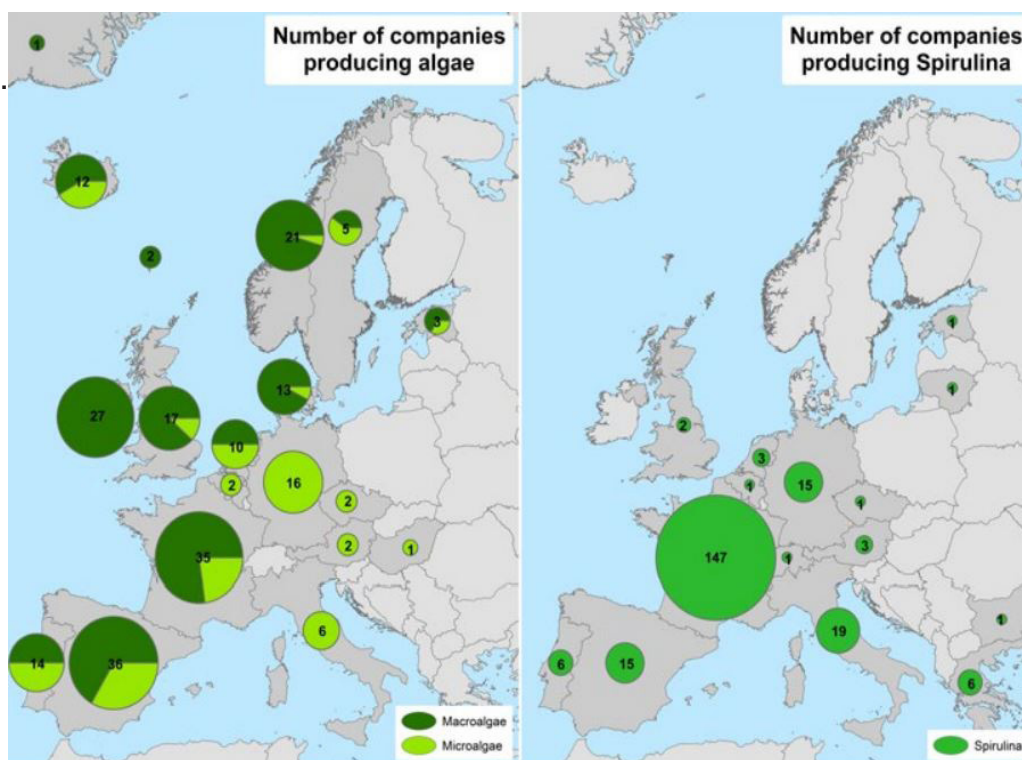
The Greek mining/metallurgical industry constitutes an important sector of the economic activity of the country (it constitutes 3-5% of the GDP, with the inclusion of interrelated enterprises such as quarrying, processing and production of intermediate and final products) and supplies essential raw materials for primary industries such as cement, production of energy, non-ferrous metals (aluminum, nickel, *etc.*), the industry of stainless steel *etc.* Estimated sales of the country's mineral industry and basic metallurgies, totals almost €2.5 billion (Mavroidis *et al.* 2011). Moreover, the industry provides a major source of employment in the country: approximately 20-23 thousand employees are employed in the sector (in mines, quarries, and the two basic extractive metallurgies of the country) and more than 90 thousand are employed in jobs dependent upon or associated with mining. In 2006, the mining sector employed approximately 0.4% of the Greek labor force. Furthermore, since - as a rule - the processing of these raw materials takes place in the region in which they are excavated, the industry contributes considerably to coveted regional growth (Mavroidis *et al.* 2011).

VI.2. Blue bioeconomy and biotechnology

The Blue Bioeconomy and biotechnology sectors in Europe include groups of marine organisms and their biomass applications. This biomass is used for a variety of commercial applications including food and food supplements, cosmetics, fertilizers, biomaterials, bioremediation or biofuels (Addamo *et al.* 2021).

According to an analysis of EU funded projects, through the European Regional Development Fund and Horizon 2020 in projects supporting Blue Bioeconomy thematic areas, around €262 million have been invested since 2014 (Addamo *et al.* 2021).

Joint efforts of the Mediterranean countries, with the support of the European Commission, since early 2014 have resulted in the launch of the BLUEMED Strategic Research and Innovation Agenda (SRIA) in October 2015, calling for joint and aligned research and innovation strategies, programs and activities related to the Mediterranean Sea. The BLUEMED Coordination and Support Action, a H2020 project to support the Initiative funded by the EC with almost €3 million and under coordination of the Italian National Research Council and involving partners from Greece, Cyprus, Malta, Croatia, Spain, Slovenia, Portugal, and France, started in October 2016 aims primarily to fill the knowledge gap on Blue biotechnology among BLUEMED partners and seek active cooperation with other European networks such as EMBRC and Euro Marine (Doussineau *et al.* 2020).



Since 2017 the BLUEMED Initiative supports and facilitates cooperation and coordination not only among the EU Member States but also with the rest of the Mediterranean countries, to promote the alignment of programs and pooling of resources and investments to address the challenges identified in the BLUEMED SRIA. Coordination with two relevant initiatives targeting the Mediterranean Basin, namely the WESTMED – Towards a Sustainable Blue Economy Initiative for the Western Mediterranean, and the EUSAIR – European Strategy for Adriatic-Ionian Region, is expected to enhance the efficiency of the actions, the investments in marine and maritime research, innovation and technology and to reduce fragmentation and duplication of efforts (Doussineau *et al.* 2020).

VI.3. Desalination

European capacity of desalination has grown over 2000-2009. In January 2021, European Union counted 2,309 operational plants producing 9.2 million m³/day of fresh water. Desalination capacity in coastal areas is mainly located in Mediterranean, supplying more than 5 million m³/day of freshwater.

Spain holds about 65% of the desalination in the EU, with the rest of the capacity being mainly in Italy with 7.5%, France with 3.5%, Cyprus with 3.4%, Malta with 2.9% and Greece with 2.8% (Addamo *et al.* 2021).

The increase in the demand for consumable water and the population increase have contributed to the growth of desalination. The high investments required in desalination plants make things difficult during the COVID-19 pandemic crisis period. Desalination is seen as a “win-win solution” to solving water cycle problems and as societies understand its benefits, it could become the most widely used system. In the frame of sustainability, the energy consumed by desalination must be fully decarbonized.

Desalination processes in Greece are mainly found in some of its islands. For example, Iraklia has an annual water supply need of approximately 20,000 m³. As it lacked a water treatment center, ships had been used to transport water to the island. This was inefficient, vulnerable to bad weather, and a huge burden on the state’s budget. The desalination plant has solved the problem. With a daily capacity of 300 m³ of drinking water, it covers the needs of the island’s 141 permanent residents and 1,260 visitors. Greece has an estimated daily desalination installed capacity of around 200,000 m³/day (IRENA, 2015). The Greek Island of Mykonos built four reverse osmosis desalination plants from 1980 to 2008 with capacities ranging between 500 m³/day and 4,500 m³/day. However, local reports have revealed that the Greek island is set to declare a state of emergency to expedite the licensing and operation of two new desalination plants. Small-scale water desalination has been seen as a solution on islands where a lack of basic infrastructure, from electrical grids and piped water supply, is a challenge.

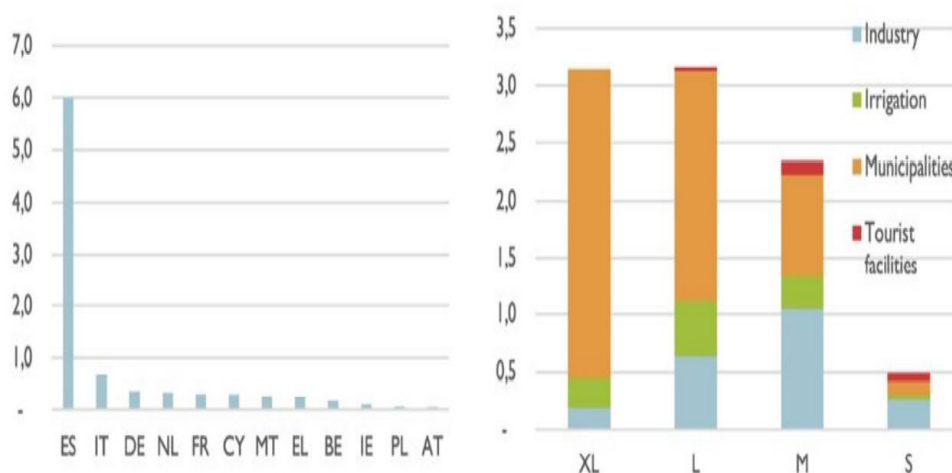


Figure 20. Desalination capacity of EU (Addamo *et al.* 2021)

VI.4. Maritime defense

European Union countries represent a large bulk of maritime trade in terms of tonnage so patrolling and protecting trade routes require important investments in terms of funding personnel and other assets.

European Defense Agency amounted total expenditure to €186 billion in 2019 (5% increase of 2018). Defense expenditure has grown since 2015 due to economic and financial crisis but by 2019, it reached 2007 levels (Addamo *et al.* 2021).

The COVID-19 pandemic crisis affects businesses activities with impacts in security of supply and future investments in R&D. According to (Addamo *et al.* 2021), there is an estimation that in the first half of 2020, new orders for warships in Europe have decreased by 62% in tonnage and 77% in value.

The modern Hellenic Navy places a decided focus on its OPV force, the fleet making up over half of all fighting strength. The branch lacks any form of aircraft-carrying capability, amphibious assault operation support, and destroyer types, making do with an aging fleet of submarines and frigates for the most part. The Papanikolis-class submarine increases the efficiency and capacity of the undersea force which numbers eleven in total - although more than half are old Glavkos-class boats. The frigate fleet is in worst shape as the youngest unit reaches 20 years. However, the category is set to be boosted by the new French-made FDI guided-missile frigates of which the Hellenic Navy is contracted for 3+1 to date. The mine warfare group suffers the same hull aging issues as other categories show and even the OPV force consists of many aging hulls with a few exceptions. In keeping up with regional rival Turkey, the Hellenic Navy has its work cut out for it and must invest more to keep pace with its potential at-sea enemy.

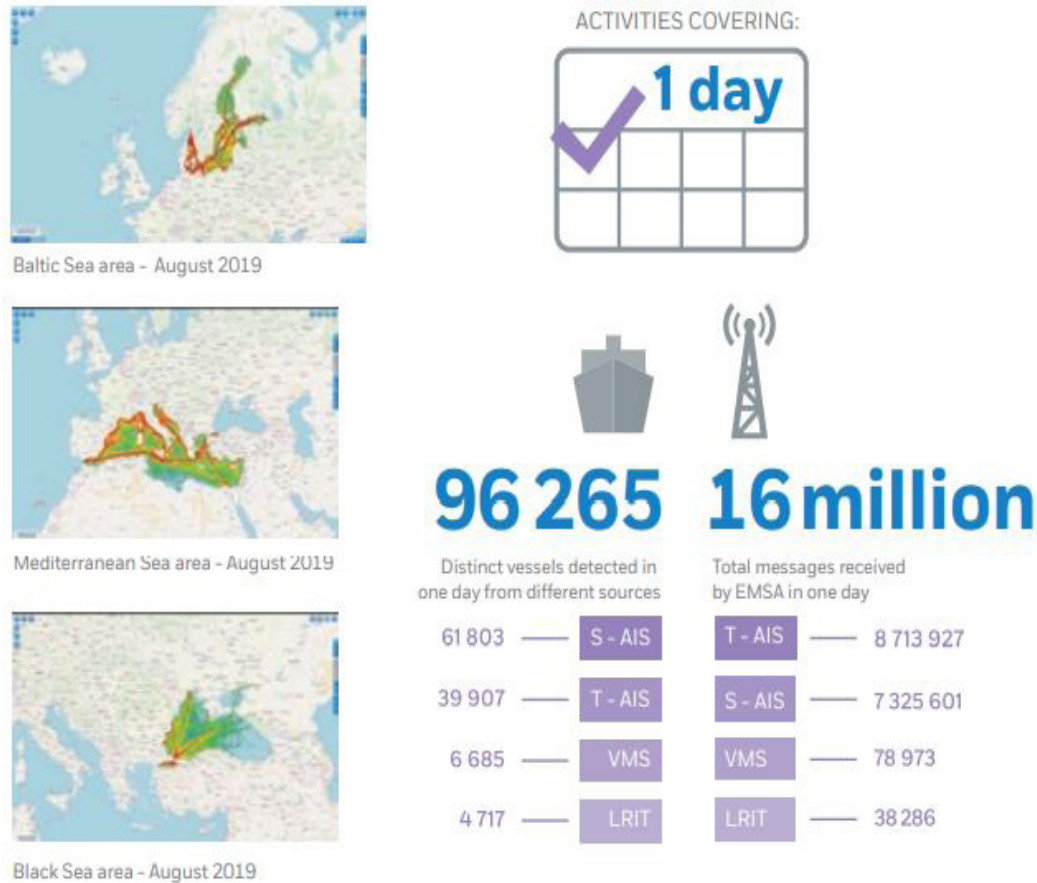


Figure 21. Traffic density maps displaying ship movement patterns (Addamo *et al.* 2021)

VI.5. Submarine cables

In 2020, there were more than 400 submarine cables while by 2025 there is an expectation of 45 more. Denmark counts the largest number of cables (32,000 km) while France is connected to the largest network of submarine cables (206,000 km).

Main challenges for submarine cables reveal from ship anchors and fishing nets while more present challenges are about international security and data protection of this infrastructure. Submarine cable networks are responsible for 99% of data transfer in the world with the economic importance increased with the COVID-19 pandemic crisis and the reliance on data and communication.

The regularly updated TeleGeography map of the world's major submarine cable systems and landing stations over Greece is shown in Figure 23.

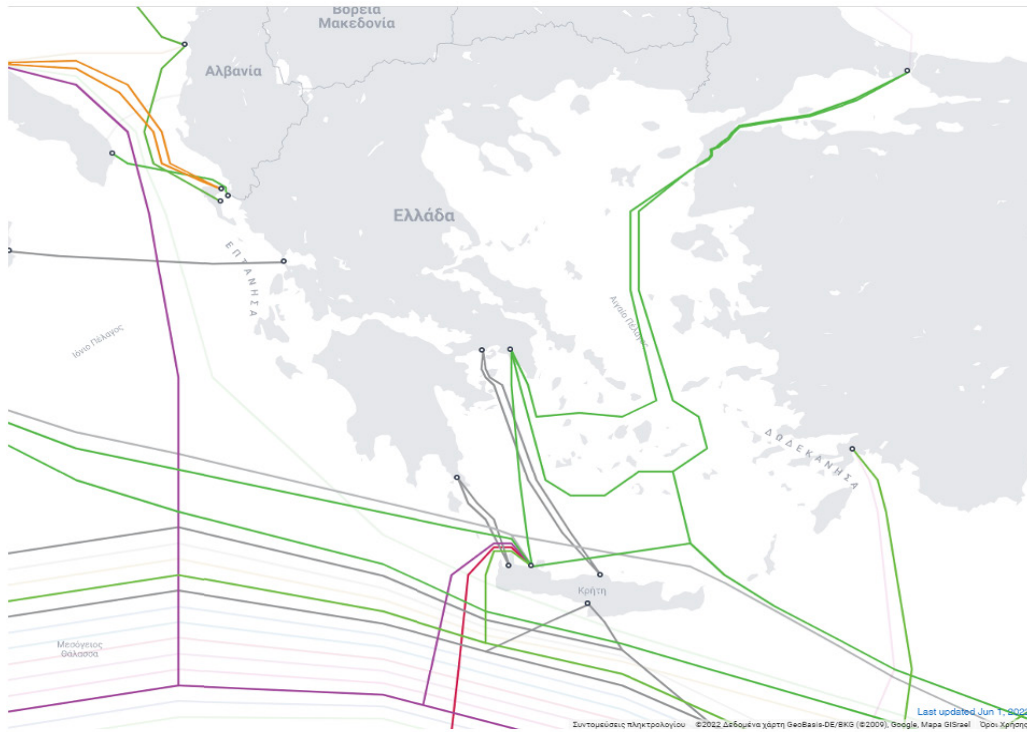


Figure 23. Greece Submarine Cable Systems (TeleGeography, 2022)

VII. Advantages of Blue Growth on Coastal/Maritime Tourism

Coastal tourism is about beach and relevant activities, such as swimming, sunbathing, coastal walks *etc.* Maritime tourism is about water and relevant activities, such as sailing, scuba diving, cruising *etc.*

The biggest sector (in terms of Gross Value Added and employment) of Blue Economy is coastal tourism. In 2018, coastal tourism contributed 64% of employment and 45% of GVA in the EU Blue Economy. According to EU Blue Growth Strategy, both coastal and maritime tourism have a high probability to promote a smart, sustainable and inclusive Europe.

Tourism is a basic sector in many economies of EU Member States, with socioeconomic impacts. For Southern Europe's countries, like Portugal, Spain, Malta, Italy, and Greece and for coastal countries, like Bulgaria, Croatia, Romania and Netherlands, tourism is notably important. Countries with a "3S" tourism model (sun, sea, and sand) generate a significant share of their total revenue from beach tourism.

VII.1. COVID-19 Crisis

The COVID-19 pandemic crisis is going to change preferences of the tourism sector and maybe in a long-term. For example, during the previous summer, tourists' fear of disease affected the preferred destinations and the will to travel.

Due to this crisis, tourists started looking for more nature-based destinations, less travelling (preferred national) and less overcrowding. While coastal areas are overcrowded during summer period, some places have been hit harder. Local data about transaction and unemployment come to confirm the fact that COVID-19 crisis affects coastal areas improperly. The estimate for the tourism sector is a drop of 60 to 80% due to measures that have led tourists not to travel and event cancellations. Around six (out of 23) million jobs lost as sector revenue losses range between 85%-90% (Addamo *et al.* 2021). In general, COVID-19 pandemic crisis affected heavily countries based on coastal tourism such as Greece (-12% in overall GDP) and Croatia (-10%). Therefore, recovery period is lagged until all the restrictions are lifted.

VII.2. Tourism capacity in coastal areas

With absolute values, Italy counts 916 thousand rooms, making it the EU country with the biggest capacity in coastal areas. Then next is Spain with 670 thousand, Greece with 585 thousand, France with 495 thousand and Croatia with 345 thousand rooms.

Regions (of EU-27, NUTS3 level) have on average 15,000 rooms. Mallorca in Spain reaches 173 thousand, which is the biggest value. Rhodes in Greece is following with 117 thousand, then Burgas in Bulgaria with 109 thousand, Algarve in Portugal with 105 thousand and Istria in Croatia with 101 thousand rooms.

Visitors to coastal areas were more numerous in southern EU Member States, which are generally more conducive to beach holidays due to climatic conditions. In 2017, coastal areas accounted for more than three quarters of the total nights spent in tourist accommodation across Malta, Cyprus, Greece, Croatia, Portugal, and Spain. The three most popular tourist destinations in the EU, all located in coastal areas, were the Canary Islands, Catalonia in Spain, and the Adriatic coastal region of Jadranska Hrvatska in Croatia.

Tourism plays an important role in many EU Member States' economies, with wide ranging impact on economic growth, employment, and social development. Tourism is particularly important for countries in Southern Europe, like Spain, Portugal, Italy, Malta, and Greece, but also in other coastal countries namely Croatia, Bulgaria, Romania, and the Netherlands. For many of the countries that offer “sun, sea and sand” (3S) tourism, beach tourism accounts for a significant amount of their total national revenue.

VII.3. Other Blue Economy sectors

Tourism coexistence with other sectors of Blue Economy such as extraction may bring conflicts or also synergies. By way of example, Renewable Marine Energies (*e.g.*, offshore wind farms) contribute to reducing the environmental impacts (less carbon, less greenhouse gases) which can in turn affect certain aesthetic issues of the coast.

Coastal ecosystem services, calculated on the basis of valuations of different services provided by the scientific literature (Costanza *et al.* 2014; de Groot *et al.* 2012), are equivalent to 2.8% of EU-27 GDP in 2018 (Paprotny *et al.* 2021). In relative economic terms, coastal ecosystems are most valuable to Greece, Cyprus, and Denmark, as they account for more than 12% of their respective 2018 GDP. On the other side of the spectrum, in countries with shorter coastlines like Belgium and Slovenia, as well as Poland and Germany, coastal ecosystem services correspond to less than 1% of the national GDP.

VIII. Conclusions

Blue Growth Concept is the most recent version for an integrated management of marine socioeconomic systems. The Blue Growth Concept is based on the Blue Economy that consists of a series of branches and sub-sectors of the economy that are directly related to the sea and the oceans. The Blue Growth Concept aims to take advantage of the potential of oceans, seas and coasts to tackle impacts of harmful fishing practices and overfishing, ensure tailor-made measures and act as a catalyst for policy development (FAO, 2014).

European Union has taken on some initiatives to improve the cooperation of the Member States on Mediterranean such as Blue Growth Interreg MED project and many other projects, strategies and protocols.

A greater range of pressures are exerted on marine ecosystems indirectly by human activities using non-living resources than those activities using living resources directly. This range involves pollution from litter, chemicals, and plastics. The Marine Strategy Framework Directive and the European Green Deal aim at solving these problems. European Union has developed a strategy for sustainable Blue Growth, recognizing that oceans and seas are important levers for European economy. Overall, EU's policy contains MSFD, Blue Growth Strategy and ICZM.

Employment in the established sectors of the blue economy is around 2,850,000 jobs and the gross value added around €178 billion. Employment in the established sectors of the Greek blue economy is around 574,102 jobs and the GVA is over €7.9 billion. This means that, Greece's Blue Economy, employs many people but does not generate too much GVA.

Blue Growth coexistence with coastal tourism may bring conflicts or also synergies. As an example, offshore wind farms help to reduce environmental impacts but in return affect some aesthetic issues of the coast.

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